# 52nd Lunar and Planetary Science Conference

**March 15-19, 2021**

## Program and Abstracts

**ORAL PROGRAM**

**Monday** **Tuesday** **Wednesday** **Thursday** **Friday**

**POSTER PROGRAM**

**iPosters**

*Posters will be displayed in the iPoster gallery in the virtual conference environment. Attendees are encouraged to view posters between oral sessions and during breaks.*

**The meeting is scheduled to begin each day at 11:00 a.m. Central Daylight Time (CDT). For different time zones, use: Time Zone Converter**

### *Monday, March 15, 11:00 a.m. CDT*

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|---|---|
| Track 1 | Special Session: Exploring Myriad Ocean Worlds |
| Track 2 | Lunar Magnetism: Unraveling the History of the Interior of the Moon Through Its Magnetic Properties |
| Track 3 | Presolar Grains, IDPs, Other Early Solar System Materials |
| Track 4 | MSL Curiosity Results I: Exploration of Glen Torridon |
| Track 5 | Small Body Impacts: CSI Dimorphos |

## *Monday, March 15, 12:30 p.m. CDT*

Track 1 Masursky Lecture (Live Presentations)

## *Monday, March 15, 2:30 p.m. CDT*

Track 1 Physicochemical Evolution of the Moon
Track 2 Shaken and Stirred: Interiors of Satellites and Ocean Worlds
Track 3 Protoplanetary Disk Evolution
Track 4 MSL Curiosity Results II: Exploration of the Greenheugh Pediment, Sulfate Unit, and Beyond
Track 5 Impacts: Crater Formation Small to Large

## *Monday, March 15, 4:00 p.m. CDT*

Track 1 Lunar Space Weathering: Spectral Studies and Experiments
Track 2 Crack, Boom! Active and Eruptive Satellites and Ocean Worlds
Track 3 Evolution of Parent Bodies: Accretion, Differentiation, Crystallization, and Bombardment
Track 4 Martian Fluids and Element Mobility
Track 5 Impacts: Changing Planetary Bodies

## *Tuesday, March 16, 11:00 a.m. CDT*

Track 1 Special Session: Mars 2020 I (Live Presentations)

## *Tuesday, March 16, 12:30 p.m. CDT*

Track 1 Special Session: Mars 2020 II (Live Presentations)

## *Tuesday, March 16, 2:30 p.m. CDT*

Track 1 Special Session: Mars 2020 III (Live Presentations)
Track 2 Endogenous Lunar Volatiles Through Time and Space
Track 3 Calcium-Aluminum-Rich Inclusions in Meteorites

Track 4 Icy Satellites and Ocean Worlds: Geology and Geophysics

Track 5 Great Balls of Fire: Explosive Volcanism Across the Solar System

## *Tuesday, March 16, 4:00 p.m. CDT*

Track 1 Special Session: Mars 2020 IV (Live Presentations)

Track 2 Lunar Volatiles Through Remote Sensing, Modeling and Experiments

Track 3 Chondrules: The Continuing Conundrum

Track 4 Icy and Ocean Worlds: Compositional Evolution and State

Track 5 Let it Flow: Lava Flow Dynamics and Emplacement Across the Solar System

## *Wednesday, March 17, 11:00 a.m. CDT*

Track 1 Lunar Science for the New Millennium (Live Presentations)

## *Wednesday, March 17, 12:30 p.m. CDT*

Track 1 Special Session: Apollo Next Generation Sample Analysis I: Fulfilling Apollo Goals and Preparing for Artemis, New Results from Special Apollo Samples

Track 2 Isotopic Reservoirs in the Early Solar System

Track 3 Small Body Spectroscopy: Composition and Classification

Track 4 Martian Hydrated Minerals and Aqueous Alteration

Track 5 Exoplanets: Composition and Structure

## *Wednesday, March 17, 2:30 p.m. CDT*

Track 1 Special Session: Apollo Next Generation Sample Analysis II: Fulfilling Apollo Goals and Preparing for Artemis, New Results from Special Apollo Samples

Track 2 Big Bodies: Modeling and Measurements of Planetesimals

Track 3 Mercury: Big Science in a Small Planet

Track 4 Martian Mineralogy from Orbit

Track 5 Atmospheres: Dynamics, Evolution, and Composition

## *Wednesday, March 17, 4:00 p.m. CDT*

Track 1 New Understanding of Mars and Asteroids (Live Presentations)

*Posters will be displayed in the iPoster gallery in the virtual conference environment. Attendees are encouraged to view posters between oral sessions and during breaks.*

## *Thursday, March 18, 11:00 a.m. CDT*

Track 1 Surface-Atmosphere Interactions on Icy Worlds: A Volatile Session

Track 2 Lunar Remote Sensing: Bad Moon Rising

Track 3 Carbonaceous Chondrites: Parent Body Processing and Organic Matter

Track 4 Beginnings: Early Evolution and the Origins of Life

Track 5 InSight Results: One Martian Year

## *Thursday, March 18, 12:30 p.m. CDT*

Track 1 NASA Headquarters Briefing (Live Presentations)

## *Thursday, March 18, 2:30 p.m. CDT*

Track 1 Special Session: Scientific Exploration of the Lunar South Pole I

Track 2 Bennu and Ryugu: Sample Collection and Return

Track 3 Melts on Differentiated Parent Bodies

Track 4 Early Mars Geomorphology I: Warm and Wet, Cold and Dry, or Something in Between?

Track 5 Venus: Geology and Geophysics

## *Thursday, March 18, 4:00 p.m. CDT*

Track 1 Special Session: Scientific Exploration of the Lunar South Pole II

Track 2 Bennu and Ryugu: Surface Evolution

Track 3 Planetary Differentiation: Accretion, Evolution, Experiments — Lots of Metal

Track 4 Early Mars Geomorphology II: Cooler with a Chance of Showers
Track 5 Venus: Coupled Evolution of the Interior, Surface, and Atmosphere

## *Friday, March 19, 11:00 a.m. CDT*

Track 1 High-Impact Lunar Impact Studies
Track 2 Planetary Tectonics and Interiors: Surface Expressions and Deep Issues
Track 3 The Legacy of Arecibo Observatory in Planetary Science
Track 4 Modern Mars: Earth, Wind, and Ice
Track 5 Organics: Early Synthesis and Detection

## *Friday, March 19, 12:30 p.m. CDT*

Track 1 Decadal Survey (Live Presentations)

## *Friday, March 19, 2:30 p.m. CDT*

Track 1 Lunar Volcanism and Tectonics
Track 2 Small Body Regolith and Interiors: Laboratory Studies and Modeling
Track 3 Martian Meteorites: Petrology and Petrogenesis
Track 4 Ice at the Martian Poles
Track 5 Microbes: Where We Live

## *Friday, March 19, 4:00 p.m. CDT*

Track 1 Space Weathering on Airless Planetary Bodies: Beyond Lunar-Style Space Weathering
Track 2 Small Body Evolution: Forces of Heat and Light
Track 3 Lunar Geochemistry and Petrology
Track 4 Icy Mars Geomorphology
Track 5 Environments: Habitability and Organic Preservation

## *iPosters*

*Posters will be displayed in the iPoster gallery in the virtual conference environment. Attendees are encouraged to view posters between oral sessions and during breaks.*

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|---|---|---|
| Special Session: Apollo Next Generation Sample Analysis: Artemis | Mars: Surface and Interior InSights | Mercury: Big Science in a Small Planet |
| Special Session: Scientific Exploration of the Lunar South Pole | Martian Volcanic Landforms | Venus Atmosphere, Emissivity, and Weathering |
| Lunar Geophysics: Shake, Rattle, Roll, and Fracture | Analyzing Chondrites and Their Components: Novel Methods | Venus Volcanism, Tectonics, and Global Evolution |
| Lunar Petrology and Geochemistry | Carbonaceous Chondrites: Parent Body Processing and Organic Matter | Venus Instrumentation and Airborne Exploration |
| Lunar Remote Sensing: From the Lab to Orbit | Chondrites — Physical Properties and Experiments | Exoplanets |
| Lunar Surface Interactions with the Space Environment | New Chondrites | Great Balls of Fire: Explosive Volcanism Across the Solar System |
| Lunar Volcanism | Characterization, Parent Body Origins, and Petrogenesis of Achondrites | Planetary Volcanism: Morphologies, Emplacement, and Evolution |
| Lunar Volatiles | Chondritic Meteorite Melange: E, O, and C | Planetary Differentiation |
| Change’4 and Change'5 Results | Martian Meteorites: Igneous and Surface Processes | Atmospheres: Dynamics, Evolution, and Composition |
| Mission Concepts: Moon | Presolar Grains, IDPs, Genesis, Stardust, Hayabusa | Space Weathering: Know More, Knowledge Gaps |
| Mission Concepts: Earth | Solar Nebular Processes | Astrobiology Analogs: Chemistry and Fluids |
| Mission Concepts: Inner Solar System | Impacts: Changing Planetary Bodies Beyond Earth | Biomarkers: How to Find Us |
| Mission Concepts: Outer Solar System and Beyond | Impacts: Finding and Analyzing Earth's Craters | Microbes: Where We Live |
| Special Session: Mars 2020 Initial Results I | Impacts: Crater Formation and Processes on Earth and Beyond | Astrobiology: Instrument and Mission Concepts |
| Special Session: Mars 2020 Initial Results II | Impacts on the Moon | Analogs: Mars, the Moon, and More |
| MSL Curiosity Results | Impacts: Studying Ejecta on Earth | Intrinsic and Spectroscopic Properties of Analog Materials |
| Gale Crater Geochemistry | Impacts: Things Get Shocked (Shocked Minerals) | Instruments: Dust, Plume, and Unique |
| ExoMars | Special Session: Exploring the Myriad of Ocean Worlds | Instruments: Orbital and Atmospheric Measurements |
| Geochemistry: The Things Microbes Care About | Geology and Geophysics of Satellites and Ocean Worlds | Instruments: RAMAN and Laser/LIBS |
| Fans, Deltas, and Lakes on Mars | Crack, Boom! Active and Eruptive Satellites and Ocean Worlds | Instruments: Surface and Subsurface Measurements |

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| Mars Geomorphology | Surface-Atmosphere Interactions on Icy Worlds: A Volatile Session | Planetary Spatial Data Infrastructure (PSDI) posters |
| Modern Mars: Earth, Wind, and Ice | Shaken and Stirred: Physical and Compositional State of Satellites and Ocean Worlds | Machine Learning Applied to Planetary Surfaces: "I'm Afraid I CAN Do That!" |
| Martian Geochemistry | Giant Planets, Rings and Dynamics — Oh My! | A Diverse and Inclusive Workforce: Who We Are and Can Be |
| Icy Mars Geomorphology and Geochemistry | Ceres and Vesta | Education and Audience Engagement: Building Bridges to Audiences |
| Ice at the Martian Poles | Small Body Observations: Near and Far | Education and Outreach in a Pandemic: Pivoting to Virtual Engagement |
| Martian Hydrated Minerals and Aqueous Alteration | Small Body Surfaces: Boulders, Craters, and Regolith | Education and Workforce Training: Preparing the Next Generation |
| Mars: Optimizations and Lab Based Studies | Small Body Laboratory Studies and Modeling | |
| Mars Sample Return | Small Body Mission Support: Past, Present, and Future | |

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**[M101]**

**Monday, March 15, 2021**
**SPECIAL SESSION: EXPLORING MYRIAD OCEAN WORLDS**

**11:00 a.m. Track 1**

**Chairs: Samuel Howell and Morgan Cable**

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Cochrane C. J. * Nordheim T. A. Vance S. D. Styczinski M. Soderlund K. et al. | *In Search of Subsurface Oceans Within the Moons of Uranus* **[#1559]** This work involves the utilization of magnetic induction for subsurface ocean detection in the moons of Uranus, with an emphasis on Miranda and Ariel. |

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| 11:08 a.m. | Hammond N. P. * Collins G. C. | *Intense Geologic Activity on Triton for Billions of Years After Orbital Capture* **[#2427]**<br>When Triton was captured and heated, its ice shell was nearly deleted. But as ice shells grow small, dissipation rates fall, so its orbital evolution was impeded. |
| 11:11 a.m. | Styczinski M. J. * Vance S. D. Cochrane C. J. Harnett E. M. | *Recent Advances in Magnetic Induction from Asymmetric Ocean Worlds* **[#2728]**<br>Magnetic induction is a powerful tool for probing the interior structure and geophysics of ocean worlds. We have developed analytical methods for extending the technique to arbitrary interiors that include asymmetry expected from gravity, etc. |
| 11:14 a.m. | Mazarico E. * Buccino D. R. Castillo-Rogez J. Dombard A. Genova A. et al. | *The Europa Clipper Gravity/Radio Science Investigation* **[#1784]**<br>The Gravity/Radio Science Team for the NASA Europa Clipper was recently selected. We present the science objectives of this investigation. |
| 11:17 a.m. | Hand K. P. * Phillips C. B. Maize E. Reeves G. Pitesky J. et al. | *Europa Lander Mission Concept (Update 2021)* **[#2120]**<br>We provide an update and the latest information on the development and technology advances being made for the Europa Lander mission concept, as originally detailed in the 2016 Science Definition Team report. |
| 11:20 a.m. | Sori M. M. * | *Does Triton's Ice Cap Reveal Its Internal Heat and Ocean?* **[#1011]**<br>Triton's nitrogen ice is unusually extensive. I show that the ice's extent may be controlled by viscous flow or basal melting, which yields quantitative constraints on the internal heat that powers Triton's geological activity. |
| 11:23 a.m. | Schenk P. * McKinnon W. B. Moore J. Nimmo F. | *The Topography of Ganymede (and Callisto): Geology, Global Characteristics, and Future Exploration* **[#2228]**<br>Ocean world of Ganymede your relief is low / Callisto remains a cypher with subtle deformation / A big giant dome on Ganymede wandered from the pole. |
| 11:26 a.m. | Theiling B. P. * Da Poian V. Powell B. | *Predicting the Seawater Chemistry of an Ocean World Using Machine Learning on Isotopic Measurements of $CO_2$* **[#2261]**<br>We used 848 isotope ratio mass spectra of $CO_2$ that had interacted with ocean worlds-relevant seawaters as a machine learning training dataset. Our algorithm can identify the seawater composition using only data from volatile $CO_2$. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[M102]**

## Monday, March 15, 2021
## LUNAR MAGNETISM: UNRAVELING THE HISTORY OF THE INTERIOR OF THE MOON THROUGH ITS MAGNETIC PROPERTIES

### 11:00 a.m. Track 2

### Chairs: David Blewett and Emily Martin

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Hamid S. H. * O'Rourke J. G. Soderlund K. M. | *A Lunar Dynamo Powered by Core Convection and a Basal Magma Ocean* **[#2038]** We test the hypothesis that an early basal magma ocean-hosted dynamo in combination with a later thermo-compositional core dynamo driven primarily by inner core solidification may help explain the history of the lunar magnetic field. |
| 11:08 a.m. | Nichols-Fleming F. * Evans A. J. Johnson B. C. Tikoo S. M. | *Short-Lived Lunar Dynamos Powered by Accretion of Cold Impactor Core Material* **[#2177]** We present work showing that the accretion of cool impactor material is able to power short-lived lunar magnetic fields. Field strengths within the first few days can reach 40–120 μT, comparable to the high-intensity era of the lunar paleorecord. |
| 11:11 a.m. | Hood L. L. * Torres C. B. Oliveira J. S. Wieczorek M. A. Stewart S. T. | *A New Large-Scale Map of the Lunar Crustal Magnetic Field and Its Interpretation* **[#1628]** The observed distribution of anomalies is consistent with the hypothesis that iron from the Imbrium impactor was mixed into ejecta that was inhomogeneously deposited downrange in groups aligned radial to the basin and concentrated antipodal to it. |
| 11:14 a.m. | Jung J. * Tikoo S. M. Gattacceca J. Lepaulard C. | *Shock Demagnetization Does Not Fully Explain Variations in the Lunar Paleointensity Record* **[#2388]** We evaluated the effects of shock demagnetization on the lunar paleointensity record by conducting hydrostatic pressure experiments (up to 1.8 GPa) on seven Apollo samples. |
| 11:17 a.m. | Strauss B. E. * Tikoo S. M. | *Magnetic Domain Behavior and Interpretation in Apollo Samples* **[#2301]** We present a case study of Apollo 12 basalts to assess the determining factors for magnetic fidelity in lunar rocks and address fundamental questions about magnetic mineralogy and domain behavior. |
| 11:20 a.m. | Seritan M. R. K. * Garrick-Bethell I. | *Modeling Thermal Demagnetization at the Lunar Swirl Reiner Gamma* **[#1811]** Modeled dome, heat flow, / and magnets. Does the swirl fade? / Hard to tell. Perhaps. |
| 11:23 a.m. | Bhatt M. * Wöhler C. Aravind K. Ganesh S. Bharadwaj A. | *Regolith Characteristics of the Reiner Gamma Swirl as Revealed by Polarimetric Observations* **[#2430]** Based on telescopic polarimetric analysis, we found that the regolith properties of Reiner Gamma are different from those of its surroundings and the examined crater ray systems. |
| 11:26 a.m. | Pieters C. M. * Donaldson Hanna K. L. Sunshine J. M. Garrick-Bethell I. | *New M-Cube Insights on the Character of the Mysterious Reiner Gamma Swirls* **[#1686]** More Moon mysteries / To unlock up close at swirls / Through soil properties. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

## [M103]

## Monday, March 15, 2021
## PRESOLAR GRAINS, IDPS, OTHER EARLY SOLAR SYSTEM MATERIALS

## 11:00 a.m. Track 3

## Chairs: Thomas Stephan and Zack Gainsforth

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Meyer B. S. * Bermingham K. R. Frizzell K. Mezger K. | *NRLEE Nucleosynthesis* **[#2598]** NRLEEs are likely some sort of exploding white dwarf stars. They produce neutron-rich iron-group isotopes like $^{48}$Ca and $^{50}$Ti and possibly 84Sr and 96Zr, and are probably important contributors to the solar system's initial building blocks. |
| 11:08 a.m. | Liu N. * Barosch J. Nittler L. R. Alexander C. M. O'D. Wang J. et al. | *Multielement Isotopic Compositions of Presolar SiC from Asymptotic Giant Branch Stars* **[#2347]** Our new NanoSIMS data for MS/Y SiC suggest that the N and Al isotope data in the literature suffer from varying degrees of contamination and that high-resolution isotope imaging and extensive sputtering are effective in suppressing the contamination. |
| 11:11 a.m. | Hoppe P. * Schofield J. Pignatari M. Amari S. | *A Presolar Silicon Carbide Grain of Type C with Extremely Low $^{12}$C/$^{13}$C Ratio* **[#1055]** We report on a presolar SiC grain of Type C with an extremely low $^{12}$C/$^{13}$C ratio of 1.0 and strong enrichments in the heavy Si isotopes. The isotopic compositions can be satisfactorily explained by an H ingestion supernova model. |
| 11:14 a.m. | Singerling S. A. * Liu N. Nittler L. R. Alexander C. M. O'D. Stroud R. M. | *TEM Studies of Presolar SiC Grains: Insights into Circumstellar Conditions and Implications for IR Spectroscopy* **[#1687]** SiC stardust / Captures range in conditions / Complex histories. |
| 11:17 a.m. | Nguyen A. N. * Mane P. Ross D. K. Simon J. I. | *Presolar Grain Abundance Variation in the Miller Range 090019 $CO_3$.1 Chondrite* **[#2709]** We determine a presolar O-rich grain abundance of 99ppm in MIL 090019 $CO_3$.1. One matrix region has a low presolar O-rich grain abundance of 28ppm, indicating localized alteration. The presolar C-rich grain abundance (64ppm) did not vary with region. |
| 11:20 a.m. | Joswiak D. J. * Brownlee D. E. Zhang M. Westphal A. J. Gainsforth Z. et al. | *Origin of low-Ca Pyroxenes in Comet Samples: Evidence for Igneous Formation in the Nebula Like Chondrules* **[#1604]** Minor elements in low-Ca pyroxenes from comet Wild 2 and a giant cluster IDP along with O isotopes suggest that comet grains formed in diverse igneous nebular environments like chondrules and are not fragments of thermally altered parent bodies. |
| 11:23 a.m. | Zhang M. * Defouilloy C. Joswiak D. J. Brownlee D. E. Nakashima D. et al. | *Oxygen Isotope Systematics of Crystalline Silicates in a Giant Cluster IDP: A Genetic Link to Wild 2 Particles and Primitive Chondrite Chondrules* **[#1685]** We report the oxygen isotope ratios of 20 crystalline silicate particles from the giant cluster IDP U2-20GCA and discuss their genetic relationships with Wild 2 particles and primitive chondrite chondrules. |
| 11:26 a.m. | Keller L. P. * Snead C. J. | *Oxygen Isotopic Compositions of Hydrated Interplanetary Dust Particles: Implications for Aqueous Alteration in Outer Solar System Objects* **[#2389]** We obtained high precision O isotopic compositions for hydrated IDPs and show that they are distinct from known carbonaceous chondrite groups. |

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| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[M104]**

## Monday, March 15, 2021
## MSL CURIOSITY RESULTS I: EXPLORATION OF GLEN TORRIDON

### 11:00 a.m. Track 4

### Chairs: Cherie Achilles and Candice Bedford

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Fox V. K. * Bennett K. A. Bryk A. B. Arvidson R. E. Fedo C. et al. | *Contextualizing CRISM Observations of the Clay-Bearing Glen Torridon Region with the Mars Science Laboratory Curiosity Rover* **[#2765]** Correlations between rover and orbital observations of clay minerals Glen Torridon, Gale Crater. |
| 11:08 a.m. | Thorpe M. T. * Bristow T. F. Rampe E. B. Grotzinger J. P. Fox V. K. et al. | *The Mineralogy and Sedimentary History of the Glen Torridon Region, Gale Crater, Mars* **[#1519]** The identification of the most phyllosilicate-rich samples to date and novel mineral detections for CheMin in Glen Torridon suggests a rich sedimentary history. |
| 11:11 a.m. | Cousin A. * Desjardins M. Dehouck E. Forni O. David G. et al. | *K-Rich Rubbly Bedrock at Glen Torridon, Gale Crater, Mars: Investigating the Possible Presence of Illite* **[#2127]** Rubbly bedrock sampled by Curiosity at Glen Torridon, Mars are enriched in K2O. Glen Torridon is clay-rich from orbital data. We investigate if this K enrichment could be due to the presence of illite from ChemCam data, as no drill has been done. |
| 11:14 a.m. | Gasda P. J. * Comellas J. Essunfeld A. Das D. Nellessen M. et al. | *The Chemistry and Morphology of Diagenetic Features in Glen Torridon, Gale Crater* **[#1271]** Ancient Mars groundwater / Left behind elements galore / Clues for multiple events? |
| 11:17 a.m. | Rudolph A. * Horgan B. Johnson J. R. Bell J. F. III Bennett K. et al. | *Diagenesis in the Glen Torridon Region of Gale Crater, Mars Using VNIR Spectral Data from Curiosity Rover* **[#1502]** Diagenesis / Highlights complex history / Of water and rocks. |
| 11:20 a.m. | Khan S. Y. * Stack K. M. Yingst R. A. | *Characterization of Clasts in the Glen Torridon Region Observed by the MSL Curiosity Rover* **[#2649]** Identifying / Erosional history / Glen Torridon clasts. |
| 11:23 a.m. | Hughes M. N. * Arvidson R. E. Fraeman A. A. VanBommel S. J. | *Characteristics of the Fractured Intermediate Unit from Orbital and Curiosity-Based Data* **[#1586]** A geomorphic map has been created over Glen Torridon in Gale Crater. The compositions of the geomorphic units, including the Fractured Intermediate Unit (FIU) and FIU-rubbly, are compared using a correspondence analysis of APXS measurements. |

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| 11:26 a.m. | O'Connell-Cooper C. D. * Thompson L. M. Gellert R. Spray J. G. Boyd N. I. et al. | *APXS Geochemistry of the Fractured Intermediate Unit (fIU) — Its Relationship to Underlying Glen Torridon Units and Overlying Pediment Rocks at the Greenheugh Unconformity* **[#2405]** MSL-APXS (Glen Torridon) — typical fractured Intermediate Unit (fIU) and altered fIU_Hutton. Increasing diagenesis with elevation, esp. at contact with Greenheugh unconformity. Compositional trends distinct from lower GT (Jura, Knockfarril Hill mbrs). |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

## [M105]

## Monday, March 15, 2021
## SMALL BODY IMPACTS: CSI DIMORPHOS

### 11:00 a.m. Track 5

### Chairs: Michael Nolan and Elena Dobrică

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Sunday C. * Murdoch N. Drilleau M. Wilhelm A. Michel P. | *Low-Velocity Collision Dynamics on Earth vs. Small-Bodies* **[#1913]** We examine how low-velocity impacts into granular surfaces differ between 1g and low-g environments. We present the results from experimental and numerical tests, and investigate the suitability of the Froude number for describing these collisions. |
| 11:08 a.m. | Sánchez D. P. * Scheeres D. J. | *Seismic Waves in the Asteroid Environment — Impactor Momentum* **[#1850]** We simulate impact generated seismic waves in granular media under extremely low pressure. This mimics the conditions in the interior of asteroids. We find that the wave induced pressure depends on the momentum of the impactor. |
| 11:11 a.m. | Nishiyama G. * Kawamura T. Fernando B. Leng K. Onodera K. et al. | *A New Model of Seismicity on Asteroids Implied by the SCI Experiment of the Hayabusa2 Mission: Insights from the Existence of Boulders Perched on Other Boulders* **[#1819]** The boulders on other boulders on Ryugu are hard to survive through strong seismic events and indicate that the seismicity is lower than expected. By modeling seismic wave propagation, we show the intensive scattering limits the seismicity. |
| 11:14 a.m. | Daly R. T. * Bierhaus E. B. Barnouin O. S. Daly M. G. Seabrook J. A. et al. | *Mound Craters on Rubble-Pile Bennu Indicate Strength at Depth* **[#1098]** A few craters on Bennu contain mounds in their interiors. We use them to gain insight into Bennu's subsurface. Mound craters are one of several lines of evidence that suggest the properties of Bennu's interior differ from those of its surface. |

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| 11:17 a.m. | Benavidez P. G. * Campo Bagatin A. Liu P. Y. Richardson D. C. | *Reaction of Dimorphos' Structure to the DART Impact* **[#2041]** Here we report on results regarding to the effects of the DART impact on Dimorphos' structure including changes in its spin period and direction of the spin axis, as well as change of its shape. Moreover, we look at the velocity field of surface. |
| 11:20 a.m. | Rossi A. * Tsiganis K. Gaitanas M. Lucchetti A. Ivanovski S. et al. | *Dynamics of Ejecta in the Didymos-Dimorphos Binary: Sensitivity to the System Parameters* **[#1404]** The dynamics of the ejecta from the impact of the DART spacecraft against the asteroid Dimorphos is studied to characterize the crater evolution and the evolution of the particles within the binary system on different time scales. |
| 11:23 a.m. | Güldemeister N. * Moreau J. Kohout T. Wünnemann K. | *Insight into the Distribution of High Pressure Shock Metamorphism in Rubble-Pile Asteroids* **[#1339]** Collisions onto rubble-pile asteroids have been investigated using numerical simulations in order to quantify shock metamorphism (shock darkening) in the asteroid and ejecting material. |
| 11:26 a.m. | Kohout T. * Petrova E. Yakovlev G. Grokhovsky V. Penttilä A. et al. | *Experimental Constraints on the Ordinary Chondrite Shock Darkening Caused by Asteroid Collisions* **[#1588]** Shock darkening is caused by two distinct mechanisms with characteristic pressure regions, which are separated by an interval where the darkening ceases. This implies a reduced amount of shock-darkened material produced during the asteroid collisions. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[M121]**

## Monday, March 15, 2021
## MASURSKY LECTURE (LIVE PRESENTATIONS)

### 12:30 p.m. Track 1

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| 12:30 p.m. | | **John Grotzinger**<br><br>*The Early Aqueous Environment of Mars Inferred from Mission Lifetime Results by the Curiosity Rover at Gale Crater* |

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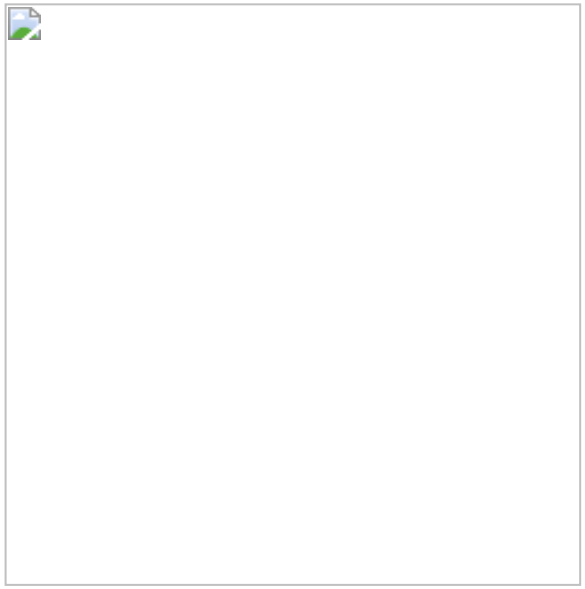
| |  | John Grotzinger is the Ted and Ginger Jenkins Chair Professor of Geology, and the Division Chair for Geological and Planetary Sciences at the California Institute of Technology (Caltech). He received his B.Sc. from Hobart College, M.Sc. from the University of Montana, Ph.D. from Virginia Tech, and was a postdoctoral fellow at Columbia University. Prior to moving to Caltech in 2005, he spent 18 years as a member of the faculty at the Massachusetts Institute of Technology, where he was the Robert Shrock Professor of Geology. At Caltech his research group studies the co-evolution of surficial environments on Earth and Mars. Field mapping studies are the starting point for more topical laboratory-based studies involving geochemical, geologic, and geochronological techniques. He served as the Project Scientist for the Mars Curiosity Rover mission from 2007 to 2015 and now serves as the strategic path planner. He was a participating scientist on the Mars Exploration Rover and HiRISE teams, and is a Co-I on the 2020 rover team. |
| 1:30 p.m. | | *End of Session* |

**[M151]**

## Monday, March 15, 2021
## PHYSICOCHEMICAL EVOLUTION OF THE MOON

### 2:30 p.m. Track 1

### Chairs: Paul Warren and Nicole Lunning

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| Times | Authors (*Denotes Presenter) | Abstract Title and Summary |
|---|---|---|
| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Downey B. G. * Nimmo F. Matsuyama I. | *Early Dynamical Evolution of the Moon with a Subsurface Magma Ocean* **[#2481]**<br>We recreate the thermal-orbital history of the Moon incorporating magma ocean tides, Cassini state transitions, and an evolving Laplace plane. We arrive at the present state with rapid outwards motion so the magma ocean survives at large distances. |

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| 2:38 p.m. | Baker E. * Wood B. Wade J. | *Crystallisation of a Model Silicate Moon* **[#2209]**<br>An experimental stepwise crystallization of a pyrolitic lunar magma ocean. Experimental crystal and liquid phases are remelted and recombined to produce the composition the mare basalts and the ferroan anorthosite suite, including REE profiles. |
| 2:41 p.m. | Schwinger S. * Breuer D. | *Determination of the Bulk Silicate Moon FeO Content from Petrological and Geophysical Models* **[#2089]**<br>We determined the bulk silicate Moon FeO content by combining models of magma ocean solidification and mantle convection with observational constraints on the stratigraphy, bulk Moon density, and moment of inertia from seismic and selenodetic data. |
| 2:44 p.m. | Dygert N. * Ji D. Fagan A. L. Neal C. R. Draper D. S. et al. | *Petrogenesis of and Subsolidus Reequilibration Within Lunar Ferroan Anorthosites: Two Demonstrations of a New $fO_2$-Dependent Model for Plagioclase-Melt Europium Partitioning* **[#2352]**<br>An $fO_2$-dependent plag-melt Eu partitioning model is used to evaluate compositions of lunar anorthites in the context of LMO solidification, and to explore subsolidus reequilibration in an impactite with positive and negative Eu anomalies. |
| 2:47 p.m. | Elardo S. M. * Astudillo Manoslava D. F. | *Ancient Igneous Differentiation Trends in the Moon's Crust Can Be Produced by Secondary Magmatism from a Common Source* **[#2313]**<br>Using crystallization modeling, we show that some lunar magnesian anorthosites and FANs may be products of secondary magmatism rather than the LMO. |
| 2:50 p.m. | Krein S. B. * Guenther M. E. Grove T. L. | *Source Regions of the Lunar Ultramafic Glasses Constrained by Experiments and Models* **[#2483]**<br>We successfully correct 20 suites of highly compositionally variable lunar ultramafic glasses to three groups of primary magmas (high-Ti, green glass, very low titanium). The high-Ti primary magma must be derived from a hybridized source. |
| 2:53 p.m. | Yen C. J.-K. * Carpenter P. K. Couvy H. Irving A. J. Krawczynski M. J. et al. | *Characterization, Modeling, and Experimental Petrology of Picritic Green Glass in Northwest Africa 12384: Probing the Lunar Mantle* **[#2285]**<br>From beads in the probe / To numbers and molten drops / Liquid line descends. |
| 2:56 p.m. | Guenther M. E. * Brown Krein S. Grove T. L. | *The Influence of Variable Oxygen Fugacity on the Source Depths for Lunar High-Titanium Ultramafic Glasses* **[#2450]**<br>We explore the influence of variable oxygen fugacity on the phase relations of the lunar ultramafic glasses. New phase diagrams are presented for the Apollo 17 Orange, 15 Red, and 14 Black glasses and we discuss the role of $TiO_2$ on phase relations. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[M152]**

**Monday, March 15, 2021**
**SHAKEN AND STIRRED: INTERIORS OF SATELLITES AND OCEAN WORLDS**

**2:30 p.m. Track 2**

**Chairs: Lea Bonnefoy and William McKinnon**

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| Times | Authors (*Denotes Presenter) | Abstract Title and Summary |
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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Weiss B. P. * Biersteker J. B. Colicci V. Couch A. Petropoulos A. et al. | *Searching for Subsurface Oceans on the Moons of Uranus Using Magnetic Induction* **[#2096]** Spacecraft magnetic induction measurements could detect and characterize subsurface oceans on the major moons of Uranus. |
| 2:38 p.m. | Denton C. A. * Johnson B. C. Wakita S. Freed A. M. Melosh H. J. et al. | *Antipodal Terrains Produced by Sputnik Planitia-Forming Impact Imply Pluto Has a Thick Ocean and Hydrated Core* **[#1078]** We use seismic waves generated by the formation of the Sputnik Planitia impact basin to constrain Pluto's internal structure. |
| 2:41 p.m. | Gyalay S. * Nimmo F. | *Insights Into Io's Interior as Inferred from Its Long-Wavelength Topography* **[#1820]** Carved by tidal heat / Does Io's shape then imply / A magma ocean? |
| 2:44 p.m. | Abrahams J. N. H. * Nimmo F. Garrick-Bethell I. Bills B. G. Bierson C. J. | *Long Period Non-Synchronous Rotation of Io* **[#1573]** One spin per orbit: / A dance throughout the cosmos. / Maybe not Io? |
| 2:47 p.m. | Kervazo M. * Tobie G. Choblet G. Dumoulin C. B? hounková M. | *Inferring Io's Interior from Tidal Monitoring* **[#2460]** Io's spectacular heat flux is due to extreme tidal heating. We calculate the tidal response of Io's interior for various distribution of melt within the mantle, to discriminate them in future tidal monitoring. |
| 2:50 p.m. | Behounkova M. * Tobie G. Choblet G. Kervazo M. Melwani Daswani M. et al. | *Tidally-Induced Magmatic Pulses on the Oceanic Floor of Jupiter's Moon Europa* **[#1880]** The melting of Europa's mantle is investigated by 3D modeling of heat transfer. We show that melt can be produced during most of Europa's history due to the limited efficiency of internal cooling and the presence of radiogenic and tidal heating. |
| 2:53 p.m. | Biersteker J. B. * Weiss B. P. Cochrane C. Harris C. D. K. Jia X. et al. | *Revealing the Internal Structure of Europa with a Bayesian Approach to Magnetic Induction Studies* **[#2654]** We present a new Bayesian approach for inverting magnetic measurements to determine the internal structures of planetary bodies. We then employ this technique to estimate the ability of the Europa Clipper Magnetometer to probe Europa's interior. |
| 2:56 p.m. | Hay H. C. F. C. * Fenty I. Pappalardo R. T. | *How Do Convective and Tidal Dynamics Interact in Europa's Subsurface Ocean?* **[#2147]** Beneath the ice, heat / And tides swirl the ocean. / How do they couple? |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

## [M153]

## Monday, March 15, 2021
## PROTOPLANETARY DISK EVOLUTION

## 2:30 p.m. Track 3

## Chairs: Andrew Westphal and Maitrayee Bose

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Miyazaki Y. * Korenaga J. | *Dynamic Evolution of Major Element Chemistry in Protoplanetary Disks* **[#2469]** Based on a new thermochemical evolution model of protoplanetary disks, we show that planetesimals with depletion patterns similar to ordinary and enstatite chondrites can originate at 1–2 AU outside where enstatite evaporates. |
| 2:38 p.m. | Sengupta D. * Cuzzi J. N. Estrada P. E. Humayun M. | *Depletion of Moderately Volatile Elements by Open-System Loss in Early Solar Nebula* **[#2766]** We investigate the problem of depletion of the moderately volatile elements in the inner solar system objects in order to constrain the physical processes active in the early solar nebula. |
| 2:41 p.m. | Vacher L. G. * Olgiore R. C. Jones C. Liu N. Fike D. A. | *Photochemical Processing by Nearby Stars Recorded in Sulfur Isotopes of Cosmic Symplectite* **[#2345]** Here we measured the S isotopic composition of cosmic symplectite (COS) in the primitive carbonaceous chondrite Acfer 094 and show that COS recorded large mass-independent S isotope anomaly, consistent with UV photolysis by massive nearby stars. |
| 2:44 p.m. | Barnett M. N. * Ciesla F. J. | *Chemical Processing of Solids Encountering Forming Giant Planet Cores* **[#2617]** Forming young giant planets / Heat their surroundings / Solids lose precious ices. |
| 2:47 p.m. | Borlina C. S. * Weiss B. P. Bryson J. F. J. Lima E. A. Bai X. | *Evidence for Non-steady Accretion in the Solar Nebula Inferred from Paleomagnetism of CO Chondrules* **[#2546]** Our paleomagnetic study with chondrules from carbonaceous chondrites supports the presence in the early solar system of magnetic inhomogeneities, associated with the formation of a disk substructure, or variations in the accretion rate over time. |
| 2:50 p.m. | Fu R. R. * Volk M. W. R. Bilardello D. Libourel G. Lesur G. et al. | *The Fine-Scale Magnetic History of the Allende Meteorite: Implications for the Structure of the SolarNebula* **[#2727]** Magnetization in Allende is carried exclusively by Fe-sulfides, supporting an early chemical origin. The magnetization may have recorded nebular fields, suggesting heterogeneity in disk properties in the outer disk. |
| 2:53 p.m. | Smith R. L. * Boogert A. C. A. Blake G. A. Pontoppidan K. M. | *Observations of Carbon Monoxide Variability in Massive Young Stellar Environments and Implications for Nebular Reservoirs* **[#2712]** Variability in CO abundances and isotope ratios in $^{12}C/^{13}C$ and $^{13}CO/C^{18}O$ are observed in massive YSOs as part of a new IRTF-iSHELL study in protoplanetary environments. These findings suggest heterogeneity and/or variability in nebular reservoirs. |
| 2:56 p.m. | Carter P. J. * Stewart S. T. | *Collision Fragments as a Chemically Similar Source for Late Accretion* **[#2288]** Young Earth's leftovers / Look chemically alike / So late impacts match. |
| 2:59 p.m. | | *Q&A* |

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| 3:30 p.m. | | *End of Session* |

**[M154]**

## Monday, March 15, 2021
## MSL CURIOSITY RESULTS II: EXPLORATION OF THE GREENHEUGH PEDIMENT, SULFATE UNIT, AND BEYOND

### 2:30 p.m. Track 4

### Chairs: Kirsten Siebach and John Grant

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Banham S. G. * Gupta S. Bryk A. B. Rubin D. M. Edgett K. S. et al. | *Reconstruction of Aeolian Palaeoenvironments and Past Climate Events at the Greenheugh Pediment, Aeolis Mons, Mars* **[#2300]**<br>A whimsical wind / Moved sediment back and forth / While Mount Sharp took form. |
| 2:38 p.m. | Thompson L. M. * Yen A. S. O'Connell-Cooper C. D. Berger J. A. Gellert R. et al. | *APXS-Derived Compositions of Greenheugh Pediment Capping Rock and Immediately Underlying Murray Formation: Implications* **[#2411]**<br>APXS composition of pediment caprock and underlying mudstone has implications for: 1) provenance, transport, and sorting of pediment caprock 2) diagenesis/alteration of caprock and mudstones, and 3) relationships with units previously encountered. |
| 2:41 p.m. | Bedford C. C. * Banham S. Bowden D. Bridges J. C. Smith R. et al. | *Identifying Ancient Dune Processes in the Stimson Formation of Gale Crater Using Geochemical Data from ChemCam: New Insights from the Greenheugh Capping Unit* **[#1569]**<br>Wind blown sand now stone / Preserved at Greenheugh on Mars / What does ChemCam show? |
| 2:44 p.m. | McAdam A. C. * Sutter B. Archer P. D. Franz H. B. Eigenbrode J. L. et al. | *Investigation of the Glen Torridon Clay-Bearing Unit and Overlying Greenheugh Pediment by the Sample Analysis at Mars Instrument Suite* **[#2337]**<br>SAM results suggest that Glen Torridon and Greenheugh Pediment rocks experienced a complex depositional and diagenetic history involving alteration episodes with fluids of varying pH and chemical composition, and with variable fluid-to-rock ratios. |
| 2:47 p.m. | Achilles C. N. * Morris R. V. Rampe E. B. Gabriel T. S. J. Ming D. W. et al. | *Factors Influencing the Formation and Preservation of X-Ray Amorphous Materials Identified in Sedimentary Deposits at Gale Crater, Mars* **[#2216]**<br>The amorphous fraction of Gale Crater sedimentary deposits demonstrate diverse detrital sources and alteration histories, and amorphous chemistries can discriminate minimal and more extensive alteration events. |
| 2:50 p.m. | Rapin W. * Dromart G. Rubin D. Le Deit L. Le Mouélic S. et al. | *First Insight on Depositional Environments Recorded in the "Clay-Sulfate" Transition at Gale Crater* **[#1479]** |

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| | | First detailed images of the sulfate-bearing unit strata in Gale Crater from the ground unveil new models on Hesperian climatic changes and paleoenvironments. |
| 2:53 p.m. | Arvidson R. E. * | *Gale Crater: Curiosity Rover and the Candidate Basal Sulfate Unit* **[#1192]** The Curiosity Mars rover will soon ascend onto basal sulfate-bearing strata that have unique spectral properties indicative of hydrated sulfate and amorphous phases, combined with relatively low concentrations of iron oxides. |
| 2:56 p.m. | Weitz C. M. * Bishop J. L. Thomson B. J. Seelos K. D. Lewis K. et al. | *Observations of the Marker Bed at Gale Crater with Recommendations for Future Exploration by the Curiosity Rover* **[#1484]** We believe the most plausible explanations for the marker bed include: (1) a more indurated sulfate unit relative to the less indurated sulfates above/below it, (2) a sandstone, or (3) a volcanic ash deposit laid down while the sulfates formed. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[M155]**

## Monday, March 15, 2021
## IMPACTS: CRATER FORMATION SMALL TO LARGE

### 2:30 p.m. Track 5

### Chairs: Nicolle Zellner and Robert Citron

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Anderson J. L. B. * Cintala M. L. Cline C. J. Dechant L. E. Taitano R. A. et al. | *Impacts into a Strength-Layered Target: The Time Evolution of the Excavation-Stage Flow* **[#1023]** Experimental impacts in strength-layered targets (loose sand over a strong substrate) show complex ejecta patterns: A typical ejecta curtain as well as high-angle ejecta near the impact point. We trace the time evolution of this excavation-stage flow. |
| 2:38 p.m. | Cline C. J. II * Cintala M. J. | *Experimentally Isolating the Effects of Density and Porosity on Impact Craters* **[#1034]** Crater measurement / Density, porosity / Unforeseen control. |
| 2:41 p.m. | Ormö J. * Raducan S. D. Luther R. Herreros M. I. Collins G. S. et al. | *Influence of Target Heterogeneity on Crater Formation: Insight from Laboratory and Numerical Studies* **[#1965]** We compare numerical models with impact experiments into targets with three different structures (homogeneous, layered, and heterogeneous) in support of the DART/Hera asteroid deflection experiment. |

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| 2:44 p.m. | De Marchi L. * Agrawal V. King D. T. Jr. Ormö J. | *Numerical and Experimental Analysis of Wetumpka Impact Crater, with Focus on the Southern Rim* **[#2217]**<br>In this study, we perform numerical simulations of the formation of Wetumpka Crater with focus on the southern collapsed rim. We explore the effects of different input parameters such as impact speed, target water depth, and sediment thickness. |
| 2:47 p.m. | Zhang Y. * Jutzi M. Michel P. Raducan S. D. Arakawa M. | *A Hybrid SPH-SSDEM Framework for End-to-End Impact Cratering Modeling* **[#1974]**<br>With a combination of the SPH and the SSDEM, we developed a novel hybrid framework to achieve self-consistent and high-efficiency end-to-end impact cratering modeling. The concept of this framework and validation tests are presented. |
| 2:50 p.m. | Raducan S. D. * Jutzi M. | *Global Scale Deformations Caused by the DART Impact: Insights to the Collisional Evolution of Small Asteroids* **[#1900]**<br>Do small asteroids / Deform when fast impacts hit? / SPH can tell. |
| 2:53 p.m. | Davison T. M. * Collins G. S. | *Complex Crater Formation by Oblique Impacts on the Earth and Moon* **[#1549]**<br>Complex craters from / Oblique incidence impacts / Are larger than thought. |
| 2:56 p.m. | Ding M. * Zhu M.-H. | *Crustal Annulus of Impact Basins Controlled by Regional Thermal State of the Moon* **[#1097]**<br>We recognize that the PKT impact basins show no crustal annulus that commonly exists for the FHT basins. We attribute the different crustal annulus to regional thermal state and use impact dynamic and viscoelastic models to test this hypothesis. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

## [M161]

## Monday, March 15, 2021
## LUNAR SPACE WEATHERING: SPECTRAL STUDIES AND EXPERIMENTS

### 4:00 p.m. Track 1

### Chairs: Timothy Glotch and David Trang

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Denevi B. W. * Yasanayake C. N. Jolliff B. L. Lawrence S. J. Hiroi T. et al. | *The Spectral Properties of Lunar Agglutinates* **[#2368]**<br>Apollo soils still surprise. It's the agglutinates that are red. The rest is more blue. |
| 4:08 p.m. | Stockstill-Cahill K. R. * Cahill J. T. S. Hibbitts C. A. Livi K. J. T. Waller D. C. | *Ultraviolet Characterization of Fe-impregnated Silica Gels as Analogs for Lunar Space Weathering* **[#1978]** |

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| | | UV reflectance / Behaves differently from Vis / Small iron brightens. |
| 4:11 p.m. | Sorokin E. M. * Yakovlev O. I. Slyuta E. N. Gerasimov M. V. Zaitsev M. A. et al. | *Laser Experimental Modeling of the Formation of Nanophase Iron (np-Fe0)* **[#1975]** As a result of a laser experiment on irradiation of three types of samples, spherules of nanophase iron (np-Fe0) were obtained and described. A mechanism of their formation as a result of thermoreduction and during the passage of a shock wave is proposed. |
| 4:14 p.m. | Lunning N. G. * Gross J. | *Impact Production of Silicon-Bearing Iron-Nickel Metal: A Widely Occurring Process on the Moon?* **[#2225]** A handful of discoveries over the last decade of Si-bearing FeNi alloys in lunar samples — including our work on lunar feldspathic breccia Northwest Africa 11303 — have prompted this evaluation of how these alloys form. |
| 4:17 p.m. | Ishii H. A. Ciston J. Bradley J. P. * Ohtaki K. K. Gillis-Davis J. J. | *Detection of Volatiles in Space Weathered Surfaces* **[#2315]** Detection of radiolytic -OH/$H_2O$ by EELS in space-weathered IDP surfaces but not mature lunar soil suggests efficient steady-state desorption from lunar regolith. |
| 4:20 p.m. | Hicks L. J. * Bridges J. C. Noguchi T. Hidaka H. Piercy J. D. et al. | *XANES and EELS Identification of Fe-Redox Variation in Space Weathered Apollo 17 Lunar Surface Soil* **[#2190]** Fe-K XANES and EELS analyses have shown increased oxidation in the space-weathered surfaces compared to the host grain mineralogy in Apollo 17 lunar surface soil sample grains. |
| 4:23 p.m. | Jordan A. P. * | *Reevaluating How Charged Particles Cause Space Weathering on the Moon* **[#1270]** Experiments that simulate space weathering by charged particles usually use fluxes and fluences that are known to cause dielectric breakdown. This has implications for our understanding of space weathering on the Moon. |
| 4:26 p.m. | Shusterman M. L. * Sharp T. G. Robinson M. S. | *Dielectric Breakdown Weathering: Morphological Effects of Electrical Breakdown in Laboratory-Irradiated San Carlos Olivine* **[#2141]** Dielectric breakdown in laboratory-irradiated San Carlos olivine yielded alterations resembling features of weathered grains typically attributed to solar wind exposure and micrometeorites bombardment. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[M162]**

**Monday, March 15, 2021**
**CRACK, BOOM! ACTIVE AND ERUPTIVE SATELLITES AND OCEAN WORLDS**

**4:00 p.m. Track 2**

**Chairs: Paul Schenk and Jennifer Scully**

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Menten S. M. * Bramson A. M. Sori M. M. | *Cryovolcanically Sourced Methane on Charon* **[#1047]** Charon exhibits evidence of cryovolcanism. We show that this cryovolcanism plausibly produced an ancient atmosphere to represent an endogenic source for its tholin-rich polar cap. |
| 4:08 p.m. | Rathbun J. A. * Tate C. D. Hayes A. G. Spencer J. R. | *Active Volcanoes on Io: Results of Ground-Based Observations from IRTF 2017-2020* **[#2090]** What's been erupting on Io lately? / Loki, Uta, Janus, oh my / Plus, four large outburst eruptions. |
| 4:11 p.m. | Byrne P. K. * Lopes R. M. C. Radebaugh J. Williams D. A. | *An Extensionally Fractured Upper Lithosphere on Io* **[#2198]** A broken island / Straight lines abounding, suggests / A fractured Io. |
| 4:14 p.m. | Skjetne H. L. * Siniger K. N. Hynek B. M. Schenk P. M. Olkin C. B. et al. | *Chaos Terrains on Pluto, Europa, and Mars: Insights to Crustal Lithology and Structure* **[#2052]** We present a morphological comparison of blocks that make up chaos terrains on Pluto, Europa, and Mars using size and height measurements. We demonstrate that chaos blocks can be used to infer information about crustal lithology and structure. |
| 4:17 p.m. | Leonard E. J. * Howell S. M. Mills A. Senske D. A. Patthoff D. A. et al. | *Bringing Order to Chaos: Insights on the Formation of Chaos Terrain from Geologic Mapping of Europa at the Regional Scale* **[#2269]** Europa's chaos: / Blocks of different sizes, / What do they tell us? |
| 4:20 p.m. | Howell S. M. * Leonard E. J. Lovelace-Sims K. Mills A. Senske D. A. et al. | *Fomenting Chaos: Formation on Europa Through Dry Porous Compaction* **[#2423]** There's water, water, / Everywhere. But it's frozen / And pretty beat up. |
| 4:23 p.m. | Schurmeier L. R. * Brouwer G. Fagents S. A. | *Explosive Gas Emission Craters on Earth: Possible Analog for Raised Rim Lakes on Titan* **[#1785]** Arctic ice craters / Analog for Titan lakes? / Gassy ice explodes! |
| 4:26 p.m. | Sharma H. * Hedman M. M. Vahidinia S. | *Variations in the Near-Infrared Spectra of the Enceladus Plume* **[#2326]** Enceladus plume / Its spectrum varies in time / Cassini VIMS saw these. Cassini VIMS observed time variations in the spectrum of the Enceladus plume in 2017. We will describe these variations and discuss their implications for Enceladus. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

## [M163]

## Monday, March 15, 2021
## EVOLUTION OF PARENT BODIES: ACCRETION, DIFFERENTIATION, CRYSTALLIZATION, AND BOMBARDMENT

## 4:00 p.m. Track 3

## Chairs: Julia Cartwright and Pipasa Layak

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Anand A. * Pape J. Wille M. Mezger K. Hofmann B. | *Accretion and Thermal Evolution of IIAB and IIIAB Iron Meteorite Parent Bodies Inferred from Mn-Cr Chronometry* **[#1933]** Mn-Cr model ages are determined from chromite or daubréelite fractions of IIAB and IIIAB iron meteorite samples. The model ages provide constraints on the accretion and differentiation of the parent bodies. |
| 4:08 p.m. | Dodds K. H. * Bryson J. F. J. Neufeld J. A. Harrison R. J. | *The Thermal Evolution of Planetesimals during Accretion and Differentiation: Consequences for Dynamo Generation by Thermally-Driven Convection* **[#2121]** The process and duration of differentiation and core formation controls a planetesimal's ability to generate a thermally-driven dynamo field. We use this result to constrain the physical properties and accretionary history of the angrite parent body. |
| 4:11 p.m. | Tornabene H. A. * Ash R. D. Walker R. J. | *New Insights to the Genetics, Formation, and Crystallization History of Group IC Iron Meteorites* **[#1531]** The chemical and isotopic composition of the IC iron meteorite group is investigated and their formation history is explored via fractional crystallization modeling. |
| 4:14 p.m. | Mikouchi T. * Zolensky M. E. | *Mineralogy and Cooling History of Ungrouped Achondrite Erg Chech 002* **[#2457]** Erg Chech 002 is characterized by large pyroxene xenocrysts whose diffusive zoning profiles suggest fast cooling from high temperature. Trapping of deep interior rocks as xenocrysts might be a common magmatic process as found for quenched angrites. |
| 4:17 p.m. | Hayashi H. * Mikouchi T. | *Stratigraphic Comparison Between Quenched Angrites and Komatiites* **[#2601]** We found stratigraphic similarities between quenched angrites and komatiites, indicating equivalent geological settings of their igneous bodies near the surface. In this case, quenched angrites might originate distant from the eruption site. |
| 4:20 p.m. | Martinez C. Righter M. * Lapen T. J. Irving A. J. | *Further Insights of Temperature-Time Events on HED Parent Body Using U-Th-Pb Chronology of Zircon-Bearing Noritic Diogenite Northwest Africa 10666* **[#2699]** We report zircon and apatite U-Th-Pb isotopic dating of zircon-bearing diogenite NWA 10666. The results are used to constrain their complex thermal history of the HED parent body. |
| 4:23 p.m. | Dhaliwal J. K. * Horan M. F. Ash R. D. Bullock E. S. Carlson R. W. | *Insights from Siderophile Elements into the Impact Origin of Mesosiderites* **[#2236]** Space rocks and breccias / Iron-loving elements / How did they evolve? |
| 4:26 p.m. | White L. F. * Moser D. E. Darling J. R. Rider-Stokes B. Hyde B. et al. | *Accessory Mineral Chronology of Eucrites Reveals New Insights into the Formation, Evolution, and Bombardment of Vesta* **[#2124]** Accessory grains / Age and structure record the / History of Vesta. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[M164]**

## Monday, March 15, 2021
## MARTIAN FLUIDS AND ELEMENT MOBILITY

### 4:00 p.m. Track 4

### Chairs: Patrick Gasda and Cherie Achilles

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| Times | Authors (*Denotes Presenter) | Abstract Title and Summary |
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| 4:00 p.m. | | *End of Session* |
| 4:05 p.m. | Das D. * Gasda P. J. Schwenzer S. P. Crossey L. Turner S. M. R. et al. | *Modeling the Behavior of Selected Water-Soluble Elements in Calcium Sulfate Veins of Gale Crater* **[#2155]** Earth is on fire / So, I found solace in old / Martian waterscapes. |
| 4:08 p.m. | Nellessen M. A. * Crossey L. Gasda P. J. Peterson E. Lanza N. et al. | *Boron Adsorption onto Clay Minerals: Insight into Martian Groundwater Geochemistry* **[#2413]** Boron adsorption analysis of martian clay analogs to determine capability of martian clays for facilitating prebiotic processes as well as the creation of boron standards to improve LIBS boron calibration. |
| 4:11 p.m. | Forni O. * Dehouck E. Cousin A. Bedford C. C. David G. et al. | *Elevated Fluorine Abundances Below the Siccar Point Unconformity: Implications for Fluid Circulation in Gale Crater* **[#1503]** We report numerous detections of high concentration of F at the Siccar Point unconformity in the Glen Torridon region of Gale Crater. We demonstrate the presence of global circulation near the contact between the Murray and the Stimson formations. |
| 4:14 p.m. | Lanza N. L. * Gasda P. J. Essunfeld A. Comellas J. Caravaca G. et al. | *Chemistry of Manganese-Bearing Materials at the Groken Drill Site, Gale Crater, Mars* **[#2231]** We're trying to grok / Weird manganese-phosphorus / Blebs near organics. |
| 4:17 p.m. | Treiman A. H. * Downs R. T. Ming D. W. Morris R. V. Thorpe M. T. et al. | *Possible Detection of a Jahnsite-Whiteite Group Phosphate Mineral by MSL CheMin in Glen Torridon, Gale Crater, Mars* **[#1200]** Black nodules, extra / Manganese and phosphorus: / Mineral surprise! |
| 4:20 p.m. | Smith R. J. * McLennan S. M. Achilles C. N. Dehouck E. Horgan B. N. et al. | *X-Ray Amorphous Sulfates in Gale Crater, Mars* **[#1486]** Gale Crater sedimentary rocks contain amorphous or poorly crystalline Fe-, Ca-, and Mg-sulfates that likely pre-date diagenetic sulfate features (i.e., veins). |
| 4:23 p.m. | Kaufman S. V. * Mustard J. F. | *Constraining the Surface Weathering Formation Conditions of the Olivine-Carbonate Unit in the Northeast Syrtis Region Using Reactive Transport Modelling* **[#2444]** Olivine dissolves. / Temperature-dependent / Magnesite then forms. |
| 4:26 p.m. | Kodikara G. R. L. * McHenry L. J. Grundl T. J. | *A Possible Formation Pathway for Zeolites in Closed-Basin Lakes on Noachian Mars: Insights from Geochemical Modeling* **[#2259]** We explore the formation and fate of zeolites that may have formed in closed basin lakes where volcaniclastic materials were present during late Noachian-early Hesperian time. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

## [M165]

## Monday, March 15, 2021
## IMPACTS: CHANGING PLANETARY BODIES

### 4:00 p.m. Track 5

### Chairs: Thomas Davison and Anna Losiak

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| Times | Authors (*Denotes Presenter) | Abstract Title and Summary |
|---|---|---|
| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Carlson M. A. * Johnson B. C. Melosh H. J. | *Effects of Atmosphere on Ejecta Emplacement on Earth and Mars* **[#1170]** Numerical simulations of impact ejecta plumes on Earth and Mars show high levels of atmospheric interactions on Earth and insignificant atmospheric interactions on Mars when full drag effects are included. |
| 4:08 p.m. | Helhoski S. * Nakajima M. Gagne J. Trail D. | *A Numerical Model to Constrain the Origin of Lunar Impact Ejecta* **[#2576]** We quantify the effect of contamination on Apollo samples due to ejecta from nearby craters. Using iSALE impact simulations, we generate profiles of the landing locations of material and the pressure-temperature distributions of material. |
| 4:11 p.m. | Wiggins S. E. * Johnson B. C. | *Solid Fragments Ejected by Lunar Hypervelocity Impacts* **[#2307]** We have used an implementation of the Grady-Kipp fragmentation algorithm to directly model the fragment size distribution within lunar ejecta curtains using the iSALE shock physics code. |
| 4:14 p.m. | Powell T. M. * Rubanenko L. Williams J.-P. Paige D. A. | *Modeling the Accumulation of Secondary Craters on Mars and the Moon* **[#2410]** We model the global accumulation of secondary craters with time on Mars and the Moon, accounting for the spatial clustering of secondaries around their parent primary. |
| 4:17 p.m. | Abramov O. * Mojzsis S. J. | *Thermal Consequences of Impact Bombardments to the Silicate Crusts of Terrestrial-Type Exoplanets* **[#1747]** We model the effects of post-accretionary impact bombardment on a mini-Earth (1/10 Earth mass), a super-Earth (10 times Earth mass), and Proxima Centauri b (2 times Earth mass), making predictions for lithospheric melting and habitable volumes. |
| 4:20 p.m. | Wójcicka N. * Collins G. S. Bastow I. D. Miljkovic K. Rajsic A. | *Seismic Source Time Function and Frequency Content of Impact-Generated Seismic Waves* **[#2134]** Seismic source models / Of meteorite impacts / Making waves on Mars. |
| 4:23 p.m. | Holm-Alwmark S. * Erickson T. Cavosie A. J. | *Twinned Magnetite in Granitic Samples from the Siljan Impact Structure, Sweden* **[#1089]** We describe twinning in magnetite in samples from the Siljan impact structure using electron backscatter diffraction. Observed twins occur in multiple orientation sets. We have not observed any such twins in seemingly unshocked investigated samples. |

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| 4:26 p.m. | Ballantyne H. * Jutzi M. Golabek G. J. | *Identifying the Sweet Spot for an Impact-Induced Martian Dichotomy* **[#2777]**<br>In this work, we use a large suite of smoothed-particle hydrodynamic simulations detailing a giant impact with a Mars-like body in an attempt to identify a parameter-space that could have led to the Martian Crustal Dichotomy. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[T201]**

**Tuesday, March 16, 2021**
**SPECIAL SESSION: MARS 2020 I (LIVE PRESENTATIONS)**

**11:00 a.m. Track 1**

**Chairs: Katie Stack Morgan and Adrian Brown**

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| Times | Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|---|
| 11:00 a.m. | Farley K. A. * Trosper J. Mars 2020 Science Team Mars 2020 Engineering Team | *The Mars 2020 Mission One Month After Landing* **[#1317]**<br>This abstract discusses the capabilities, plans, and current status of the Mars 2020 mission and its Perseverance rover about one month after scheduled landing on Mars. |
| 11:15 a.m. | Williford K. H. * Farley K. A. Stack K. M. Bosak T. Flannery D. T. et al. | *A Tour of Ancient Habitable Environments In and Around Jezero Crater, Mars* **[#1599]**<br>The Mars 2020 team plans to explore and collect samples from diverse ancient environments preserved in the rocks in and around Jezero Crater. Here, we offer a tour of diverse, ancient habitable environments planned for exploration and sampling. |
| 11:30 a.m. | Herd C. D. K. * Bosak T. Stack K. M. Sun V. Z. Benison K. C. et al. | *Sampling Mars: Notional Caches from Mars 2020 Strategic Planning* **[#1987]**<br>We describe the general characteristics of the samples that we anticipate the Mars 2020 rover to be able to collect, and demonstrate that these samples match the priorities as articulated by the scientific community. |
| 11:45 a.m. | Ehlmann B. L. * Bell J. III Brown A. Horgan B. Hurowitz J. A. et al. | *Mineralogy from Mars-2020: Updates to the Regional Geologic History of Jezero Crater, Its Watershed, and a Framework for Perseverance Exploration* **[#1721]**<br>We integrate existing initial data from Mars 2020 and describe how in situ mineralogy data of detrital materials will resolve key questions about magmatic, impact, and alteration processes in the Noachian regional units eroded by the Jezero watershed. |
| 12:00 p.m. | | *End of Session* |

**[T221]**

## Tuesday, March 16, 2021
## SPECIAL SESSION: MARS 2020 II (LIVE PRESENTATIONS)

### 12:30 p.m. Track 1

### Chairs: Ken Williford and Nina Lanza

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| Times | Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|---|
| 12:30 p.m. | Maki J. N. * Gruel D. McKinney C. Ravine M. A. Morales M. et al. | *Initial Results from the Mars 2020 ECAM Imaging System* **[#1004]** Mars 2020 Perseverance rover is scheduled to land on Mars on Feb 18, 2021. The rover is equipped with a next-generation engineering camera (ECAM) imaging system, an upgrade over previous rover missions. We will review the initial images and results. |
| 12:45 p.m. | Bell J. F. III * Maki J. N. Mehall G. L. Ravine M. A. Caplinger M. A. et al. | *Anticipated Initial Results from the NASA Mars 2020 Perseverance Rover Mastcam-Z Multispectral, Stereoscopic Imaging Investigation* **[#2181]** This presentation will describe the initial results obtained at the Jezero Crater landing site during the first ~month of observations from the Mars 2020 Perseverance rover's Mastcam-Z multispectral, stereoscopic imaging investigation. |
| 1:00 p.m. | Wiens R. C. * Maurice S. Gasnault O. Anderson R. B. Beyssac O. et al. | *SuperCam on the Perseverance Rover for Exploration of Jezero Crater: Remote LIBS, VISIR, Raman, and Time-Resolved Luminescence Spectroscopies Plus Micro-Imaging and Acoustics* **[#1182]** SuperCam will perform remote observations of chemistry, mineralogy, physical properties, and morphology of rocks and soils at the Perseverance landing site, plus study wind and atmospheric species. First results may be presented at the meeting. |
| 1:15 p.m. | Rodriguez-Manfredi J. A. * de la Torre Juarez M. Apestigue V. Arruego I. Banfield D. et al. | *First Observations with MEDA: The Environmental and Meteorological Package for Mars 2020* **[#1506]** We will share the initial results recorded by the MEDA instrument onboard Perseverance. |
| 1:30 p.m. | | *End of Session* |

**[T251]**

## Tuesday, March 16, 2021
## SPECIAL SESSION: MARS 2020 III (LIVE PRESENTATIONS)

### 2:30 p.m. Track 1

## Chairs: Ken Farley and Marion Nachon

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| Times | Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|---|
| 2:30 p.m. | Hamran S.-E. * Paige D. A. Amundsen H. E. F. Berger T. Brovoll S. et al. | *RIMFAX GPR on the MARS 2020 Investigation at Jezero Crater* **[#1223]** The Radar Imager for Mars' Subsurface Experiment (RIMFAX) is a Ground Penetrating Radar on the Mars 2020 mission's Perseverance rover, which is planned to land in Jezero Crater on February 18, 2021. |
| 2:45 p.m. | Bhartia R. * Beegle L. W. Deflores L. Abbey W. Razzell Hollis J. et al. | *The Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals Instrument on the Mars 2020 Perseverance Rover* **[#1302]** The Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals (SHERLOC) is a robotic arm-mounted instrument on NASA's Perseverance rover. |
| 3:00 p.m. | Minitti M. E. * Kennedy M. R. Edgett K. S. Beegle L. W. Asher S. A. et al. | *The Mars 2020 WATSON Imaging Subsystem of the SHERLOC Investigation and Anticipated Early Results* **[#2028]** Perseverance has / WATSON to spy rocks, boreholes / And sometimes itself. |
| 3:15 p.m. | Allwood A. C. Hurowitz J. A. * Clark B. C. Cinquini L. Davidoff S. et al. | *The PIXL Instrument on the Mars 2020 Perseverance Rover* **[#1591]** Scanning through the night / X-rays, lasers, images / Mars petrology. |
| 3:30 p.m. | | *End of Session* |

**[T252]**

## Tuesday, March 16, 2021
## ENDOGENOUS LUNAR VOLATILES THROUGH TIME AND SPACE

## 2:30 p.m. Track 2

## Chairs: Allan Treiman and Sarah Valencia

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Charnoz S. * Sossi P. Lee Y.-N. Siebert J. Hyodo R. et al. | *Tidal Pull of the Earth Strips the Proto-Moon of Its Volatiles* **[#1326]** |

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| | | We investigate how the proto-Moon may have lost its volatiles. We consider the case of a molten proto-Moon with a magma ocean. We model loss through hydrodynamical escape, including Earth's tides. We get good match with Na and K lunar abundances. |
| 2:38 p.m. | Mallik A. * Schwinger S. Roy A. Moitra P. | *The Importance of Hydrogen Partitioning During Lunar Magma Ocean Crystallization: Implications for Constraining the Water Content of the Bulk Silicate Moon* **[#1800]**<br>We show the importance of H partition coefficients between nominally anhydrous minerals and melt on constraining how wet the Moon is, by modeling the behavior of H during fractional crystallization of lunar magma ocean. |
| 2:41 p.m. | Su X. * Zhang Y. | *15597 Pigeonite Basalts: Evidence for a Wet Primitive Lunar Mantle* **[#1153]**<br>We report in 15597 pigeonite basalts, two glassy pyroxene-hosted melt inclusions contain 558–733 ppm $H_2O$ with $H_2O$/Ce ratios ~22. Augite and pigeonite in the basalts contain 14–26 ppm $H_2O$, leading to $H_2O$/Ce ratios of 11 to 13 in the equilibrium melt. |
| 2:44 p.m. | Costin G. * Barker D. C. | *Lunar Sample 15421,67: Enigmatic Magnesio-Hornblende Monocrystal Hosting Almandine, Omphacite, Quartz, Epidote, Osumilite-Mg, and $Al_2SiO5$* **[#2267]**<br>A 15421,67 handpicked grain was analyzed confirming that it is a crystal of magnesio-hornblende (Mg-hb) with inclusions of almandine-rich garnet, zoisite-epidote, quartz, osumilite-Mg, rutile, and $Al_2SiO5$, giving a unique and anomalous assemblage. |
| 2:47 p.m. | Liu Y. * Ma C. | *Discovery of A Na-K-Sulfate on Apollo 74220 Orange Beads: Direct Evidence of Volcanic Outgassing of Na and K on the Moon* **[#2064]**<br>Discovery of a Na-K-sulfate on the surface of 74220 orange beads indicates active outgassing of Na and K with H, S, F, Cl in the pyroclastic eruption that formed orange beads, with implications of volatile loss on the Moon. |
| 2:50 p.m. | Zhang Y. * | *Magnitude of Stable Isotope Fractionation in Lunar Basalts* **[#1220]**<br>Possible cause for larger magnitude of isotope fractionation in lunar basalts than in terrestrial basalts will be discussed. |
| 2:53 p.m. | Wilcoski A. X. * Hayne P. O. Landis M. E. | *Polar Ice Accumulation on the Moon Due to Volcanically Induced Transient Atmospheres* **[#2344]**<br>Volcanoes erupt / Water vapor into ice / Condensing at poles. |
| 2:56 p.m. | Aleinov I. * Way M. J. Tsigaridis K. Wolf E. T. Harman C. et al. | *The Role of the Transient Volcanically-Induced Lunar Atmosphere in Transport and Deposition of Polar Volatiles* **[#2335]**<br>During the peak of volcanic activity ~3.5 Ga the Moon could have a transient volcanically-induced atmosphere. We use a 3-D GCM to study the ability of such an atmosphere to transport volatiles to the polar cold traps. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[T253]**

## Tuesday, March 16, 2021
## CALCIUM-ALUMINUM-RICH INCLUSIONS IN METEORITES

## 2:30 p.m. Track 3

## Chairs: Nan Liu and Rachel Smith

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Desch S. J. * Herbst A. K. Williams C. D. Dunham E. T. Mane P. | *Radial Distribution of CAIs* **[#2663]** Whence far CAIs? / Disk winds? In the disk, drifting? / Drift. Winds don't fling things. |
| 2:38 p.m. | Mane P. * Desch S. J. Dunham E. T. Williams C. D. | *Oxygen Isotope Reservoirs in the Solar Nebula* **[#2566]** Solar nebula / Isotopes, fugacities / Oxygen defined. |
| 2:41 p.m. | Tissot F. L. H. * Charlier B. L. A. Vollstaedt H. Dauphas N. Wilson C. J. N. et al. | *Evidence for the Survival of a P-Process Anomaly Carrier in Fine-Grained CAIs from Allende* **[#2641]** Step-leaching of fine-grained refractory inclusions from Allende reveal the presence of large 84Sr anomalies. These are best explained by the preservation in fine-grained CAIs of a presolar carrier enriched in p-process 84Sr. |
| 2:44 p.m. | Nakashima D. * Friedrich J. M. Ott U. | *Initial 244Pu/$^{238}$U Ratios and Search for Presolar SiC in CAIs Inferred from Noble Gas and Trace Element Abundances in CAIs from CV3 Chondrites* **[#1944]** The Pu/U ratio estimated from noble gas and REE abundances in the five CV3 CAIs is consistent with the inferred value of 0.0068 within the uncertainty. The five CAIs showed no 130Xe excess due to pre-solar SiC, unlike CAIs in previous studies. |
| 2:47 p.m. | Shollenberger Q. R. * Render J. Jordan M. K. McCain K. A. Ebert S. et al. | *Titanium Isotope Systematics of Refractory Inclusions: Echoes of Molecular Cloud Heterogeneity* **[#2316]** We suggest that the Ti isotope heterogeneity in CAIs is an "echo" of the heterogeneity in hibonites. We propose that the heterogeneity in hibonites is in turn an echo of the much greater heterogeneity in the precursor presolar grains. |
| 2:50 p.m. | Mishra R. K. * Marhas K. K. Chaussidon M. | *Multiple Episodes of Superflares from Our Nascent Sun: Evidences from a Canonical CAI in Vigarano* **[#1834]** 7Be and $^{10}$Be records in a type B canonical CAI from Vigarano (CV~3.1-3.4) provides evidence of multiple episodes of superflares from our nascent Sun. |
| 2:53 p.m. | Pravdivtseva O. * Meshik A. Hohenberg C. M. | *Experimental Determination of the 129I/127I Ratio in the Early Solar System* **[#2570]** We estimated 129I/127I ratio at the time of CAIs condensation based on the measured 129I/127I value in neutron irradiated Shallowater. Two standards with ppb iodine levels were used to determine the conversion factor for this irradiation. |
| 2:56 p.m. | Ebel D. S. * Fendrich K. V. | *Separate CAI Reservoirs for Allende (CV3) and Murchison (CM2)* **[#2311]** Chemical compositions, textures, and sizes of CAIs reveal characteristic populations in CV and CM chondrites. With chondrule evidence, this supports a single reservoir, local formation, and accretion origin for all components of each chondrite type. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[T254]**

## Tuesday, March 16, 2021
## ICY SATELLITES AND OCEAN WORLDS: GEOLOGY AND GEOPHYSICS

### 2:30 p.m. Track 4

### Chairs: Erin Leonard and Lauren Schurmeier

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | McGovern P. J. * White O. L. Schenk P. M. | *New Constraints on Pluto's Lithosphere from Tectonics, Cryovolcanism, and Sputnik Planitia Loading Models* **[#2698]**<br>Sputnik Basin II / To match stress, faults, volcanoes / Shell must be just so. |
| 2:38 p.m. | Moruzzi S. A. * Andrews-Hanna J. C. Schenk P. | *Constraining the Compensation State, Structure, and Geophysical Evolution of Sputnik Basin on Pluto* **[#2099]**<br>Numerical modeling of the local gravity field over the center of Sputnik Basin for a range of compensation states using the topography of Sputnik Planitia and a comparison of the observed and predicted geoids. |
| 2:41 p.m. | Kang W. * Flierl G. Mittal T. Bire S. Campin J. et al. | *The Enceladus's Ice Shell Geometry: How It Could Form and What It Tells Us* **[#1392]**<br>Two questions are approached regarding Enceladus: 1) what gives rise to the dramatic hemispheric asymmetry of the Enceladean ice shell, and 2) under what condition the observed ice geometry can be sustained. |
| 2:44 p.m. | Belgacem I. * Schmidt F. Jonniaux G. | *Regional Photometric Study of Ganymede's Surface* **[#1142]**<br>Jupiter's icy moons are at the center of future missions. Ganymede will be the primary target of ESA's JUICE mission. Here, we focus on the photometry of its surface and what we can learn to identify regions of interest for future exploration. |
| 2:47 p.m. | King O. R. T. * Fletcher L. N. | *Compositional Mapping of Europa and Ganymede with VLT/SPHERE and Galileo/NIMS Using Markov Chain Monte Carlo Fitting* **[#1060]**<br>Infrared spectral observations of Europa and Ganymede from VLT/SPHERE and Galileo/NIMS have been fit using a Monte Carlo model to calculate compositional abundances and uncertainties. |
| 2:50 p.m. | Detelich C. E. * Kattenhorn S. A. | *Regional Scale Tectonic Features at Argadnel Regio and Agenor Linea, Europa: Plate Tectonic Evidence or Global Tidal Forcing?* **[#2461]**<br>Europa's fractures / Mapped in tremendous detail / Global tides or plates? |
| 2:53 p.m. | Himo R. * Carpy S. Tobie G. Castelain C. | *Effect of a Superficial Porous Brittle Layer on the Thermal Equilibrium of Europa's Ice Shell* **[#1240]**<br>A superficial porous brittle layer can change the thermal equilibrium of Europa's ice shell and increase the near surface temperature gradient which can improve convection and promote local rise of warm material near the surface. |

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| 2:56 p.m. | Lien R. * Craft K. Walker M. German C. Jakuba M. et al. | *Modeling Fracture Hazards at Europa for Cryobot Tunneling and Communication* **[#1005]**<br>The abundance of fractures within Europa's ice shell could make for a challenging environment to explore. Fractures can grow and slip like a fault, so we are modeling fracture slip events to understand the risks for a probe tunneling through the ice. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

## [T255]

## Tuesday, March 16, 2021
## GREAT BALLS OF FIRE: EXPLOSIVE VOLCANISM ACROSS THE SOLAR SYSTEM

## 2:30 p.m. Track 5

## Chairs: Erica Jawin and Sebastien Besse

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Jozwiak L. M. * Wagoner C. M. Izenberg N. R. | *Investigating the Unexpected Youth of Mercury's Pyroclastic Deposits* **[#2223]**<br>We use a combination of stratigraphy, geomorphologic, and spectral techniques to investigate the relative ages of Mercury's pyroclastic deposits. We determined that deposit reflectance is consistent with vent degradation, and vents are likely young. |
| 2:38 p.m. | Barraud O. * Besse S. Doressoundiram A. Cornet T. Munoz C. | *Global Analysis of Mercury's Pits Surroundings* **[#2065]**<br>We investigate the spectral properties of Mercury's pits surroundings. First results indicate that 136 have been observed in the UV, VIS, and NIR, of which 87 show a spectral anomaly specific to pyroclastic deposits in the three wavelength ranges. |
| 2:41 p.m. | Henderson M. J. B. * Horgan B. H. N. | *Spectral Analysis of Explosive and Effusive Volcanic Edifices in the Marius Hills Volcanic Complex with Moon Mineralogy Mapper* **[#2465]**<br>Many volcanics / Each a different color / Perfect place to Go! |
| 2:44 p.m. | Pigue L. M. * Bennett K. A. Horgan B. H. N. Gaddis L. R. | *Spectral Analysis of Lunar Pyroclastic Deposits in the Montes Apenninus Region* **[#1568]**<br>We evaluated the mineralogy of lunar pyroclastic deposits in the Montes Apenninus region to determine their igneous provenance. We used data from the Moon Mineralogy Mapper spectrally to evaluate the complex volcanology within the region. |
| 2:47 p.m. | Ganesh I. * McGuire L. Carter L. M. | *Dynamics of Dense Pyroclastic Flows on Venus — Insights into Pyroclastic Eruptions* **[#1218]**<br>Radar bright features / If these are pyroclastics / How could they have formed? |
| 2:50 p.m. | Bates A. * Karunatillake S. Goossens S. Ohja L. | *Evidence for Supervolcanic Resurfacing in Arabia Terra, Mars* **[#1520]** |

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| | Lorenzo J. M. | An ancient province on Mars bears a regional chemistry that is strikingly similar to other martian igneous provinces, but lacks convincing morphological evidence for igneous activity. Our analyses suggests that volcanism emplaced this chemistry. |
| 2:53 p.m. | Payre V. * Siebach K. L. Thorpe M. T. Antoshechkina P. Rampe E. B. | *Is Tridymite a Witness of Explosive Volcanism in Early Mars?* **[#1707]** Reviewing terrestrial literature and running thermodynamical models, we propose that the monoclinic tridymite in a Si-rich mudstone in Gale Crater, Mars is the witness of an explosive silicic eruption that could have happened thousands of km away. |
| 2:56 p.m. | Moitra P. * Horvath D. G. Andrews-Hanna J. C. | *Roles of Magmatic Volatile, Ground Ice, and Impact Triggering on the Dynamics of the Most Recent Explosive Volcanic Eruption on Mars* **[#1803]** Using magma ascent and heat transfer models, we studied the dynamics of highly explosive eruption that formed the most recent volcanic deposit on Mars. Using scaling analysis, we explored eruption-triggering by nearby Zunil crater-forming impact. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[T261]**

## Tuesday, March 16, 2021
## SPECIAL SESSION: MARS 2020 IV (LIVE PRESENTATIONS)

### 4:00 p.m. Track 1

### Chairs: Christopher Herd and Rebecca Smith

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|---|---|---|
| 4:00 p.m. | Hundal C. B. * Mustard J. F. Tarnas J. D. Kremer C. H. | *Comparing the Jezero Floor Unit and the Circum-Isidis Mafic Cap: Morphology, Stratigraphy, and Composition* **[#2475]** Two mafic units / Present to CRISM's sharp eye / A single vision. |
| 4:15 p.m. | Quantin-Nataf C. * Holm-Alwmark S. Lasue J. Calef F. J. Shuster D. et al. | *The Complex Exhumation History of Jezero Crater Floor Unit* **[#2034]** We present evidence showing the crater floor unit of Jerero is >3 Ga old and has been initially buried below a few tens of meters thick unit that gradually eroded away resulting in uneven exposure to impact bombardment. |
| 4:30 p.m. | Tarnas J. D. * Parente M. Stack K. M. Mustard J. F. Koeppel A. H. D. et al. | *Origins of Carbonate-Bearing Rocks in Jezero Crater* **[#2251]** We constrain hypotheses for carbonate formation in Jezero Crater by integrating all available datasets with sufficiently high spatial resolution. |
| 4:45 p.m. | Simon J. I. * Scheller E. L. Holm-Alwmark S. | *Characterizing the Stratigraphy of the Nili Planum Region Outside Jezero Crater: Implications for* |

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| | Benison K. C. Bosak T. et al. | *Mars 2020 Strategic Planning* **[#1515]**<br>We characterized Nili Planum stratigraphy and geologic units near Jezero Crater at HiRISE scale and outline Mars 2020 science for a possible extended mission. Rover paths considered encounter units overlapping all major events in martian history. |
| 5:00 p.m. | | *End of Session* |

**[T262]**

## Tuesday, March 16, 2021
## LUNAR VOLATILES THROUGH REMOTE SENSING, MODELING AND EXPERIMENTS

### 4:00 p.m. Track 2

### Chairs: Charles Hibbitts and Parvathy Prem

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|---|---|---|
| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Lucey P. G. * Costello E. Hurley D. M. Orlando T. Farrell W. M. et al. | *Understanding the Contemporary Lunar Volatile System as a Key to the Past* **[#1764]**<br>Does the lunar atmosphere go ballistic? We ought to find out. |
| 4:08 p.m. | Flom A. J. * Lucey P. G. Honniball C. I. Head J. W. III | *Telescopic Hydration Observations of Change'e 5 Landing Site in Partial Eclipse* **[#1863]**<br>Chang'e 5 in eclipse, water dimly perceived. |
| 4:11 p.m. | Honniball C. I. * Lucey P. G. Petro N. E. Li S. Young K. E. | *Enhanced Hydration at Craters with Central Peaks Detected by Ground-Based Observations* **[#1256]**<br>We present observations of 3 μm hydration at Bullialdus and Aristarchus craters using the ground-based NASA InfraRed Telescope Facility. The location and distribution of hydration is consistent with an internal magmatic source. |
| 4:14 p.m. | Li S. * Taylor G. J. Lentz R. Needham D. H. Gaddis L. et al. | *Water Anomalies at Rugged Lava Flows on the Moon* **[#2508]**<br>We observed water anomalies at rugged lava flows revealed by 70 cm radar CPR on the Moon. These water anomalies do not show up in maps of albedo, topography, $TiO_2$ content, and 12 cm radar CPR. The excess water could be sourced from the interior. |
| 4:17 p.m. | Thomson B. J. * Bhiravarasu S. S. Nypaver C. A. Patterson G. W. Stickle A. M. et al. | *One of These Poles is Not Like the Other: Asymmetry in the Global Distribution of Lunar CPR Anomalous Craters* **[#2489]**<br>Lunar polar ice / Hiding in craters, or just / Rough walls, fooling us? |
| 4:20 p.m. | Fisher E. A. * Mustard J. F. Pieters C. M. | *Evaluating Water Adsorption Through Remotely Acquired Spectra of the Lunar Surface* **[#2742]**<br>We use Hapke radiative transfer modeling to isolate the spectral signatures of surface adsorbed and internally bound water on lunar relevant materials, information critical to interpreting remotely acquired spectra returned from lunar missions. |

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| 4:23 p.m. | Reiss P. * Warren T. Sefton-Nash E. Trautner R. | *Diurnal Storage and Release of Lunar Subsurface Water in the Clavius Region* **[#2333]** We modelled the subsurface migration of lunar water in the Clavius region and found that water temporarily captured at night and released during day might partially explain observations of water signatures in illuminated areas. |
| 4:26 p.m. | Keller J. W. * Chornay D. J. McLain J. L. | *Negative Secondary Ion Sputtering by Solar Wind Energy Ions on Lunar Samples* **[#1522]** We will report preliminary results from time-of-flight (TOF) mass analysis of negative ions sputtered from lunar samples when exposed to ions with solar wind energies. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[T263]**

**Tuesday, March 16, 2021**
**CHONDRULES: THE CONTINUING CONUNDRUM**

**4:00 p.m. Track 3**

**Chairs: Tasha Dunn and Ashley King**

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Siron G. Kita N. T. * Fukuda K. Kimura M. | *High Precision Al-Mg Chronology of Chondrules in Unequilibrated Ordinary Chondrites* **[#1639]** New analyses of UOC chondrules with a range of mesostasis compositions indicate a restrict range of their formation ages from 1.8 to 2.2 Ma after CAIs, much shorter than 1.5-3 Ma and 0-4 Ma estimated from previous Al-Mg and Pb-Pb ages, respectively. |
| 4:08 p.m. | Fukuda K. * Hibiya Y. Kastelle C. R. Suzuki K. Iizuka T. et al. | *Multiple CV Chondrule Precursors Originating from the Inner and Outer Solar System: Evidence from Cr-Ti-O Isotope Systematics of Allende Chondrules* **[#1319]** The large ranges of Cr-Ti-O isotope ratios among CV chondrules indicate that they formed by reprocessing of multiple chemically and isotopically distinct precursors that include the materials originating from the inner solar system. |
| 4:11 p.m. | Cashion M. D. * Johnson B. C. Wakita S. Davison T. Krot A. N. et al. | *Producing Chondrules in the Outer Solar System: The Effect of Ice on Impact Jetting* **[#1737]** In this work, we simulate collisions between bodies of mixed ice and rock composition to emulate early outer solar system impacts. We determine that ice content significantly reduces the efficiency of chondrule formation by impact jetting. |
| 4:14 p.m. | Greenwood J. P. * Herbst W. | *New Constraints on Chondrule Formation from Experimental Reproduction of Aluminum and Titanium Zoning in Chondrule Olivine* **[#1617]** |

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| | | Al and Ti zoning in chondrule olivine is best reproduced at 3000-6000 K/hr. New experimental techniques reproduce textures, chemistry of glass and olivine, retain Na, and have many relict grains, similar to Type I chondrules. |
| 4:17 p.m. | Koefoed P. * Pravdivtseva O. Ogliore R. Jiang Y. Lodders K. et al. | *K Isotope Systematics of the CB Chondrite Gujba: Testing the Impact Plume Model of Formation* **[#2310]**<br>High-precision K isotope analysis of chondrule and bulk fractions from the CB chondrite Gujba and their implications on CB chondrite formation. |
| 4:20 p.m. | Sheikh D. * Humayun M. | *Geochemical Constraints on Potential UOC Chondrule Genesis by Hypervelocity Impact Vapor Plumes and Likely Precursor Sources* **[#1279]**<br>Most UOC chondrules analyzed exhibit Ce, and Eu anomalies, implying a chondrule forming process that began oxidized but went reducing, consistent with an impact scenario within nebular gas. Most UOC chondrules formed from undifferentiated precursors. |
| 4:23 p.m. | Azevedo-Vannson S. * Remusat L. Piani L. Pont S. Roskosz M. | *Hydrogen Content in Chondrules of CM Chondrites: Influence of Aqueous Alteration or Preaccretional Heritage?* **[#1867]**<br>Ion probe reveals high H content in NAMs of chondrules in Paris and Aguas Zarcas CM chondrites. D/H, H, and FeO concentrations appear correlated. This may relate to preaccretionnary formation processes or aqueous alteration on the parent body. |
| 4:26 p.m. | Carballido A. * Xiang C. Hanna R. D. Matthews L. S. Hyde T. W. | *Early Accretion of Chondrule Dust Rims* **[#1976]**<br>We are conducting numerical and laboratory studies of the accretion and compaction of chondrule fine-grained rims (FGRs). Our aim is to determine FGR porosity, thickness, and grain alignment. Rim grain shape is important for FGR porosity. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[T264]**

## Tuesday, March 16, 2021
## ICY AND OCEAN WORLDS: COMPOSITIONAL EVOLUTION AND STATE

### 4:00 p.m. Track 4

### Chairs: Bethany Theiling and Xinting Yu

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Spiers E. M. * Schmidt B. E. | *Water Activity of Europa's Ocean: Temporal Variability and Implications* **[#2643]** |

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| | | In this work, we examine how changes in ocean salinity and water activity affect geochemical processes in Europa's rocky mantle, driven by its tidal and thermal evolution, and implications for Europa's habitability. |
| 4:08 p.m. | Fox-Powell M. G. * Buffo J. J. Vance S. D. Semprich J. Ramkissoon N. et al. | *Brine Evolution and Transport-Driven Fractionation of Ocean Fluids Within Europa's Icy Shell* **[#1929]**<br>We use models of brine freezing and ice shell structure to explore the potential for brines within Europa's icy shell to become fractionated away from ocean composition. |
| 4:11 p.m. | Cerubini R. * Pommerol A. Galli A. Yoldi Z. Jost B. et al. | *VIS-NIR Spectral Study of Salty Ice Analogue Samples with Implications for Icy Moons* **[#1466]**<br>We produce, sublimate, and irradiate salty ices as analogues for icy moons surfaces. We show how their spectra reflect the complex structure and composition of the samples due to their production procedure and alteration through electrons irradiation. |
| 4:14 p.m. | Semprich J. * Schwenzer S. P. Treiman A. H. | *Rocky Core Meets Fluids — Modeling Metamorphic Phases on Icy Moons* **[#1059]**<br>Fluids meet rock core / On Icy Moons far away / New minerals form. |
| 4:17 p.m. | Prettyman T. H. * Castillo-Rogez J. C. Landis M. E. Yamashita N. | *Elemental Constraints on Ceres' Hydrothermal Evolution: Regolith Models* **[#1249]**<br>Geochemical models of Ceres' global regolith are compared to elemental data acquired by Dawn's Gamma Ray and Neutron Detector. The data are consistent with endogenic mixtures of salts from crustal brines, aqueously altered rock, and organic matter. |
| 4:20 p.m. | Hamp R. E. * Schwenzer S. P. Fox-Powell M. Olsson-Francis K. Pearson V. K. | *Modelling Water-Rock Interactions in the Subsurface Environment of Enceladus* **[#1244]**<br>Thermochemical modelling of the subsurface environment of Enceladus from different hypothetical starting conditions, to ascertain a modern day ocean chemistry that has been compared to the Cassini observations. |
| 4:23 p.m. | Cable M. L. * Vu T. H. Maynard-Casely H. E. Malaska M. J. Choukroun M. et al. | *The New Field of Titan Cryomineralogy: Six Confirmed Co-Crystals and Counting* **[#1211]**<br>First one, then two, now up to six / New minerals lab work predicts / On Titan — lots more in the queue, / And Dragonfly may shed light too. |
| 4:26 p.m. | Duncan T. * Yu X. Thompson M. Kim K. Telus M. et al. | *Outgassing Experiments on Carbonaceous Chondrites and Their Implications for Titan's Secondary Atmosphere* **[#2664]**<br>Outgassed organics / Inside Titan / May resupply / The mysterious methane. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[T265]**

**Tuesday, March 16, 2021**
**LET IT FLOW: LAVA FLOW DYNAMICS AND EMPLACEMENT ACROSS THE SOLAR SYSTEM**

**4:00 p.m. Track 5**

**Chairs: Ethan Schaefer and Susan Sakimoto**

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Schaefer E. I. * Neish C. D. Hamilton C. W. | *Strong Variability in the Decameter-Scale Geometries of Lava Flow Margins* **[#2401]** The progressive margins of the 2014–2015 Holuhraun flow field exhibit strong geometric variability at coarse scales (>10 m) that is absent at finer scales. Such geometries may support remote interpretation of emplacement dynamics for planetary flows. |
| 4:08 p.m. | Keszthelyi L. P. * Rumpf M. E. | *Progress Toward a Porous Flow Model for the Emplacement of Pahoehoe Flow Fields* **[#2005]** We are making progress toward testing the concept that compound pahoehoe lava flow fields can be simulated using a porous flow model. |
| 4:11 p.m. | Sisolekar S. * Duraiswami R. Monterio A. | *A Rheological, Mathematical, and Statistical Comparison of Lunar Rilles and Terrestrial Lava Tubes* **[#2298]** Dimensional/rheological analysis of lunar and terrestrial lava tubes explain the occurrence and huge dimensions of lunar rilles. Lunar lavas had high eruption temperatures/inflation and deeper/wider/longer flows due to low gravity and atmospheric pressure. |
| 4:14 p.m. | Wilson L. * Head J. W. | *Lunar Volcanic Eruptions: Estimates of Magma Volatile Contents, Volumes, and Eruption Rates* **[#1226]** We infer lunar magma volatile contents using depths and widths of sinuous rille source craters and compare these with dark mantle eruption volatile contents. |
| 4:17 p.m. | Davies A. G. * Wilson L. Head J. W. III de Kleer K. de Pater I. | *Modelling Voluminous, Rapid Lava Flow Emplacement on Io to Constrain Lava Composition* **[#1539]** We model rapid, voluminous lava flow emplacement on Io to constrain eruption parameters and lava composition using groundbased telescope thermal emission data of Io's most powerful eruptions. |
| 4:20 p.m. | Quick L. C. * Fagents S. A. Nunez K. A. Beyer R. A. Beddingfield C. B. et al. | *A Volume Flux Approach to Europa Cryolava Dome Formation and Implications for the Thermal Evolution of Crustal Fluid Reservoirs* **[#2637]** We consider cryolava dome emplacement on Europa as cryolavas are actively erupted from a vent. We also consider thermal conditions in subsurface fluid reservoirs (i.e., cryomagama chambers) that would facilitate these eruptions. |
| 4:23 p.m. | Morrison A. A. * Whittington A. G. Mitchell K. L. | *Modeling Effusive Cryolava Flows: Reevaluating Flow Emplacement* **[#2123]** Modeling effusive cryolava emplacement lies at the intersection of volcanology and hydrology. Cryolavas are better modeled as floods rather than lava flows. Physical state of flow at transition to laminar is key to resulting morphology and textures. |
| 4:26 p.m. | Dapremont A. M. * Wray J. J. | *Subsurface Sediment Mobilization on Mars: Compositional Analysis Using HiRISE Color Data* **[#2101]** An investigation of the compositional characteristics of proposed mud volcanoes on Mars using HiRISE color data. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

## [W301]

## Wednesday, March 17, 2021
## LUNAR SCIENCE FOR THE NEW MILLENNIUM (LIVE PRESENTATIONS)

### 11:00 a.m. Track 1

### Chairs: Lisa Gaddis and Walter Kiefer

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| 11:00 a.m. | Lin Y. * Li X. Zhou Y. | *The Scientific Achievements by Chang'E-4 and the New Lunar Samples Returned by Chang'E-5* **[#2779]** Chang'e-5 is the first sample return mission of China, which returned new lunar samples after the Apollo and Luna missions finished more than 40 years ago. |
| 11:20 a.m. | Shearer C. K. * McCubbin F. M. | *Revisiting Apollo and Preparing for Artemis: A Perspective from the ANGSA Initiative* **[#1566]** Using new lunar samples stored for almost 50 years, we are fulfilling goals of the Apollo Program, investigating new lunar concepts, and preparing for Artemis. |
| 11:40 a.m. | Weber R. C. * Lawrence S. J. Cohen B. A. Bleacher J. E. Boyce J. W. et al. | *The Artemis III Science Definition Team Report* **[#1261]** Bearing science dreams / We place at our Moon's doorstep / The fruit of our toil. |

**[W321]**

## Wednesday, March 17, 2021
## SPECIAL SESSION: APOLLO NEXT GENERATION SAMPLE ANALYSIS I: FULFILLING APOLLO GOALS AND PREPARING FOR ARTEMIS, NEW RESULTS FROM SPECIAL APOLLO SAMPLES

### 12:30 p.m. Track 1

### Chairs: Natalie Curran and Charles Shearer

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| 12:30 p.m. | | *Presenter Introductions* |

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| 12:35 p.m. | McCubbin F. M. * Shearer C. K. Barnes J. J. Burgess K. Cohen B. A. et al. | *The ANGSA Program: A Low-Cost Lunar "Sample Return Mission." An Overview and Progress Over the Last 18 Months* **[#1541]**<br>Slowed, not defeated / Patience, diligence, teamwork / ANGSA progresses. |
| 12:38 p.m. | Schmitt H. H. * | *Apollo 17 Deep Drill Core 70001/9: Large Impact Ages at Taurus-Littrow, Recorded Increase in Solar Luminance, and Implications for ANGSA Studies* **[#2575]**<br>Published data on maturity indices and other measurements provides new insights into the depositional and exposure history of Apollo 17 deep drill regolith zones and those to be encountered ANGSA in drive tube core 73001/2. |
| 12:41 p.m. | Petro N. E. * Moriarty D. P. Schmitt H. H. Shearer C. Sun L. | *Compositional Variability and Basalt Stratigraphy of the Taurus-Littrow Valley Floor: Implications for Double Core Tube 73001/02* **[#2381]**<br>The distribution of olivine in the Taurus-Littrow Valley indicate multiple processes may be controlling its distribution. Disentangling multiple spectral signatures and geologic processes requires analyses of new samples from the Station 3 core. |
| 12:44 p.m. | Gross J. * Krysher C. Mosie A. Zeigler R. A. McCubbin F. M. et al. | *Preliminary Examination Process of Apollo Core 73002 — Insights and Lessons Learned from ANGSA for Future Sample Return Missions* **[#2684]**<br>Here, we report on the preliminary examination report and catalog of Apollo 17 core sample 73002 from the ANGSA initiative. |
| 12:47 p.m. | Zeigler R. A. * Eckley S. A. Hanna R. Edey D. Ketcham R. A. et al. | *Using X-Ray Computed Tomography to Image Apollo Drive Tube 73002* **[#2632]**<br>Apollo drive tube 73002 was scanned by X-ray Computed Tomography prior to being opened as part of the Apollo Next Generation Sample Analysis Program, and individual >4 mm particles were scanned during the preliminary examination of the sample. |
| 12:50 p.m. | Schild T. * Tuohy E. Medeiros P. Crespi C. Scharnholz F. et al. | *Development of a High Vacuum CSVC Penetration System for the Apollo Next-Generation Sample Analysis Programme* **[#1888]**<br>Working with the ANGSA Science Team, collaborators at ESA have been working to develop an integrated high vacuum system and penetrator to allow for the piercing of Apollo era CSVCs, with a view to analyzing evacuated bound volatiles. |
| 12:53 p.m. | Sun L. * Lucey P. Flom A. Ferrari-Wong C. Zeigler R. et al. | *Multispectral Imaging and Hyperspectral Profile of the First Dissection of Core 73002* **[#1789]**<br>We present preliminary spectral measurement results of the core 73002, systematic spectral darkening and reddening from bottom to top of the core is observed from both multispectral image and hyperspectral profile, which is due to space weathering. |
| 12:56 p.m. | Neuman M. D. * Jolliff B. L. Koefoed P. Wang K. ANGSA Science Team | *Apollo 17 Drive Tube 73002 Major and Trace Element Characterization* **[#1470]**<br>We report preliminary results for six samples allocated to us from the 1st dissection pass of the 18.5 cm unsealed (upper) drive tube 73002 and model Apollo 17 lithologic components indicated by these compositions. |
| 12:59 p.m. | | *Q&A* |
| 1:30 p.m. | | *End of Session* |

## [W322]

## Wednesday, March 17, 2021
## ISOTOPIC RESERVOIRS IN THE EARLY SOLAR SYSTEM

## 12:30 p.m. Track 2

## Chairs: Jean-David Bodénan and Bradley Meyer

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| 12:30 p.m. | | *Presenter Introductions* |
| 12:35 p.m. | Bose M. * Schulte J. Vance G. Jansen R. A. Young P. | *Heterogeneous R-Process Chromium and Titanium Ejecta from Core Collapse Supernova Ejecta Polluted Our Solar System* **[#1414]**<br>Star explodes / Dust everywhere / Sprinkles metal. |
| 12:38 p.m. | Bermingham K. R. * Meyer B. S. Frizzell K. Mezger K. M. | *Isotopic Constraints on the Building Blocks of the Solar System* **[#2107]**<br>Isotopic variations in meteorites coupled with new nucleosynthesis models are used to constrain the stellar building blocks of the solar system. |
| 12:41 p.m. | Jacquet E. * Pignatale F. C. | *Inheritance of Meteoritic Isotopic Anomalies from a Zoned Protosolar Cloud* **[#1042]**<br>Sequential infall from an isotopically zoned protosolar cloud created the range of isotopic compositions fossilized by CAIs. Bulk meteorites sample the isotopic range of the disk after infall ceased, more reduced because of transport and mixing. |
| 12:44 p.m. | Bodénan J.-D. * Hutchison M. Mayer L. Schönbächler M. | *Nucleosynthetic Variations Generated by Size and Density Driven Sorting of Dust in Protoplanetary Disk* **[#1954]**<br>Planet and dust grains / Drive isotopic changes / In solar system. |
| 12:47 p.m. | Bryson J. F. J. * Brennecka G. A. | *Constraints on Chondrule Generation, Disk Dynamics, and Asteroid Accretion from the Compositions of Carbonaceous Meteorites* **[#1301]**<br>The compositions of CC chondrites and iron meteorites originate from mixing NC chondrite material, CAI material, and CI chondrite material. These trends provide novel constraints on chondrule generation, dust and gas dynamics, and asteroid accretion. |
| 12:50 p.m. | Grewal D. S. * Dasgupta R. Marty B. | *A Very Early Origin of Isotopically Distinct Nitrogen in Inner Solar System Protoplanets* **[#1601]**<br>Nitrogen isotopic composition of iron meteorites is used to infer that non-nebular, isotopically processed nitrogen was ubiquitous in the growth zone of inner solar system protoplanets at ~0-0.3 Myr after the formation of solar system. |
| 12:53 p.m. | Ku Y. * Petaev M. I. Skripnik A. Ya. Ivanova M. A. Jacobsen S. B. | *K Isotope Variations in Chondrules, CAIs. Matrix and Bulk Chondrites* **[#2377]**<br>We presented high-precision K isotope data on major chondritic components, including 5 matrix samples and 13 chondrules separated from 3 ordinary chondrites; and 9 chondrules, 2 CAIs, and 5 matrix samples with different grain sizes from Allende. |
| 12:56 p.m. | Miller A. M. * Dey S. Yin Q.-Z. Goodrich C. A. Hamilton V. E. et al. | *Stalking a Large Carbonaceous Chondrite Asteroid Using $\varepsilon^{54}$Cr-$\Delta^{17}$O Isotope Systematics of the Unique Xenolith Almahata Sitta 202* **[#2360]**<br>Xenolithic clast, unique among the regolith: Who was your parent? |
| 12:59 p.m. | | *Q&A* |
| 1:30 p.m. | | *End of Session* |

**[W323]**

## Wednesday, March 17, 2021
## SMALL BODY SPECTROSCOPY: COMPOSITION AND CLASSIFICATION

### 12:30 p.m. Track 3

### Chairs: Sherry Fieber-Beyer and Driss Takir

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| 12:30 p.m. | | *Presenter Introductions* |
| 12:35 p.m. | Germann J. T. * Fieber-Beyer S. K. | *VNIR Reflectance Spectroscopy of Five G-Class Asteroids: Implications for Mineralogy and Geologic Evolution* **[#1143]** Our pilot study investigates five G-class asteroids in the VNIR spectral range. We identified subtle absorptions related to phyllosilicates in four asteroids, and we are attempting to determine mineral end-members responsible for these absorptions. |
| 12:38 p.m. | Strom C. A. * Fieber-Beyer S. K. Gaffey M. J. Germann J. T. | *A Spectral Analysis of the Massalia Asteroid Family to Evaluate the L-Chondrite Source Hypothesis* **[#1597]** We observed and analyzed the spectra of seven asteroids in the Massalia asteroid family to test the hypothesis that the Massalia asteroid family is the source of the L-chondrites. We used IRTF at Mauna Kea in Hawaii to make the observations. |
| 12:41 p.m. | Rivkin A. S. * Howell E. S. Emery J. P. Richardson M. | *Hydrated Minerals on B-class Asteroids* **[#1945]** "B is for Bennu." / Is that good enough for you? / Spectra disagree. |
| 12:44 p.m. | Lim L. F. * Kaplan H. H. Hamilton V. E. Christensen P. R. Simon A. A. et al. | *Main-Belt Infrared Spectral Analogues for (101955) Bennu: Gaussian Fitting to AKARI Spectra of Bennu-Like Asteroids* **[#2219]** We place the global average spectrum of (101955) Bennu in the context of the wider asteroid population as represented by infrared reflectance spectra from the AKARI mission. |
| 12:47 p.m. | Parra S. A. * Ehlmann B. L. Velbel M. | *Characterizing Spectral Diversity in Carbonaceous Chondrites and Linking Meteorites to Asteroids with Microimaging Spectroscopy* **[#2282]** Microimaging VSWIR spectroscopy of carbonaceous chondrites reveals spatial trends in spectral diversity, including the distribution of primary mafic and aqueous alteration features. Connections to spectral diversity in asteroids are also presented. |
| 12:50 p.m. | Trigo-Rodriguez J. M. * Pérez del Pino A. Peña-Asensio E. Rimola A. | *Meteorite Controlled Ablation Under Low Vacuum Studied Using Emission Spectroscopy: A Technique to Sample the Bulk Composition of Asteroids* **[#1384]** An experiment to simulate the ablation of a meteorite, or an impact plume is presented. A laser pulse |

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| | | was used to heat the meteorite surface under vacuum, and a spectrometer allows to study the temperature and chemical composition of the hot vapor. |
| 12:53 p.m. | Wallace S. M. * Dyar M. D. Burbine T. H. Sheldon D. | *Utility of Generative Approaches for Meteorite and Asteroid Classification* **[#2507]** In this abstract, we analyze the potential benefits of using a generative machine learning model for the task of classifying meteorites. We discuss how this model can be applied to the task of classifying asteroids. |
| 12:56 p.m. | Breitenfeld L. B. * Rogers A. D. Glotch T. D. Hamilton V. E. Christensen P. R. et al. | *An Integrated Fine and Coarse Particulate Machine Learning MIR Model Predicts Modal Mineralogy of CI/CM Chondritic Asteroids and Bennu* **[#1147]** Determination / Of asteroids and Bennu / Mineralogy. |
| 12:59 p.m. | | *Q&A* |
| 1:30 p.m. | | *End of Session* |

**[W324]**

## Wednesday, March 17, 2021
## MARTIAN HYDRATED MINERALS AND AQUEOUS ALTERATION

## 12:30 p.m. Track 4

## Chairs: Mark Salvatore and Katherine Primm

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| Times | Authors (*Denotes Presenter) | Abstract Title and Summary |
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| 12:30 p.m. | | *Presenter Introductions* |
| 12:35 p.m. | Viviano C. E. * Phillips M. S. Seelos K. D. Roberts J. H. | *Unique Basin-Related Alteration on Early Mars* **[#1675]** We present the distribution of alteration phases associated with uplifted massifs on the Hellas rim. These assemblages may record unique at- or near-surface conditions where an ancient long-lived habitable environment may have been present. |
| 12:38 p.m. | Krzesinska A. M. Bultel B. * Loizeau D. Craw D. April R. et al. | *Mineralogy, Aqueous Alteration, and Biosignature Preservation Potential of Bedrock Deposits at Oxia Planum, ExoMars 2022 Landing Sites, as Inferred from Spectral Study of Terrestrial Analogues* **[#1189]** The abstract presents spectral characterization of terrestrial Fe-rich vermiculite-bearing rocks. This allows supporting the interpretation of mineralogy and habitability potential of Oxia Planum, ExoMars2022 landing site. |
| 12:41 p.m. | Pineau M. * Mathian M. Baron F. Le Deit L. Rondeau B. et al. | *Near-Infrared Signature of Kaolinite: A Proxy for Estimating Its Crystallinity and Its Geological Origin on Earth and Mars* **[#1898]** In order to see if the NIR spectrum of kaolinite could be a proxy of its geological origin on Earth and |

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| | | Mars, we performed spectral analyses showing that its NIR signature reflects its crystalline order and, also, its origin only in a limited extent. |
| 12:44 p.m. | Sheppard R. Y. * Milliken R. E. Robertson K. M. | *Presence of Clay Minerals Can Obscure Spectral Evidence of Mg Sulfates: Implications for Orbital Observations of Mars* **[#1560]** Mg sulfates and clay minerals are exposed to Mars-relevant temperature, pressure, and relative humidity in an environmental chamber while collecting VNIR spectra. We find the presence of clay minerals >10 wt% obscures spectral evidence of Mg sulfate. |
| 12:47 p.m. | Bishop J. L. * Weitz C. M. Parente M. Gross C. Saranathan A. M. et al. | *Correlating Sulfates with the Aqueous Geochemical History at Juventae Chasma, Mars* **[#1082]** New analyses of sulfate mounds at Juventae Chasma reveal jarosite in addition to polyhydrated and monohydrated sulfates. Light-toned layered outcrops on the plateau contain Fe hydroxy sulfate and FeMg hydroxy sulfate with bands at 2.238 and 2.226 µm. |
| 12:50 p.m. | Hughes E. B. * Gilmore M. S. Eleazer M. | *VNIR and Raman Spectral Characterization of Martian Analogue Chloride and Sulfate Brines* **[#2050]** Experimentally evaporated martian analogue chloride and sulfate brines reveal variations in IDed salt across ID methodology. Amorphous, hygroscopic salts dominate in the VNIR even if precipitating in low abundance. Crystalline salts dominate in XRD. |
| 12:53 p.m. | Qu S. Y. * Cui H. Yin X. Z. Jackson W. A. Nie X. et al. | *Fe Mineralogy Controls on Generation Ratio of Chlorate/Perchlorate on the Martian Surface* **[#1973]** We investigate $ClO_3^-$/$ClO_4$-generation ratios by mixing halite salt or solution with different Fe minerals under three oxidative conditions, and propose a conceptual model for $ClO_3^-$/$ClO_4$ generation ratios in different surficial environments on Mars. |
| 12:59 p.m. | | *Q&A* |
| 1:30 p.m. | | *End of Session* |

**[W325]**

**Wednesday, March 17, 2021**
**EXOPLANETS: COMPOSITION AND STRUCTURE**

**12:30 p.m. Track 5**

**Chairs: Stephen Kane and Noam Izenberg**

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| Times | Authors (*Denotes Presenter) | Abstract Title and Summary |
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| 12:30 p.m. | | *Presenter Introductions* |
| 12:35 p.m. | Parman S. W. * Evans A. J. Alvarez E. G. Weller M. B. Reinhard C. T. et al. | *Assessing the Abundance of Super-Mercuries and Their Habitability* **[#2477]** Mercury is highly reduced, and sulfur-rich, compared to the other terrestrial planets. Here, we show |

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| | | that such reduced sulfide planets may be common in other planetary systems. Some of them may be habitable. |
| 12:38 p.m. | Ostberg C. M. * Dalba P. Kane S. R. | *Differentiating Exo-Venus and Exo-Earth Using Transmission Spectroscopy* **[#2580]** Earth and Venus are very similar in terms of physical properties, but dramatically different in terms of climate. Investigating exoplanet systems with an Earth-like and Venus-like planet will be useful for understanding their evolutions. |
| 12:41 p.m. | Jackson A. P. * Desch S. J. | *To See a World in a Shard of Ice: 'Oumuamua as a Fragment of $N_2$ Ice from an Exo-Pluto* **[#1718]** Visitor from afar / How we wondered what you are / But now we ken / It is nitrogen! |
| 12:44 p.m. | Brugman K. K. * Phillips M. G. Till C. B. | *Petrological Experiments on Rocky Exoplanet Compositions Reveal Clues to Habitability* **[#1967]** Partial mantle melting experiments were conducted on two hypothetical silicate exoplanet compositions. The results for an exoplanet with a higher Ca/Al mantle than that of Earth cast doubt on this type of exoplanet's ability to sustain life. |
| 12:47 p.m. | Spaargaren R. J. * Wang H. S. Ballmer M. D. Mojzsis S. J. Tackley P. J. | *The Compositional Range of Terrestrial Exoplanets in the Solar Neighborhood* **[#2605]** We attempt to constrain the range of bulk terrestrial exoplanet compositions in the solar neighborhood by considering stellar abundance estimates, and simulate planet structure and mantle mineralogy for a small number of end-member compositions. |
| 12:50 p.m. | Blaske C. H. * O'Rourke J. G. | *Energetic Requirements for Dynamos in the Metallic Cores of Super-Earth and Super-Venus Exoplanets* **[#2323]** Studies super-Earths / And their heat flows from the core / Super-Venus too. |
| 12:53 p.m. | Foing V. * Heras A. M. Foing B. | *Characterizing Exoplanet Transits and Stellar Activity in Kepler Lightcurves with Scalable Gaussian Processes* **[#1552]** We apply scalable Gaussian Process (GP) models to characterize exoplanet transits and stellar activity in Kepler lightcurves. Our aim is to retrieve accurate transit and rotation parameters, such as planet radii and stellar rotation periods. |
| 12:56 p.m. | Rusticus Y. J. * Foing B. H. Heras A. M. Foing V. Hönes C. J. et al. | *Towards Deep Learning for Transiting Exoplanet Search Using Simulated TESS Data* **[#2080]** We discuss the necessity of Deep Learning methods for transit detection, and present early results of the ongoing research to develop such methods using simulated TESS-like light curves. |
| 12:59 p.m. | | *Q&A* |
| 1:30 p.m. | | *End of Session* |

**[W351]**

**Wednesday, March 17, 2021**
**SPECIAL SESSION: APOLLO NEXT GENERATION SAMPLE ANALYSIS II: FULFILLING APOLLO GOALS AND PREPARING FOR ARTEMIS, NEW RESULTS FROM SPECIAL APOLLO SAMPLES**

**2:30 p.m. Track 1**

**Chairs: Richard Walroth and Francis McCubbin**

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|---|---|---|
| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Cymes B. A. * Burgess K. D. Stroud R. M. ANGSA Science Team | *Nanoscale Insights into Apollo 17 Regolith Samples from Stations 2 and 6: Exposure History, Mineral Phase Composition, and Space Weathering* **[#1152]** Veneers beyond sight / Under boulders, far from shade: / Lunar weathering. |
| 2:38 p.m. | Simon S. B. * Shearer C. K. Cato M. Jolliff B. L. Neal C. et al. | *Exploring the South Massif of the Taurus-Littrow Valley (TLV) by Examining the Less Than 2mm Lithic Fragments in the 73001/73002 Double Drive Tube* **[#1562]** We report results of petrographic examination of polished sections of two 90-150µm aliquots and one >1mm lithic fragment from Apollo 17 drive tube section 73002, newly opened as part of the ANGSA initiative. |
| 2:41 p.m. | Jolliff B. L. * Yen C. J.-K. Gross J. Zeigler R. A. Eckley S. A. et al. | *Lithology of Rock Fragments in Apollo 17 Double Drive Tube Core 73002 Using X-Ray Computed Tomography and Comparison to Lithologic Makeup of Station 3 Soils* **[#2681]** The lithologic makeup of 73002 determined by X-ray Computed Tomography (XCT) of rock particles separated during the 1st pass dissection and preliminary examination compares well with previous studies of lithologic components in Station 3 soils. |
| 2:44 p.m. | Valenciano J. L. * Neal C. R. Shearer C. K. ANGSA Science Team | *Crystal Size Distributions of Ilmenite in Basalt Clasts from Apollo 17 Drive Tube 73002* **[#2135]** A study using crystal size distributions to analyze ilmenite in basalt clasts from Apollo 17 drive tube 73002. |
| 2:47 p.m. | Wilbur Z. E. * Barnes J. J. Eckley S. A. Boyce J. W. Brounce M. et al. | *Investigating the Magmatic History of Volatiles in Apollo 17 Basalts, Apollo Next Generation Sample Analysis* **[#1497]** Apollo basalts / We look for the volatiles / How did they evolve? |
| 2:50 p.m. | Recchuiti E. M. * McCanta M. C. Dyar M. D. Skulte E. Lanzirotti A. | *Mapping Hydrogen Variations in Silicate Glasses: Eruptive Lunar Degassing* **[#1299]** Understanding the amount of H lost during degassing and eruptive processes can aid in estimation of primary volatile content in a melt. Preliminary data indicate that H loss is associated with fractures on lunar glass beads from the Apollo program. |
| 2:53 p.m. | Brounce M. * Barnes J. Boyce J. Wilbur Z. E. McCubbin F. M. et al. | *The Oxidation State of Sulfur in Apollo Samples 71035 and 71055* **[#1572]** We report the oxidation state of sulfur in apatite and associated phases in Apollo-era thin sections of 71035 and 71055, in preparation for measurements of new thin sections of the same samples, and the special frozen sample 71036. |
| 2:56 p.m. | Sehlke A. * Sears D. W. G. | *Natural Thermoluminescence of Lunar Samples: Review and Update* **[#2658]** We provide an overview of natural thermoluminescent (TL) measurements over the past 50 years with respect to lunar science, the current status of our TL investigations, and the significance of natural TL measurement during the Artemis generation. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[W352]**

## Wednesday, March 17, 2021
## BIG BODIES: MODELING AND MEASUREMENTS OF PLANETESIMALS

### 2:30 p.m. Track 2

### Chairs: Andrew Rivkin and Jennifer Scully

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| Times | Authors (*Denotes Presenter) | Abstract Title and Summary |
|---|---|---|
| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Holsapple K. A. * | *New Findings from Simulations of the History of Main Belt Asteroids* **[#1373]** Results from a study of the histories of asteroids in the main belt using a new Monte Carlo code "Stochastic Simulations of Asteroid Histories" (SSAH). It models cratering, ejecta mass loss, spinning, catastrophic dispersion, binaries, and wobbling. |
| 2:38 p.m. | Takir D. * Neumann W. Raymond S. N. Emery J. P. Trieloff M. | *Large Low-Albedo Asteroids: Thermal and Dynamical Context* **[#1364]** We present new telescopic near-infrared measurements of large and low-albedo asteroids and their their dynamical and thermal context. |
| 2:41 p.m. | Rousseau B. * De Sanctis M. C. Raponi A. Ciarniello M. Ammannito E. et al. | *DAWN-VIR at Vesta and Ceres: A New Look in the Visible Through Global Maps of Spectral Parameters* **[#1431]** Following the recent correction of the visible dataset acquired by the Dawn-VIR spectrometer, we present and discuss global maps of spectral parameters (reflectance, RGB color composites, and spectral slopes maps) of Vesta and Ceres. |
| 2:44 p.m. | Scully J. E. C. * Poston M. J. Carey E. M. Baker S. R. Castillo-Rogez J. C. et al. | *Testing the Hypothesis that Curvilinear Gullies, Lobate Deposits, and Pitted Terrain on Vesta and Ceres Were Formed by Short-Lived, Debris-Flow-Like Processes* **[#1252]** We use lab experiments (the behavior of liquid water/brine under low transient atmospheric pressures) and geomorphologic analyses to investigate if specific geomorphologic features on Vesta/Ceres were formed by short-lived debris-flow-like processes. |
| 2:47 p.m. | Mitchell J. T. * Tomkins A. G. Newton C. Johnson T. E. | *The Evolving Crust of 4 Vesta from Compositional and Thermal Modelling* **[#1576]** The development and relationship of eucrite and diogenite magmatism early in Vesta's history is explored through combined thermal and compositional modelling, as well as the importance of accretion age with relation to the distribution of $^{26}$Al. |
| 2:50 p.m. | Cheng H. C. J. * Klimczak C. Fassett C. I. | *Age Relationships of Large-Scale Troughs and Impact Basins on Vesta* **[#1014]** We documented age relationships between the large troughs and impact basins on Vesta. Our results do not contradict nor yield tight constraints on the hypothesis that the basin-forming impacts directly triggered the formation of troughs on Vesta. |
| 2:53 p.m. | Courville S. W. * O'Rourke J. G. Castillo-Rogez J. C. Oran R. Weiss B. P. et al. | *Magnetization of Large C-Type Asteroids: A Detectable Consequence of Pebble Accretion?* **[#2355]** The theory of pebble accretion implies that large planetesimals formed in the presence of strong |

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| | | magnetic fields. We argue that spacecraft missions to some C-type asteroids would detect chemical remanent magnetization acquired from the solar nebula. |
| 2:56 p.m. | Arredondo A. * Campins H. Pinilla-Alonso N. de Leon J. Lorenzi V. et al. | *Spectroscopic Survey of the Inner Belt Primitive Background Population* **[#1535]**<br>We present new spectra of 55 primitive asteroids that are not classified into dynamical families (i.e., background asteroids). We show that the background is related to asteroid families at similar inclinations, suggesting that they are related. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[W353]**

## Wednesday, March 17, 2021
## MERCURY: BIG SCIENCE IN A SMALL PLANET

### 2:30 p.m. Track 3

### Chairs: Ariel Deutsch and Edgard Rivera-Valentín

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Clement M. S. * Chambers J. E. | *Small, Dense, and Isolated: Growing Better Mercury Analogs with In-Situ Accretion and Cataclysmic Instabilities* **[#1024]**<br>In stark contrast to classic theoretical predictions and rocky exoplanet demographics, the Mercury-Venus mass and orbital period ratios are not common simulation outcomes. We present two dynamical models capable of resolving these discrepancies. |
| 2:38 p.m. | Peterson G. A. * Johnson C. L. Jellinek A. M. | *Thermal Evolution of Mercury with a Volcanic Heat Pipe Flux* **[#2354]**<br>Forming Mercury's crust via a heat pipe mechanism accelerates interior cooling, which helps sustain an ancient magnetic field at 4.0 Ga and explains an initially high formation rate of shortening structures. |
| 2:41 p.m. | Iacovino K. * Boyce J. W. Lunning N. G. McCubbin F. M. Moore G. M. et al. | *Carbon Solubility in Mercurian Magmas: What We Don't Know* **[#1057]**<br>Solubility / Relevant to Mercury / High uncertainty. |
| 2:44 p.m. | Gosselin G. J. * Freed A. M. Johnson B. C. | *Where Have All the Rings Gone? Exploring the Reputed Multiring Nature of Mercury's Caloris Basin* **[#1529]**<br>We simulate the formation of Caloris Basin to explore the possibility that it formed as a multiring basin. Model results suggest the formation of large crustal blocks separated by high-strain zones. Are these the rings we're looking for? |

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| 2:47 p.m. | Gray R. W. * Byrne P. K. | *Spectral Analysis of Distinct Geological Units on Mercury* **[#2610]**<br>In this study, we analyzed the difference between three types of surface material on Mercury — lava, impact melt, and intercrater plains material — and compared their spectral characteristics. |
| 2:50 p.m. | Varatharajan I. * Tsang C. Wohlfarth K. Wöhler C. Izemberg N. et al. | *Surface Mineralogy of Major Geochemical Terranes of Mercury: Results from NIR (0.7-4.2 microns) Ground Based IRTF/SpeX Spectroscopy* **[#1359]**<br>Surface composition of major geochemical terranes has been investigated using the near-infrared spectroscopy data in the 0.7 - 4.5 microns spectral region obtained from SpeX instrument onboard ground based NASA IRTF telescope in Hawaii. |
| 2:53 p.m. | Meyer H. M. * Rivera-Valentín E. G. Chabot N. L. | *A Multi-Wavelength Study of Mercury's Polar Anomalies: New Data from Arecibo Informed by MESSENGER* **[#1508]**<br>We apply machine learning algorithms to new S-band SC backscatter data from Arecibo to identify local-scale variations in backscatter to compare to MESSENGER observations of Mercury's north polar deposits. |
| 2:56 p.m. | Thompson M. S. * Vander Kaaden K. E. Loeffler M. J. McCubbin F. M. | *Understanding the Space Weathering of Mercury Through Laboratory Experiments* **[#1496]**<br>Submitted last year / But you never saw it and / Mercury is rad. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

## [W354]

## Wednesday, March 17, 2021
## MARTIAN MINERALOGY FROM ORBIT

## 2:30 p.m. Track 4

## Chairs: Christina Viviano and Giulia Alemanno

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Zastrow A. M. * Glotch T. D. | *A Tour of Carbonate Lithologies in Huygens Basin, Mars* **[#2751]**<br>Carbonates, plus more / Exhumed, altered by water / Come take a fun tour! |
| 2:38 p.m. | Sathe V. M. * Sur K. Chauhan M. Chauhan P. Sharma R. U. | *Geological Investigation of Northern Rim of Argyre Planitia, Mars Using High Resolution Datasets* **[#1916]**<br>Northern portion of Argyre Planitia Basin of Mars has been investigated for mineralogy and morphology using high-resolution imaging hyperspectral CRISM datasets and their nature observed using HiRISE data. |

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| 2:41 p.m. | Lane M. D. * Bishop J. L. Loizeau D. Tirsch D. Tornabene L. L. et al. | *Identifying Two Distinct Olivine Compositions in Tyrrhena Terra and Libya Montes, Mars* **[#2550]** Made from liquid Mars / Crater floors and airfall ash / Show two (Fo)livines. |
| 2:44 p.m. | Sinha P. * Horgan B. | *The Mineralogy of Lithic Sediments Within the South Polar Layered Deposits of Mars* **[#2070]** The South Polar Layered Deposits (SPLD) of Mars being older than its northern counterpart are a window into the pre-modern climate records. Here, we constrain the composition of lithics at the SPLD using visible/near-infrared spectroscopy from orbit. |
| 2:47 p.m. | Condus T. * Arvidson R. E. Moreland E. L. | *CRISM-Derived Modal Mineralogy and Thermal Inertia for Oxia Planum* **[#1670]** Using CRISM data, we present initial spectral unmixing results for a deposit near the Oxia Planum delta with a strong clay signature, and a surface kinetic temperature map to be used in future thermal inertia studies. |
| 2:50 p.m. | Cowart J. C. * Rogers A. D. | *Compositional Analysis of Martian Regolith and Surface Deposits Using THEMIS Repeat Imaging Over the Diurnal Cycle* **[#1112]** Compare day and night: / The surface cools, bedrock shines / The fines fade away. |
| 2:53 p.m. | Rani A. * Basu Sarbadhikari A. Hood D. R. Karunatillake S. Nambiar S. | *Synthesis of Chemical Provinces on Mars and Their Geologic Interpretations* **[#2353]** To access geological processes that could tie to vital elements like Al, Ca, and volatile elements like sulphur. Consequently, we advanced the methods and used the latest chemical maps to delineate new chemical provinces on the martian surface. |
| 2:56 p.m. | Scudder N. A. * Rutledge A. M. Horgan B. Smith R. J. | *Hydrated Silica Associated with Glacier-Like Forms on Mars* **[#2062]** Cold-climate alteration can form silica-rich materials associated with glacial settings on Mars. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[W355]**

## Wednesday, March 17, 2021
## ATMOSPHERES: DYNAMICS, EVOLUTION, AND COMPOSITION

### 2:30 p.m. Track 5

### Chairs: German Martinez and Robin Wordsworth

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Thompson M. A. * Telus M. Schaefer L. Fortney J. J. Joshi T. et al. | *Leveraging Meteorite Outgassing Experiments to Improve Models of the Initial Atmospheres of Terrestrial Exoplanets* **[#1313]** To inform the initial chemical composition of terrestrial exoplanet atmospheres, we present the results |

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| | | of our outgassing experiments in which we heated CM carbonaceous chondrite samples to 1200 C and measured the abundances of released volatiles. |
| 2:38 p.m. | Kite E. S. * Steele L. J. Mischna M. A. Wilson S. A. Morgan A. M. et al. | *Sustaining Mars Surface Habitability: Climate and Climate Evolution* **[#1703]** Why did early Mars have lakes? We generated new datasets and data analyses which indicate that average $pCO_2$ was <~$10^2$ mbar around 3.0 Ga, supporting the $H_2O$-ice cloud greenhouse hypothesis. New GCM results for the cloud greenhouse will be presented. |
| 2:41 p.m. | Navarro-González R. * Navarro K. F. Coll P. McKay C. P. Sutter B. et al. | *Abiotic Input of Fixed Nitrogen by Bolide Impacts in $CH_4$+$CO_2$+$N_2$ and $H_2$+$CH_4$+$CO_2$+$N_2$ Atmospheres. Comparison with Nitrate Levels Measured by the Curiosity Rover's Sample Analysis at Mars Instrument* **[#1365]** The variation of nitrates along the stratigraphic column examined by Curiosity could be explained by changes in the rate of nitrogen fixation caused by fluctuations in the type and amount of greenhouse gases in the atmosphere. |
| 2:44 p.m. | Vicente-Retortillo A. * Martínez G. M. Lemmon M. T. Renno N. O. Rodríguez-Manfredi J. A. | *Diurnal Variations in Atmospheric Opacity at Gale Crater, Mars* **[#1419]** Temporal variations in atmospheric opacity on timescales shorter than one sol from Mars Science Laboratory REMS UV measurements. |
| 2:47 p.m. | Bapst J. * Piqueux S. Edwards C. S. Hayne P. O. Kass D. M. et al. | *Global Dust Redistribution on Mars: Insights from Observed Surface Temperatures* **[#2639]** Year-to-year dust redistribution on Mars results in observed changes in surface temperature. Multiyear records of surface temperature measured from orbit are used to map dust redistribution globally. |
| 2:50 p.m. | Sharaf O. * Amiri S. Almatroushi H. AlDhafri S. AlRais A. et al. | *Emirates Mars Mission (EMM) 2020 Overview and Status* **[#1077]** The Emirates Mars Mission, Hope Probe, launched on July 20, 2020 with three scientific instruments to study the martian atmosphere, revealing important information about how atmospheric processes drive diurnal variations in one martian year. |
| 2:53 p.m. | Brinjikji M. * Lyons J. R. | *The Effect of Diffusion on Oxygen Isotopes in the Upper Atmosphere of Mars* **[#2544]** In this study, we model oxygen isotope composition in the martian upper atmosphere using 1) an atmospheric diffusion theory model, and 2) the photochemical code VULCAN. |
| 2:56 p.m. | Kutsop N. W. * Corlies P. M. Hayes A. G. Le Mouelic S. Lunine J. I. et al. | *Stratospheric Haze Bands Observed in Cassini VIMS* **[#2500]** Using data from the Visual and Infrared Mapping Spectrometer aboard Cassini, we observed bands in Titan atmosphere consistent with stratospheric haze contained to a toroid. We describe the altitude, seasonality, and origin of the bands. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[W361]**

**Wednesday, March 17, 2021**
**NEW UNDERSTANDING OF MARS AND ASTEROIDS (LIVE PRESENTATIONS)**

**4:00 p.m. Track 1**

**Chairs: Eileen Stansbery and Walter Kiefer**

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|---|---|---|
| 4:00 p.m. | Panning M. P. * Banerdt W. B. Smrekar S. Antonangeli D. Asmar S. et al. | *Results from InSight's First Full Martian Year* **[#1533]**<br>InSight's still on Mars / One martian year of science / Crust to core results. |
| 4:20 p.m. | Lauretta D. S. * OSIRIS-REx TAG Team | *The OSIRIS-REx Touch-and-Go Sample Acquisition Event and Implications for the Nature of the Returned Sample* **[#2097]**<br>The OSIRIS-REx spacecraft contacted the surface of asteroid (101955) Bennu on October 20, 2020 with the Touch-and-Go Sample Acquisition Mechanism (TAGSAM) and collected a sample. The sample is safely stowed and the team is preparing for return cruise. |
| 4:40 p.m. | Tachibana S. * Sawada H. Okazaki R. Takano Y. Sakamoto K. et al. | *Hayabusa2 Reentry Capsule Retrieval and Sample Container Opening Operations* **[#1289]**<br>Hayabusa2 delivered the reentry capsule to the Earth on December 6, 2020. The sample container was safely transported from Woomera, Australia to ISAS, JAXA. The particles inside the sample container indicates that the Hayabusa2 sampler system worked efficiently at Ryugu. |

**[R401]**

## Thursday, March 18, 2021
## SURFACE-ATMOSPHERE INTERACTIONS ON ICY WORLDS: A VOLATILE SESSION

### 11:00 a.m. Track 1

### Chairs: Rajani Dhingra and Paul Schenk

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Yu X. * Yu Y. Garver J. Zhang X. | *Cloud-Aerosol and Cloud-Lake Interactions on Titan* **[#2711]**<br>Hydrocarbon clouds / Nitrile clouds / All good clouds / Seeded with the aerosol / Hydrocarbon clouds / Nitrile clouds / All sink into the lake / Only hydrogen cyanide / Float on top / Ethane-rich lakes. |
| 11:08 a.m. | Lapotre M. G. A. * Malaska M. J. Cable M. L. | *Interplay Between Grain Sintering and Transport-Induced Abrasion in Creating Sand-Sized Sediments on Titan* **[#1135]**<br>Sand grains on Titan / Under wind or river flow / Roll and rest. Not grow. |

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|---|---|---|
| 11:11 a.m. | Bonnefoy L. E. * Lorenz R. D. Hayes A. G. Lucas A. Poggiali V. et al. | *Radar Backscatter Properties of the Dragonfly Landing Site* **[#1920]**<br>Radar backscatter at Selk Crater, the Dragonfly landing site, varies with incidence angle and geological unit. Subsurface scattering is likely in the radar-bright rim. |
| 11:14 a.m. | Wakita S. * Johnson B. C. Soderblom J. M. Shah J. Neish C. D. | *Methane-Saturated Crust May Prevent the Formation of Detectable Impact Craters on Titan* **[#1173]**<br>Impact simulations on Titan showed that a methane-saturated water ice crust can produce craters with limited topographic expression. |
| 11:17 a.m. | Mao X. * McKinnon W. B. Singer K. N. Keane J. T. Robbins S. J. et al. | *Collisions with Small Classical Kuiper Belt Objects are Not Sufficient to Cause Substantial Spin Changes to Arrokoth* **[#2415]**<br>Adopting a dynamically-equivalent triaxial form for Arrokoth, Monte Carlo simulations confirm limited post-lobe-merger spin change by collisions with other KBOs. |
| 11:20 a.m. | Hedgepeth J. E. * Neish C. D. Bray V. J. | *Nitrogen's Role in the Degradation of Craters on Pluto* **[#2555]**<br>Pluto exhibits a variety of landscapes with some regions that continue to be reshaped by volatile ices. We quantify this degradation observed on Pluto by measuring the crater depths and compare them with $N_2$ present. |
| 11:23 a.m. | Lisse C. M. * Young L. A. Cruikshank D. P. Sandford S. A. Schmitt B. et al. | *On the Origin and Thermal Stability of Arrokoth's and Pluto's Ices* **[#2187]**<br>The New Horizons flyby of KBO MU69 found large amounts of methanol on its surface. We explain why this makes sense compared to Pluto, the Centaurs, and comets. |
| 11:26 a.m. | Suárez J. * Ochoa L. Delgado C. Saavedra F. | *Geomorphological Mapping of Sputnik Planitia and Its Surroundings, and How It`s Shaped by Pluto Internal and External Processes* **[#1736]**<br>We made a geomorphological analysis of New Horizons data of Pluto to understand the geological processes that shape this gelid crust and to make an evaluation of a convective model as the endogenic source of Sputnik Planitia geologic activity. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[R402]**

## Thursday, March 18, 2021
## LUNAR REMOTE SENSING: BAD MOON RISING

## 11:00 a.m. Track 2

## Chairs: Paul Lucey and Emily Martin

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|---|---|---|
| 11:00 a.m. | | *Presenter Introductions* |

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|---|---|---|
| 11:05 a.m. | Narendranath S. * Pillai N. S. Vadodariya K. Dhingra D. Bhatt M. et al. | *New Insights from Chandrayaan-2 Large Area Soft X-Ray Spectrometer* **[#2230]**<br>Chandrayaan$N_2$-2 Large Area Soft X-ray Spectrometer has near global coverage of all O, Mg, Al, and Si and local coverage at the highest spatial resolution in Ca, Ti, and Fe. We present new insights on composition in near side lunar mare. |
| 11:08 a.m. | Kremer C. H. * Mustard J. F. Pieters C. M. Greenhagen B. T. Donaldson Hanna K. L. | *Detecting Olivine Composition in Troctolitic Mixtures in the "Cross-Over" Infrared Range (4–8 μm)* **[#2191]**<br>Olivine Mg-Fe composition is detectable in anorthite-bearing mixtures in the 4–8-μm infrared range. |
| 11:11 a.m. | Patterson G. W. * Cahill J. T. S. Carter L. M. Morgan G. A. Neish C. D. et al. | *Mini-RF X-Band Bistatic Observations of the Moon* **[#2607]**<br>We discuss results from Mini-RF X-band bistatic SAR observations that address LRO science objectives dealing with impact, volcanic, and volatile processes on the Moon. |
| 11:14 a.m. | Giannakis I. * Zhou F. Warren C. Giannopoulos A. | *A Shallow Layered Structure at Chang'E-4 Landing Site Revealed Using Lunar Penetrating Radar* **[#1276]**<br>A novel method using lunar penetrating radar is proposed and used at Von Karman Crater at Chang'E-4 landing site. A complex layered structure for the first 12 meters of the ejecta is revealed leading to a revised stratigraphic model for the area. |
| 11:17 a.m. | Chertok M. A. * Lucey P. G. Costello E. S. | *The Size-Frequency Distribution of Rocky Craters at the Chang'e 5 Landing Site: Rock Abundance as a Probe for Mechanical Properties of Regolith* **[#1360]**<br>We examine craters with rocky ejecta at the Chang'e 5 landing site and compare with an older Mare study area. We find that rock abundance has a unique relationship with the mechanical properties of regolith. |
| 11:20 a.m. | Watkins R. N. * Jolliff B. L. Boyd A. Gonzales N. Speyerer E. | *LROC NAC Photometry of the Apollo 16 Landing Site: Correlating Feldspathic Compositions Using Landing Site and Sample Data* **[#2158]**<br>Samples from the ground / Reflectance sensed from above / New studies abound. |
| 11:23 a.m. | Valencia S. N. * Watkins R. N. Moriarty D. P. III Jolliff B. L. Petro N. E. | *Surface Composition and Mineralogy of the Apennine Bench Formation* **[#2154]**<br>KREEPy Apennine / Photometry and M3 / Tell mafic content. |
| 11:26 a.m. | Chauhan M. * Chauhan P. Thangjam G. Bhattacharya S. Dagar A. et al. | *Mineral Detection Using Chandrayaan-2 Imaging Infrared Spectrometer (IIRS): Some Initial Results* **[#1907]**<br>The study presents some initial results of ISRO's Chandrayaan-2 Imaging Infrared Spectrometer (IIRS) reflectance data analyzed for mineral and the comparison of the detected mineral spectra with Chandrayaan-1 M3 data from the same locations. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[R403]**

## Thursday, March 18, 2021
## CARBONACEOUS CHONDRITES: PARENT BODY PROCESSING AND ORGANIC MATTER

### 11:00 a.m. Track 3

### Chairs: Ryan Ogliore and Martin Lee

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| Times | Authors (*Denotes Presenter) | Abstract Title and Summary |
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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Chennaoui Aoudjehane H. * Agee C. B. Ziegler K. Garvie L. A. J. Irving A. et al. | *Tarda (C2-Ung): A New and Unusual Carbonaceous Chondrite Meteorite Fall from Morocco* **[#1928]** Tarda is the latest meteorite fall in Morocco on August 25, 2020. Field mission has been conducted and petrography, geochemistry analysis performed. Oxygen isotopes allow a classification of Tarda as an ungrouped C2 not belonging to any known CC group. |
| 11:08 a.m. | Dey S. * Yin Q.-Z. Zolensky M. | *Exploring the Planetary Genealogy of Tarda — A Unique New Carbonaceous Chondrite* **[#2517]** Enigmatic new meteorite from Morocco, / Sibling of Tagish Lake? / Find out with isotopes of Cr and O. |
| 11:11 a.m. | Martin P. M. C. * Lee M. R. | *Clast Populations Within the CM2.2 Brecciated Carbonaceaous Chondrite Aguas Zarcas: Implications for Understanding Aqueous Alteration on Ryugu* **[#2068]** Petrological characterization of clasts found within the CM2.2 brecciated Aguas Zarcas carbonaceous chondrite using EDS and Raman spectroscopy. Same rock from the void / This time it is about clasts / Interesting, maybe? |
| 11:14 a.m. | Schrader D. L. * Davidson J. McCoy T. J. Zega T. J. Russell S. S. et al. | *The Fe/S Ratio of Pyrrhotite Group Sulfides in Chondrites is Related to the Degree of Oxidation* **[#1058]** Sulfide grains so small / But complex story to tell / Of oxidation. |
| 11:17 a.m. | Busemann H. * Schrader D. L. Alexander C. M. O'D. Spring N. H. Kuga M. et al. | *Parent Body Processing in CR Chondrites Recorded by Noble Gases* **[#2718]** Noble gases measured in a large number of CR chondrites show the presence of an abundant Ar-rich carrier that is susceptible to aqueous alteration and essentially lost in type 1 CR chondrites. |
| 11:20 a.m. | Stroud R. M. * De Gregorio B. T. Alexander C. M. O'D. | *Elemental Composition and Functional Chemistry Variation at the Nanoscale in Insoluble Organic Matter from Carbonaceous Chondrites* **[#2745]** Our data show the importance of coordinated STEM-EELS-EDX measurements for revealing the variation in N elemental abundance and functional groups in early solar system organic matter. |
| 11:23 a.m. | Glavin D. P. * Elsila J. E. McLain H. L. Aponte J. C. Parker E. T. et al. | *Evidence for Extraterrestrial L-Amino Acid Excesses in the CM2 Aguas Zarcas and Murchison Meteorites: Predictions for Ryugu and Bennu* **[#1086]** We report the detection of extraterrestrial L-amino acids excesses in the Aguas Zarcas and Murchison meteorites that provides additional evidence of amplification of left over right handed amino acids during aqueous alteration on the CM2 parent body. |
| 11:26 a.m. | De Gregorio B. T. * Stroud R. M. | *Insoluble Organic Matter in Ryugu Analog Meteorite Jbilet Winselwan* **[#2059]** Studies of Ryugu return samples require refined approaches in sample preparation and analysis. We demonstrate advanced methods to investigate the origin of insoluble organic matter in a heated analog meteorite. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[R404]**

## Thursday, March 18, 2021
## BEGINNINGS: EARLY EVOLUTION AND THE ORIGINS OF LIFE

### 11:00 a.m. Track 4

### Chairs: Jessica Weber and David Kring

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Jusino M. * Méndez A. | *The Occurrence of Planets in the Abiogenesis Zone* **[#2327]** So far, not a single Earth-sized planet has been discovered to be in both the Habitable Zone and the Abiogenesis Zone. |
| 11:08 a.m. | Lyons J. R. * Garani J. | *$N_2$ Self-Shielding in the Solar Nebula as the Mechanism of $^{15}N$ Enrichment in Meteoritic Amino Acids* **[#2716]** Amino acids in meteorites exhibit $^{15}N$ enrichments of about 50 to 200 permil relative to Earth atmosphere, which itself is enriched by about 400 permil relative to the bulk Sun. $N_2$ self-shielding in the solar nebula can account for this enrichment. |
| 11:11 a.m. | Safonova M. * Sivaram C. | *Interplanetary Exchange in the Solar System — Are We Really Biologically Isolated?* **[#1346]** Planetary protection introduced to limit biological contamination of Earth and outer worlds are too restrictive and basically unnecessary due to continuous interplanetary exchange of meteoroids with their water, organics, and possible biota content. |
| 11:14 a.m. | Burton A. S. * Berger E. L. Fox A. C. Lee C. | *The Detection of Aromatic Amino Acids in CR Chondrites Suggests They are Prebiotically Plausible* **[#1475]** Aromatic amino acids are hard to make in the lab, but their presence as indigenous species in C chondrites suggest that abiotic chemistry found a way. |
| 11:17 a.m. | Rothschild L. J. * Fujishima K. Head J. W. Paulino-Lima I. | *Synthetic Biology, Astrobiology, and the Search for Life in the Universe* **[#2687]** Synthetic biology has the potential to transform fields from pharmaceuticals to fuels. Our lab has focused on the potential of synthetic biology to revolutionize all three major parts of astrobiology. Here, we give examples from our lab. |
| 11:20 a.m. | Berea A. * Liu R. Santiago M. F. | *Universal Constraints to Life Derived from Artificial Agents and Games* **[#1026]** This paper explores evolutionary game theory in agent-based models within the context of astrobiology; access to global — local information and cooperation — competition can influence whether artificial systems have an evolutionary stable strategy. |
| 11:23 a.m. | Méndez A. * Rivera-Valentín E. G. Schulze-Makuch D. Filiberto J. Ramírez R. et al. | *Habitability Models for Planetary Sciences* **[#2291]** Here we show how to adapt and expand the habitability models used in ecology to astrobiology and |

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| | | planetary sciences. |
| 11:26 a.m. | Torres-Santiago N. J. * Pérez J. Delgado K. Cruz E. Ramírez J. et al. | *Evolution of Terrestrial Habitability* **[#2720]** There is a positive correlation between global terrestrial habitability and diversity in the last 650 million years. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[R405]**

## Thursday, March 18, 2021
## INSIGHT RESULTS: ONE MARTIAN YEAR

### 11:00 a.m. Track 5

### Chairs: Anna Mittelholz and Mark Panning

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Lognonné P. * Banerdt W B. Giardini D. Panning M. Pike W T. et al. | *One Martian Year of Seismic Monitoring of Mars by InSight: Seis Results and Perspectives for the Extended Mission* **[#1936]** With SEIS onboard InSight, a full martian year of seismic monitoring of Mars has been achieved on January 1, 2021. We present here scientific results, in term of seismic noise, seismic activity, ground-atmosphere coupling, and internal structure. |
| 11:08 a.m. | Wieczorek M. A. * Knapmeyer-Endrun B. Panning M. P. Plesa A.-C. McLennan S. M. et al. | *Global Character of the Martian Crust as Revealed by InSight Seismic Data* **[#1412]** Seismic data from the InSight mission provide in situ estimates for the local thickness of the martian crust. We extrapolate these measurements globally, constraining the average thickness of the crust and the maximum crustal density. (Not a haiku.) |
| 11:11 a.m. | Michaut C. Plesa A.-C. * Samuel H. Wieczorek M. A. McLennan S. et al. | *Crustal Radioactivity on Mars Constrained by InSight Data and Geodynamic Modeling* **[#1415]** We investigate the consequences of the crust thickness determined from InSight seismological data and gravity and topography inversions on the crustal radioactivity of Mars using geodynamical modeling. |
| 11:14 a.m. | Khan A. * Ceylan S. van Driel M. Giardini D. Lognonne P. et al. | *Constraints on the Martian Upper Mantle from InSight Seismic Data* **[#1836]** We invert seismic body wave information for the upper mantle structure of Mars. |
| 11:17 a.m. | Stähler S. C. * Ceylan S. Duran A. C. Garcia R. G. Giardini D. et al. | *Seismic Detection of the Martian Core by InSight* **[#1545]** Mars has a core / It's liquid, metal, and large / Seismic waves did tell us. |
| 11:20 a.m. | Le Maistre S. * Rivoldini A. Yseboodt M. Dehant V. | *Preliminary Results of One Martian Year of Observations from the Radio-Science Experiment of* |

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| | Van Hoolst T. et al. | *InSight, RISE* **[#2011]**<br>Preliminary results from InSight-RISE experiment. The effect of the liquid core on the nutation of Mars spin axis is observed for the first time. This independent confirmation of the state of the core provides constraints on its size and density. |
| 11:23 a.m. | Drilleau M. * Garcia R. Samuel H. Rivoldini A. Wieczorek M. et al. | *Marsquakes' Location and 1-D Seismic Models for Mars from InSight Data* **[#1627]**<br>After two years of recording by the InSight seismometer, seismic body waves phases of a small number of marsquakes have been clearly identified. We use these arrival times to constrain the locations of the marsquakes and the interior structure. |
| 11:26 a.m. | Knapmeyer M. * Stähler S. C. Daubar I. Forget F. Spiga A. et al. | *Marsquake Activity Driven by the Sun?* **[#1069]**<br>We demonstrate that seismic activity on Mars shows a truly seasonal variability, beyond the variation of detectability that could be expected from seasonal wind noise changes at the InSight landing site. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[R421]**

## Thursday, March 18, 2021
## NASA HEADQUARTERS BRIEFING (LIVE PRESENTATIONS)

### 12:30 p.m. Track 1

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| 12:30 p.m. | | *TBD* |

**[R451]**

## Thursday, March 18, 2021
## SPECIAL SESSION: SCIENTIFIC EXPLORATION OF THE LUNAR SOUTH POLE I

### 2:30 p.m. Track 1

### Chairs: Kathleen Mandt and Bradley Thomson

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| 2:30 p.m. | Mitchell J. L. * McCubbin F. M. Gross J. Boyce J. W. Harris C. L. et al. | *Artemis Curation: Preparing for Sample Return from the Lunar South Pole* **[#1214]** This abstract summarizes the ongoing work to prepare for Artemis sample return, and new updates after the release of the Artemis Science Definition Team report. |
| 2:33 p.m. | Young K. E. * Hurtado Jr. J. M. Noble S. Bleacher J. E. Bailey B. et al. | *Structuring Real-Time Science Support of Artemis Crewed Operations: Results from the Lunar Surface Science Workshop #8* **[#1634]** We will summarize results from the 8th virtual Lunar Surface Science Workshop, discussing structuring real-time science support for Artemis lunar surface operations. The workshop is scheduled for February 24–25, 2021. |
| 2:36 p.m. | Foing B. H. * Rogers H. Musilova M. Weert A. Mulder S. et al. | *Life and Research at SouthPole Moonbase: EuroMoonMars Campaigns Results 2019-2020* **[#2502]** We present life and research on the SouthPole Moonbase, as experienced from EuroMoonMars campaigns EMMIHS HISEAs, EMMPOL Poland that simulated expected science and operations at the base. We give an update on ILEWG EuroMoonMars Results in 2019-2020. |
| 2:39 p.m. | Colaprete A. * Elphic R. C. Shirley M. Ennico-Smith K. Lim D. S. S. et al. | *The Volatiles Investigating Polar Exploration Rover (VIPER) Mission* **[#1523]** The VIPER mission will explore the lunar south pole in late 2023, mapping volatiles over distances of several kilometers. |
| 2:42 p.m. | Fisch P. R. M. * Schweitzer L. C. Jones H. L. Whittaker W. L. | *Lunar Polar Autonomous Micro-Roving for Hydrogenous Volatile Characterization* **[#2239]** MoonRanger is an autonomous micro-rover landing at the lunar south pole to explore for lunar ice. This abstract details technical innovations and scientific significance which will provide revolutionary value for future rover exploration missions. |
| 2:45 p.m. | Cohen B. A. * Barber S. J. Curran N. M. Driggers P. Farrell W. M. et al. | *The Peregrine Ion Trap Mass Spectrometer (PITMS): A CLPS-Delivered Ion Trap Mass Spectrometer for In Situ Studies of the Lunar Water Cycle* **[#1556]** Water vapor and other volatile inorganic compounds constitute the chemtrails of robotic missions. Our exclusive investigation will uncover how human health and habitation on the Moon might be affected. |
| 2:48 p.m. | Mitrofanov I. G. * Tretyakov V. I. Zelenyi L. M. | *Mission of Luna-25, as the First Step of Russian Robotic Moon Exploration Program* **[#2032]** In this talk we present Luna-25, the Russian robotic mission to the lunar south pole, discuss its instruments, scientific programme, and expected results. |
| 2:51 p.m. | Ohtake M. * Karouji Y. Ishihara Y. Nomura R. Inoue H. et al. | *Current Status of the Planned Lunar Polar Exploration Mission Jointly Studied by India and Japan* **[#1840]** The Japan Aerospace Exploration Agency and the Indian Space Research Organisation are jointly planning the lunar polar exploration mission. We discuss the objective and current status of the mission planning, including selected Japanese instruments. |
| 2:54 p.m. | | *Presenter Introductions* |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[R452]**

## Thursday, March 18, 2021
## BENNU AND RYUGU: SAMPLE COLLECTION AND RETURN

### 2:30 p.m. Track 2

### Chairs: Eri Tatsumi and Harold Connolly

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Yada T. * Abe M. Nakato A. Yogata K. Miyazaki A. et al. | *Handling and Description of C-Type Asteroid Ryugu Samples Returned by Hayabusa2* **[#2008]** Hayabusa2 returned samples from C-type asteroid Ryugu last December. >5 grams of black pebbles and particles were found inside the container. They are under initial description, followed by initial analyses, which will start six months after the return. |
| 2:38 p.m. | Sakatani N. * Tanaka S. Okada T. Fukuhara T. Riu L. et al. | *Anomalously Porous and Dark Rocks on Asteroid (162173) Ryugu* **[#1832]** This study reports the finding of anomalously porous and dark materials on asteroid Ryugu, using high resolution thermal and optical images by Hayabusa2 spacecraft. |
| 2:41 p.m. | Sugita S. * Sugimoto C. Tatsumi E. Yokota Y. Morota T. et al. | *Collisional and Thermal Evolution of Ryugu's Parent Body Inferred from Bright Boulders* **[#1399]** Analyses on bright boulders (BBs) on Ryugu suggest that its parent body went through radiogenic thermal metamorphism and was struck by multiple projectiles. Size distribution suggests that returned sample may contain BBs fragments. |
| 2:44 p.m. | Neumann W. * Grott M. Trieloff M. Jaumann R. Biele J. et al. | *Parent Body of the Hayabusa2 Target (162173) Ryugu: High Porosity, Early Accretion, Small Size* **[#1361]** Porosity models constrain a parent body compatible with microporosity and alteration temperatures of Ryugu's surface material, and provide burial depths for both low- and high-density boulders within an a few km-sized early accreting planetesimal. |
| 2:47 p.m. | Barnouin O. S. * Daly M. G. Seabrook J. Gaskell R. W. Palmer E. et al. | *Topography of Nightingale, the OSIRIS-REx Sample Site on Bennu* **[#1133]** The OSIRIS-REx spacecraft collected a sample from the Nightingale site on asteroid Bennu. We investigate high-resolution digital terrain models to understand the geological characteristics of Nightingale with implications for the sample's origin. |
| 2:50 p.m. | Ballouz R.-L. * Walsh K. J. Michel P. Zhang Y. Sánchez P. et al. | *Landing on an Asteroid: Simulations of the OSIRIS-REx Spacecraft Touching Down on (101955) Bennu* **[#1349]** Touching an asteroid. / Is the surface soft or hard? / Packing matters most. |
| 2:53 p.m. | Rizos J. L. * de León J. Licandro J. Golish D. R. Campins H. et al. | *Bennu's Candidate Sample Sites and Global Surface Characterized by Spectral Clustering of OSIRIS-REx Images* **[#1099]** In this work, we apply an unsupervised machine learning classification algorithm to MapCam images |

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| | | (OSIRIS-REx). It allows to spectrophotometrically characterize the mission's primary and backup sample collection sites, called Nightingale and Osprey. |
| 2:56 p.m. | Ishimaru K. * Lauretta D. S. Porter N. Golish D. R. Al Asad M. et al. | *Apparently Layered Boulders with Multiple Textures on Bennu's Surface* **[#1154]** We investigated layered boulders on Bennu using image and altimetry data. Normal albedo analysis and physical measurements were performed on selected boulders. Apparent layers could reflect size sorting in the interior of the parent body. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[R453]**

## Thursday, March 18, 2021
## MELTS ON DIFFERENTIATED PARENT BODIES

## 2:30 p.m. Track 3

## Chairs: Aaron Bell and Jasmeet Dhaliwal

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Pang R. L. * Du W. | *A New Occurrence of Phosphoran Olivine in Ungrouped Achondrite Northwest Africa 12319* **[#2417]** We report the first description of P-rich olivine (up to 12.4 wt% P2O5) in an ungrouped achondrite NWA 12319 and propose that it might be formed from the high-T, P-rich residual melts after core crystallization of asteroid. |
| 2:38 p.m. | Abe D. * Mikouchi T. Irving A. J. | *Experimental Evidence for Formation of Northwest Africa 6962 CR-Related Achondrite from a CR Chondrite Precursor Melt* **[#1813]** We conducted partial melting experiments of CR2 to understand the petrogenetic link between CR chondrites and CR-related NWA 6962. We found CR partial melt could crystallize NWA 6962 olivine, implying extensive thermal evolution in a CR parent body. |
| 2:41 p.m. | Gorce J. S. * Milttlefehldt D. W. Simon J. I. | *Textural, Geochemical, and Thermodynamic Constraints on the Evolution of Eucrite EET 90020* **[#1656]** A combination of textural observations, chemical analyses, and thermodynamic modeling is employed to better understand the evolution of highly metamorphosed basaltic eucrites. |
| 2:44 p.m. | Chaussidon M. * Barrat J. A. Yamaguchi A. Beck P. Villeneuve J. et al. | *$^{26}$Al Chronology of Erg Chech 002, the Oldest Andesite in the Solar System* **[#2222]** $^{26}$Al chronology shows that the Erg Chech 002 meteorite of andesitic composition is the oldest known |

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| | | differentiated crust of a protoplanet, and that it formed contemporaneously with the formation of the cores in the parent bodies of magmatic iron meteorites. |
| 2:47 p.m. | Vaci Z. * Ziegler K. Yang S. Humayun M. Agee C. B. | *Northwest Africa 6698: Dioritic Partial Melt of the Ureilite Parent Body* **[#2378]** New oxygen isotopic measurements on the diorite Northwest Africa 6698 suggest that it is the second evolved igneous rock associated with the ureilite parent body. |
| 2:50 p.m. | Lucas M. P. * Dygert N. Miller N. R. McSween H. Y. | *New Major and Trace Element Data from Acapulcoite-Lodranite Clan Meteorites: Evidence for Melt-Rock Reaction Events and Early Collisional Fragmentation of the Parent Body* **[#1307]** New major and trace element data for acapulcoite-lodranite meteorites indicate melt-rock reaction processes. Thermometric results show rapid cooling from high temps, consistent with collisional fragmentation of the parent body during differentiation. |
| 2:53 p.m. | Karageozian M. E. * Sharp T. Van Soest M. McDonald C. | *Anomalous $^{40}Ar/^{39}Ar$ Shock Ages in Mbale: Nonintuitive K and Ar Behavior, Implications for the Interpretation of Shock Ages in Shocked Meteorites* **[#2318]** Laser $^{40}Ar/^{39}Ar$ dates, combined with K and Ar measurements, demonstrate that K loss and Ar retention in S6 shock veins results in anomalously high ages in Mbale. This illustrates the importance of determining how specific shock effects effect K and Ar. |
| 2:56 p.m. | Martin-Wells K. S. * Partee J. Nebel-Crosson J. | *Topography and Impact Melt at Distal Tycho Secondary Chains* **[#2636]** Steep slopes face Tycho / Ejecta slides down the hill / Revealing its melt. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[R454]**

## Thursday, March 18, 2021
## EARLY MARS GEOMORPHOLOGY I: WARM AND WET, COLD AND DRY, OR SOMETHING IN BETWEEN?

### 2:30 p.m. Track 4

### Chairs: Rossman Irwin III and Marisa Palucis

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Citron R. I. * Manga M. Hemingway D. Plattner A. | *Are We Visiting the Coastlines of Mars? Load-Corrected Paleo-Ocean Levels at Jezero, Oxia Planum, and Gale* **[#1605]** Several current and upcoming missions are located near the best-fit sea-level for an early Mars "Arabia" ocean, when accounting for deformation due to Tharsis and Isidis loading. |

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| 2:38 p.m. | Salese F. * McMahon W. J. Balme M. Ansan V. Davis J. et al. | *Fluvial Siliciclastic Deposition on an Unvegetated Planet: The Izola Outcrop (Mars)* **[#1948]**<br>For the first time, orbital data has allowed to examine, through detailed architectural analysis, a large (1500 m by 190 m) pre-late Noachian outcrop, and draw reliable paleoenvironmental interpretations based on sedimentary-stratigraphic evidence. |
| 2:41 p.m. | Goudge T. A. * Fassett C. I. Coholich M. | *Assessing Controls on the Termination of Overflow Floods for Paleolakes on Mars* **[#2196]**<br>Mars lakes filled to brim / Overflow drained some water / Why not all of it? |
| 2:44 p.m. | Craddock R. A. * Ramirez R. M. Irwin, III R. P. Howard A. D. | *The Nature of Modified Impact Craters on Mars* **[#2513]**<br>Early Mars warm/wet / Impact craters tell us so / Here we show it's true. |
| 2:47 p.m. | Grau Galofre A. * Whipple K. X. Christensen P. R. | *Valley Networks and the Fingerprints of Martian Wet Based Glaciation* **[#1879]**<br>Wet-based ice masses produce large-scale erosional landscapes on Earth, and yet these landscapes are rare on Mars. Using models of glacial hydrology under low gravity, we show that glacial scouring is strongly inhibited on Mars. |
| 2:50 p.m. | Boatwright B. D. * Head J. W. Palumbo A. M. | *Inverted Fluvial Channels in Terra Sabaea, Mars: Geomorphic Evidence for Proglacial Lakes and Widespread Highlands Glaciation in the Late Noachian* **[#1641]**<br>We describe the results of a survey documenting 42 new examples of inverted fluvial channels on Mars that suggest widespread melting and runoff from cold-based glaciers in the Late Noachian highlands. |
| 2:53 p.m. | McNeil J. D. * Fawdon P. Balme M. R. Coe A. L. | *The Geology of Isolated Landforms on the Margin of Chryse Planitia, Mars* **[#1429]**<br>There are >14,000 kilometre-scale mounds around the margin of Chryse Planitia. These mounds originated from a Noachian-aged ~500 m-thick layer that overlies the Oxia Planum clay-bearing material, and is of similar age to the Mawrth Vallis plateau. |
| 2:56 p.m. | Buczkowski D. L. * Wyrick D. Y. Seelos K. D. Viviano C. E. Seelos F. P. et al. | *Her Desher and Nirgal Valles: An Integrated Geomorphic, Structural, and Mineralogic Evaluation of Groundwater Flow in NW Noachis Terra* **[#1748]**<br>An integrated analysis of Nirgal and Her Desher Valles are consistent with the exposed alteration layer being originally formed by pedogenesis, but then further altered by interaction with acidic groundwater channeled through structural controls. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[R455]**

## Thursday, March 18, 2021
## VENUS: GEOLOGY AND GEOPHYSICS

### 2:30 p.m. Track 5

### Chairs: Lindsay McHenry and Ana-Catalina Plesa

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Albach R. S. * Whitten J. L. | *Global Morphologic Map of Tesserae on Venus* **[#2232]** Tesserae textures / This looks different from that / Morphologic map. |
| 2:38 p.m. | Fattaruso L. A. * Buczkowski D. L. McGowan E. M. McGill G. E. | *The Lachesis Tessera Quadrangle (V-18), Venus* **[#2557]** We present a draft geologic map of the Lachesis Tessera (V-18) quadrangle of Venus. The map includes deformation belts, three large volcanoes, many small shield volcanoes, impact craters, coronae, arachnoid-like features, and annular dark spots. |
| 2:41 p.m. | Antropova E. G. * Braga C. H. G. Ernst R. E. Buchan K. L. El Bilali H. | *Geological Mapping of Unnamed Volcanic Event (Centered at 0.6°N and 277.8°E) in Eastern Part of BAT Region, Venus* **[#1402]** Separate volcanic units (two flow fields, a shield field, and an intermediate size volcano) are linked into a single volcanic event >400 km across centered on 0.6°N, 277.8°E in eastern BAT region, Venus. Detailed mapping is revealing the flow history. |
| 2:44 p.m. | Braga C. H. G. * Antropova E. G. Ernst R. E. Buchan K. L. El Bilali H. | *Detailed Mapping of the Volcanic Center Atira Mons, BAT Region, Venus* **[#1387]** Atira Mons (V-6, Venus) is a large volcano with flows out to 300 km. Detailed mapping reveals evolution of its summit caldera (100 km across) and history of flank flows. An arcuate fracture system on the E side suggests corona-like characteristics. |
| 2:47 p.m. | Conrad J. W. * Nimmo F. Black B. A. | *Uplift Record of Baltis Vallis, Venus* **[#1636]** Baltis Vallis seems / To flow up and over hills / Recording wavelengths. |
| 2:50 p.m. | Borrelli M. E. * O'Rourke J. G. Smrekar S. E. Ostberg C. M. | *A Global Survey of Lithospheric Flexure at Pancake Domes on Venus Reveals Intermediate Elastic Thickness* **[#1250]** Venus pancake domes / Found where the lithosphere is / Moderately thick. |
| 2:53 p.m. | Maia J. S. * Wieczorek M. A. | *Crustal Thickness of Venusian Crustal Plateaus* **[#1910]** Localized spectral admittance techniques show that the thickness of the crustal plateaus are around 25 km and that the elastic thickness is close to zero. |
| 2:56 p.m. | Bjonnes E. * Johnson B. C. Evans A. J. | *The Effects of Venus' Thermal Conditions on Multiring Basin Formation* **[#1513]** Faults circling around / Hinting at the hidden depths / Understated truth. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[R461]**

**Thursday, March 18, 2021**
**SPECIAL SESSION: SCIENTIFIC EXPLORATION OF THE LUNAR SOUTH POLE II**

**4:00 p.m. Track 1**

**Chairs: Bernard Foing and Myriam Lemelin**

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Schorghofer N. * Williams J.-P. Paige D. A. | *Carbon Dioxide Cold Traps on the Moon* **[#1389]** Carbon dioxide cold traps are mapped in the south polar region of the Moon based on 11 years of Diviner data. |
| 43:08 p.m. | Dong C. * Green J. L. Wang L. Draper D. S. Lingam M. et al. | *Moon's Polar Ice and Hematite: A Consequence of Ancient Lunar Dynamo* **[#1790]** We study the formation of lunar polar ice and hematite by modeling the self-consistent magnetic field interactions between the Moon and Earth immersed in a solar storm at ~4Ga based on sophisticated 3-D multifluid magnetohydrodynamic simulations. |
| 4:11 p.m. | Mandt K. E. * Mousis O. Bouquet A. Hurley D. Luspay-Kuti A. | *The Origin of Volatiles Samples by the LCROSS Mission in Cabeus Crater* **[#2167]** We evaluate the origin of the volatiles sampled by the LCROSS impact based on elemental composition of the plume. |
| 4:14 p.m. | Bhiravarasu S. S. * Chakraborty T. Das A. Kumar R. Neish C. D. et al. | *L-Band Radar Observations of Cabeus Crater: Initial Results from DFSAR Onboard Chandrayaan-2 Mission* **[#1787]** The first-ever L-band orbital radar observations of a part of Cabeus' crater floor near the Moon's south pole revealed no evidence for thick deposits of pure water ice within the top ~2-3 meters of the surface. |
| 4:17 p.m. | Deutsch A. N. * Heldmann J. L. Colaprete A. Cannon K. M. Elphic R. C. | *Investigating the Control of Surface Temperature on Surface Ruggedness at the Lunar Poles* **[#2019]** We analyze the relationship between surface ruggedness and surface temperature within ice stability zones at the lunar poles, and discuss the possibility that ice is softening polar topography. |
| 4:20 p.m. | Feng J. * Siegler M. A. | *Thermal Gradient in the Lunar South Polar Region Estimated from Infrared and Microwave Observations* **[#2678]** We use the data measured by LRO Diviner and CE-2 Microwave Radiometer to estimate the thermal gradients of regolith in lunar south polar region. The result implies the thermal conductivity of lunar regoith has a temperature dependence. |
| 4:23 p.m. | Cannon K. M. * Deutsch A. N. Head J. W. | *Stratigraphy of Ice and Ejecta Deposits at the Lunar Poles: Updates and New Insights* **[#2497]** We carried out Monte Carlo simulations of the deposition of ice, and of ejecta from large craters at the poles. Results show significant amounts of ice buried at depth in the oldest cold traps, and a shallow gardened mantle near the surface. |
| 4:26 p.m. | Costello E. S. * Ghent R. R. Lucey P. G. | *Impact Gardening Does Not Protect South Polar Ice* **[#1073]** Shield or sabotage? / Garden icy regolith / Many meters deep. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[R462]**

**Thursday, March 18, 2021**
**BENNU AND RYUGU: SURFACE EVOLUTION**

**4:00 p.m. Track 2**

**Chairs: Terik Daly and Seiji Sugita**

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Jawin E. R. * McCoy T. J. Walsh K. J. Connolly H. C. Ballouz R.-L. et al. | *Last Epoch of Resurfacing on Asteroid (101955) Bennu Revealed by Global Geologic Map* **[#2022]** Heterogeneity on Bennu's surface was caused by recent surface activity including mass movement, leading to rough and smooth units. These units were influenced by global-scale dorsa and fossae, but less so by the equatorial ridge. |
| 4:08 p.m. | Hamilton V. E. * Christensen P. R. Kaplan H. H. Haberle C. W. Rogers A. D. et al. | *Thermal Infrared Evidence for Limited Compositional and Particle Size Variability on Asteroid (101955) Bennu* **[#2148]** TIR spectra of Bennu exhibit two endmembers representing differences in the distribution of thin deposits (~15 μm) of fine particulates. Compositional diversity is limited, and most consistent with aqueously altered CI and CM carbonaceous chondrites. |
| 4:11 p.m. | Simon A. A. * Reuter D. C. Kaplan H. H. Hamilton V. E. DellaGiustina D. N. et al. | *OVIRS Visible to Near-IR Spectral Results at (101955) Bennu* **[#1093]** We present the visible to near-IR spectral results obtained at Bennu, including the identification of hydrated phyllosilicates, iron oxides, carbon bearing materials, and pyroxene. |
| 4:14 p.m. | Praet A. * Barucci M. A. Hasselmann P. H. Kitazato K. Iwata T. et al. | *Hydration State of Asteroid (162173) Ryugu's Surface Using Hayabusa2/NIRS3 Spectral Data* **[#1163]** The JAXA mission Hayabusa2 studied the asteroid (162173) Ryugu. The Near-Infrared Spectrometer (NIRS3) collected reflectance data that showed a 2.72-μm absorption band. We estimate the hydrogen content of hydrated phyllosilicate $H_2O$, OH groups. |
| 4:17 p.m. | Pilorget C. * Fernando J. Riu L. Kitazato K. Iwata T. | *Albedo and Spectro-Photometric Properties of Ryugu from NIRS3/Hayabusa2, Implications for the Composition of Ryugu, and the Representativity of the Returned Samples* **[#2016]** Here, we report on the albedo and spectro-photometric properties of Ryugu as derived from the NIRS3 IR spectrometer and their implications for our understanding of Ryugu's composition. |
| 4:20 p.m. | Tatsumi E. * Matsuoka M. Sugita S. Yumoto K. Takaki N. et al. | *Rapid Space Weathering Process on Ryugu Inferred from the Artificial Crater* **[#1338]** Small carry-on Impactor on Hayabusa2 made the first artificial impact crater on Ryugu. The crater should be the most fresh surface on the asteroid, which suggests a rapid space weathering process on the carbonaceous asteroid. |
| 4:23 p.m. | Takaki N. * Morota T. Cho Y. Tatsumi E. Honda R. et al. | *Surface Flows Mechanism on Asteroid Ryugu Inferred from the Azimuthal Direction of Wake-Like Features on Regolith Around Large Boulders* **[#1432]** We analyzed the directions of flow features based on spectral color of asteroid Ryugu. We found that the flow directions are consistent with current downslope directions. In addition, the flow features were found on flatter slopes than ~35°. |

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| 4:26 p.m. | Tang Y. * Lauretta D. S. Ballouz R.-L. DellaGiustina D. N. Bennett C. A. et al. | *Analysis and Simulation of Boulder Mass Movement Sites on Asteroid Bennu* **[#1795]** The OSIRIS-REx mission to Bennu has revealed a boulder dominated surface. Here, we survey and model the mass movement of boulders at specific sites in order to understand their contribution to the surface evolution of Bennu. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[R463]**

## Thursday, March 18, 2021
## PLANETARY DIFFERENTIATION: ACCRETION, EVOLUTION, EXPERIMENTS — LOTS OF METAL

### 4:00 p.m. Track 3

### Chairs: Tim McCoy and Kelsey Prissel

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Nimmo F. * Fischer R. A. Kleine T. | *Using Moderately Volatile Elements to Probe Planetary Accretion* **[#1247]** We use accretion simulations to show that the moderately volatile element depletion patterns of the Earth and Mars can be explained if the precursor bodies consisted of an inner volatile-poor group and an outer volatile-rich group. |
| 4:08 p.m. | Tian Z. * Magna T. Day J. M. D. Mezger K. Scherer E. E. et al. | *Potassium Isotope Composition of Mars Reveals a Mechanism of Planetary Volatile Retention* **[#2192]** This study provides an alternative for evaluating the nature of volatiles on Mars using K isotopes. New K isotope data reveal that the sizes of differentiated planetary bodies fundamentally control their ability to retain volatiles. |
| 4:11 p.m. | Yuan Q. * Li M. M. Desch S. J. Ko B. | *Giant Impact Origin for the Large Low Shear Velocity Provinces* **[#1980]** After the Moon-forming impact, we propose part of its mantle sank to the core-mantle boundary and were collected by mantle convection to form the largest structures in the mantle, the Large Low-Shear-Velocity Provinces. The model supported by geodynamic and thermodynamic modeling. |
| 4:14 p.m. | Walker R. J. * | *$^{182}$Hf-$^{182}$W Dating of Iron Meteorites and Pallasites: Virtues and Vices* **[#1540]** Variations in the Hf/W ratio of precursor materials leading to the formation of differentiated planetesimals can lead to uncertainties in model $^{182}$W ages that are rarely considered. |
| 4:17 p.m. | Crossley S. D. * Ash R. D. Sunshine J. M. Corrigan C. M. McCoy T. J. | *Parent Body Histories Recorded in Oxidized Chondrite Sulfides: Implications for Core Formation* **[#2249]** |

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| | | Can oxidized, sulfur-rich parent bodies produce metallic cores? We investigate the siderophile element contents of sulfides during R chondrite metamorphism to estimate characteristics of iron meteorites that could have formed from FeNi-sulfide melts. |
| 4:20 p.m. | Mei Q.-F. * Sharma S. Leya I. Humayun M. | *Evidence for Rhenium Isotopic Fractionation During Crystallization and Mixing in the IIAB Iron Core* **[#1564]**<br>We report combined W-Re-Pt isotopic data for IIAB iron meteorites. A reversal in the pre-irradiated ? $^{187}$Re versus Re contents is observed, which indicates that fractionation in the IIAB core is more complex than closed system Rayleigh fractionation. |
| 4:23 p.m. | Ray S. * Wadhwa M. | *Correlated Iron and Silicon Isotope Compositions of Aubrites as Tracers of Differentiation Processes* **[#2652]**<br>Iron loves the core / But silicon is moody / What secrets they hold? |
| 4:26 p.m. | Righter K. * Yang S. Humayun M. Boujibar A. Rowland R. et al. | *Metal-Silicate Partitioning of Re, Ru, Pt, Os, Ti, Nb, and Ta in Reduced Differentiated Planetary Bodies* **[#1071]**<br>Ti, Ta, Nb, Re, Ru, Pt, and Os are all excluded from FeNi metallic cores containing silicon. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[R464]**

## Thursday, March 18, 2021
## EARLY MARS GEOMORPHOLOGY II: COOLER WITH A CHANCE OF SHOWERS

### 4:00 p.m. Track 4

### Chairs: Timothy Goudge and Virginia Gulick

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Schmidt F. * Way M. Costard F. Bouley S. Séjourné A. | *Cold Late Hesperian Climate* **[#2660]**<br>How was the martian climate 3Gy ago? We propose a new 3D-GCM model with fully coupled ocean/atmosphere. |
| 4:08 p.m. | Bahia R. S. * Galofre A. G. Covey-Crump S. Jones M. Mitchell N. | *Discordance Mapping of Argyre Basin: An Insight into the Fluvial and Subglacial Origin of Valley Networks in Southern Mars* **[#1117]**<br>Martian valley networks are evidence for surface run-off and past water cycles on ancient Mars. The |

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| | | origin of some valleys is still uncertain. We determine whether valleys dissecting the Argyre Basin region are subglacial or fluvial in origin. |
| 4:11 p.m. | Ivanov M. A. * Hiesinger H. | *Main Topographic and Morphologic Characteristics and Chronology of the Uzboi-Ladon Fluvial System on Mars* **[#1436]**<br>Uzboi and Ladon Valles are not pieces of a larger, single outflow system (Uzboi-Ladon-Morava) but represent individual fluvial features with independent histories. |
| 4:14 p.m. | Russell C. E. * Konsoer K. Karunatillake S. Burr D. Forte A. | *Interpreting Paleohydrology and Fluvial Dynamics of Martian Channels in the Aeolis Dorsa Region* **[#2702]**<br>Novel methodologies that characterize paleochannel planform geometries, offer insights into interpreting the paleohydrologic variability and fluvial dynamics of martian channels. |
| 4:17 p.m. | Grant J. A. * Wilson S. A. | *Late Aqueous Activity on Mars: Evidence from Southern Margaritifer Terra and Gale Crater* **[#1719]**<br>Alluvial fans in southern Margaritifer Terra and Gale Crater record evidence of limited magnitude, late activity that extended into the Hesperian and Amazonian on Mars. |
| 4:20 p.m. | Palucis M. C. * Morgan A. M. Strauss J. V. Rivera-Hernandez F. Marshall J. A. et al. | *What Do You Call a Martian That (Still) Likes Stream Deposits? A Big Alluvial Fan* **[#1918]**<br>We present initial results from a field-based terrestrial analog study of martian fans, including the characterization of the sedimentology and geomorphology of a periglacial alluvial fan in the Aklavik Range, Northwest Territories, Canada. |
| 4:23 p.m. | Irwin R. P. III * Wolfe E. | *Spatially and Temporally Variable Degradation of Large Post-Noachian Impact Craters: A Record of Paleoclimate and Climate Change on Mars* **[#2729]**<br>Post-Noachian impact craters >90 km in diameter experienced regionally variable degradation through about the Hesperian/Amazonian boundary, a possible result of regional differences in snow accumulation and melting. |
| 4:26 p.m. | Watters W. A. * Chickles E. T. Fassett C. I. Hundal C. B. Pimperl H. | *Relating Thermal Inertia to Crater Shape Characteristics in Equatorial Mars* **[#2115]**<br>We characterize the modification sequence of simple craters quantitatively in different settings across equatorial Mars, finding the largest variations in high vs. low thermal inertia environments, probably owing to differences in sediment supply. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[R465]**

## Thursday, March 18, 2021
## VENUS: COUPLED EVOLUTION OF THE INTERIOR, SURFACE, AND ATMOSPHERE

## 4:00 p.m. Track 5

## Chairs: Kevin Baines and Siddharth Krishnamoorthy

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Plesa A.-C. * Breuer D. | *The Effects of Intrusive Magmatism on the Mechanical Lithosphere Thickness of Venus* **[#2130]** Intrusive melt depth / Affects mechanical thickness / Of Venus' lithosphere. |
| 4:08 p.m. | Ernst R. E. * Buchan K. L. | *Large Igneous Provinces: Integrating Lessons from Venus and Earth* **[#2359]** There are key differences between Venus and Earth in the expression of Large Igneous Provinces (LIPs), due to presence/absence of plate tectonics and erosion. New insights are provided by an integrated study of the LIP records of Venus and Earth. |
| 4:11 p.m. | Head J. W. III * Wilson L. Ivanov M. A. Wordsworth R. | *Contributions of Volatiles to the Venus Atmosphere from the Observed Extrusive Volcanic Record: Implications for the History of the Venus Atmosphere* **[#2143]** The total volume of mapped volcanic deposits on Venus releasing volatiles into the atmosphere is small; Venus' atmosphere today may be a "fossil atmosphere." |
| 4:14 p.m. | Weller M. B. * Kiefer W. S. | *Punctuated Evolution of the Venusian Atmosphere from Mantle Outgassing* **[#1555]** Surface moves and warms / Seizes, disturbed fits and starts / Volcanoes release. |
| 4:17 p.m. | Warren A. O. * Kite E. S. | *Degassing, Decarbonation, and Dehydration: Investigating the Likelihood of a Habitable Era on Venus* **[#1253]** Models give hope for / Past habitable Venus. / What are the constraints? |
| 4:20 p.m. | Teffeteller H. * McCanta M. C. Filiberto J. Treiman A. H. Keller L. et al. | *An Experimental Study of the Alteration of Basalt on the Surface of Venus* **[#1635]** We are presenting results from an experimental study of the alteration of basaltic glasses under Venus-like surface atmospheric conditions. Our results characterize the rock-atmosphere interaction on Venus and could inform past and future missions. |
| 4:23 p.m. | Filiberto J. * Semprich J. Cutler K. S. Teffeteller H. Reid R. et al. | *Venus Alteration: Model and Experimental Results* **[#1201]** The Venus surface / Hidden from view by clouds and / Mineral coatings. |
| 4:26 p.m. | McHenry L. J. * Ruffini J. J. | *Extended, High-Temperature Cooling of Lava Tube Interiors: Analog for Venus* **[#2348]** The interior of basaltic lava tubes provide an environment in which basalt cools in an insulated, high-temperature surface environment, similar to Venus surface temperatures, during which a hematite-rich surface layer forms. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

## [F501]

## Friday, March 19, 2021
## HIGH-IMPACT LUNAR IMPACT STUDIES

## 11:00 a.m. Track 1

## Chairs: Kassandra Martin-Wells and Harald Hiesinger

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Ravi S. * Robinson M. S. | *Evidence for the Lunar Procellarum Basin: Insights from the Spatial Distribution of Floor-Fractured and Concentric Craters* **[#2245]** We present statistical evidence for the presence of the lunar Procellarum Basin using the spatial distribution of floor-fractured and concentric craters as proxies. |
| 11:08 a.m. | Douglass B. D. * Elder C. M. | *Constraining the Thickness of the Lunar Regolith Using Cold-Spot Craters* **[#2668]** By comparing to previous work, we show that crater age can affect constraints on regolith thickness inferred from the presence or absence of blocks around lunar craters. |
| 11:11 a.m. | Elder C. M. * Douglass B. Ghent R. R. Hayne P. O. Williams J.-P. et al. | *The Subsurface Coherent Rock Content of the Moon as Revealed by Cold-Spot Craters* **[#1725]** Lunar regolith / Contains rocks, increasing with / Depth, not abruptly. |
| 11:14 a.m. | Nypaver C. A. * Thomson B. J. Rivera-Valentín E. G. Fassett C. I. Neish C. D. et al. | *Prolonged Boulder Exhumation at the Rims of Kilometer-Scale Craters on the Lunar Maria* **[#2324]** Boulders at the rim. / Exposed by the sands of time. / Destroyed and replaced. |
| 11:17 a.m. | O'Brien P. * Byrne S. | *Surface Residence Times of Regolith on the Lunar Maria* **[#1652]** Using a Monte Carlo landscape evolution model, we investigate surface exposure histories in lunar regolith. Comparison with existing soil maturity datasets yields the first comprehensive estimate of the mare space weathering rate. |
| 11:20 a.m. | Neish C. D. * Lafleche E. A. Patterson G. W. | *Physical Properties of Lunar Impact Melt Deposits* **[#1589]** Lunar impact melts / Won't forgo their rocky shields / Do not tread on me. |
| 11:23 a.m. | Talkington C. L. * Hirabayashi M. Montalvo P. King D. T. Jr. | *The Depletion of Craters Larger than 600-800 m in Diameter on the Walls of Lunar Complex Craters* **[#1342]** In this study, we discuss our investigations into morphological features found within complex crater walls on the lunar southern pole and the relation between crater size and complex crater wall strength. |
| 11:26 a.m. | Rajšić A. * Miljković K. Kawamura T. Collins G. S. Wójcicka N. et al. | *Numerical Simulations of the Apollo S-IVB Artificial Impacts on the Moon* **[#1830]** The aim is to validate the application of the iSALE-2D code in quantification of seismic efficiency in impact events in general via modelling of artificial impacts on the Moon. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[F502]**

## Friday, March 19, 2021
## PLANETARY TECTONICS AND INTERIORS: SURFACE EXPRESSIONS AND DEEP ISSUES

### 11:00 a.m. Track 2

## Chairs: Paul Byrne and Sean O'Hara

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Broquet A. * Andrews-Hanna J. C. | *Plume-Induced Flood Basalts on Hesperian Mars: An Investigation of Hesperia Planum* **[#1893]** Based on orbital observations and modeling, we propose that Hesperia Planum formed as a plume-induced flood basalt province, similar to continental flood basalts on Earth. |
| 11:08 a.m. | Bose N. * Sarkar R. | *Transpression and Multiphase Deformations Identified from the Discontinuity Patterns in Lunae Planum, Mars* **[#1889]** Conjugate Riedel fractures, en-echelon ridges, and their interactions indicate strike-slip component associated with ridge formation in Lunae Planum. The offset of ridges and grabens testifies multiple deformation phases. |
| 11:11 a.m. | Früh T. * Hiesinger H. van der Bogert C. H. Schmedemann N. Pauw L. | *Possible Timing of Wrinkle Ridge Formation in Mare Tranquillitatis* **[#1661]** Lunar wrinkle ridges are common tectonic landforms within the maria. Here, we mapped and studied wrinkle ridges in Mare Tranquillitatis to get new insights into the timing of lunar wrinkle ridge formation and their prevailing stress fields. |
| 11:14 a.m. | Atkins R. M. * Byrne P. K. Bohnenstiehl D. R. | *Investigating Morphometric Characteristics of Shortening Structures Across Mars* **[#1679]** Mars dichotomy / Different fault geometry? / Lowland interbeds? |
| 11:17 a.m. | Collins M. S. * Byrne P. K. Klimczak C. Mazarico E. | *Deep-Seated Thrust Ring Faults Bound Elevated Mantle Plug Beneath Several Lunar Basins* **[#2447]** At Maria Crisium, Serenitatis, and Nectaris, thrust faults compose a (partial) ring fault system and geometrically bound the elevated mantle plug beneath each basin. |
| 11:20 a.m. | Wagner N. L. * James P. B. | *Evaluating Magma Ascent at Pavonis Mons, Mars Using Stress from Flexure* **[#2564]** In this study, we use a combination of stress calculations generated from lithospheric flexure and magma ascent evaluation in order to predict where we see different volcanotectonic features surrounding Pavonis Mons. |
| 11:23 a.m. | Seales J. * Payre V. | *Compositional Variations of Martian Primary Magmas Due to the Water Loss from the Martian Mantle* **[#2393]** We calculate the water content of the martian mantle using constraints on the martian effective elastic thickness and thermal history. From these, we calcuate compositional variances in the primary magma. |
| 11:26 a.m. | Zhou W.-Y. Zhang J. S. * Olsen P. L. Shearer C. K. Agee C. B. et al. | *Plate Tectonics on Mars Hindered by Buoyant Martian Eclogite* **[#2144]** Our high P-T phase equilibrium experiments suggest the martian crustal slabs made of shergottite are less likely to sink to the mantle because of the buoyancy relationship, which hindered the development of tectonics on Mars. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[F503]**

## Friday, March 19, 2021
## THE LEGACY OF ARECIBO OBSERVATORY IN PLANETARY SCIENCE

### 11:00 a.m. Track 3

### Chairs: Patrick Taylor and Luisa Fernanda Zambrano-Marin

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Taylor P. A. * Rivera-Valentín E. G. | *The Legacy of Arecibo Observatory in Planetary Science and Beyond* **[#2179]**<br>Six decades' service / Arecibo's telescope / Lost, not forgotten. |
| 11:08 a.m. | Rivera-Valentín E. G. * Meyer H. M. Taylor P. A. Bhiravarasu S. S. Nolan M. C. et al. | *Arecibo S-Band Radar Characterization of the Mercurian North Polar Deposits* **[#2104]**<br>Radar waves reveal / At Arecibo's bequest / Ice at Mercury! |
| 11:11 a.m. | Campbell B. A. * Campbell D. B. | *The Earth-Based Radar Search for Volcanic Activity on Venus* **[#2339]**<br>Venus is expected to have ongoing volcanic activity based on its similar size to Earth and likely heat budget. Ground-based radar mapping over the past 32 years offers the opportunity to search for surface changes due to volcanic eruptions. |
| 11:14 a.m. | Morgan G. A. * Patterson G. W. Mini-RF Team | *The Moon at 12.6 cm: Legacy of Arecibo/LRO Mini-RF Partnership* **[#2512]**<br>Presenting the results of the Arecibo — Mini-RF bistatic radar studies of volcanics and impacts. |
| 11:17 a.m. | Ortiz Ceballos K. N. * Colón Cesaní A. H. Howell E. S. Méndez A. Fernandez Y. R. et al. | *Constraints on the Water-Production Rates of Interstellar Comet 2I/Borisov from Arecibo Radio OH Observations* **[#2582]**<br>Interstellar guest / Spied with Arecibo's eye / Searching for water. |
| 11:20 a.m. | Shepard M. K. * de Kleer K. Cambioni S. Taylor P. Virkki A. K. et al. | *Asteroid (16) Psyche: A Ferrovolcanic World?* **[#2201]**<br>We overlay 30 radar albedo observations of 16 Psyche over an optical albedo map and find a correlation between optical and radar albedo. This is consistent with the hypothesis that Psyche is a differentiated body with regions of ferrovolcanism. |
| 11:23 a.m. | Zambrano-Marin L. F. * Howell E. S. Devogèle M. Marshall S. E. Hickson D. et al. | *Radar Observations of Near-Earth Asteroid 2019 OK* **[#2451]**<br>We report the analysis of radar observations obtained during the close fly-by of near-Earth asteroid (NEA) 2019 OK on 2019 July 25. |
| 11:26 a.m. | Nolan M. C. * Planetary Radar Team | *The Heterogeneous Population of Near-Earth Asteroids Revealed by the Arecibo Planetary Radar* **[#1860]**<br>Near Earth Asteroids / Arecibo se cayó / No more RADAR pings. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[F504]**

## Friday, March 19, 2021
## MODERN MARS: EARTH, WIND, AND ICE

### 11:00 a.m. Track 4

### Chairs: John Grant and Susan Conway

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Golombek M. * Warner N. Grant J. Weitz C. Williams N. | *Comparison of Degradation Rates at the InSight and Spirit Landing Sites on Mars* **[#1563]** Both InSight and Spirit landed on old lava flow surfaces capped by meters of impact derived regolith, but degradation rates at InSight are 10-100 times faster. |
| 11:08 a.m. | Fassett C. I. * Watters W. A. Chickles E. T. | *Slow Hillslope Processes on Equatorial Mars as Revealed by the Topographic Diffusivity of Km-Scale Crater Rims* **[#1571]** Martian crater rims / Have no gophers, no rain splash / So diffuse slowly. |
| 11:11 a.m. | Weintraub A. R. * Edwards C. S. Chojnacki M. F. Edgar L. A. Fenton L. K. | *Using Thermal Inertia and Short-Wave Infrared Spectroscopy to Characterize Lithified Bedforms on Mars* **[#2648]** Lithified bedforms, or paleobedforms, are all over Mars. They look like modern dunes, but have erosional features common to lithified rock. Yet, thermal inertia models show they are not well lithified, thus implying complex preservation histories. |
| 11:14 a.m. | Khuller A. R. * Plaut J. J. | *Characteristics of the Basal Interface of the Martian South Polar Layered Deposits* **[#1680]** We used MARSIS radar data to characterize the properties of the basal interface beneath the martian south polar layered deposits. |
| 11:17 a.m. | Primm K. M. * Hoover R. H. Kaplan H. H. Michaels T. I. Stillman D. E. | *Seasonality and Surface Properties of Slope Streaks at Acheron Fossae* **[#2385]** Slope streaks are studied / Formed by dry, wet, or hybrid? / Early data shown. |
| 11:20 a.m. | Pasquon K. * Conway S. J. Vincendon M. Massé M. Raack J. et al. | *Observing Seasonal Ices on Gullied Slopes in Sisyphi Cavi with CaSSIS and HiRISE* **[#2487]** A link between seasonal frost deposits and gullies seems likely, but the exact relationship is still under discussion.To clear up this, we study the evolution of seasonal frost deposits over the gullies in Sisyphi Cavi (68-74°S ; 345°- 5°E). |
| 11:23 a.m. | Dickson J. L. * Palumbo A. M. Kerber L. A. Fassett C. I. Kreslavsky M. A. | *The Elevation Distribution of Mid-Latitude Gullies on Mars as a Test of $CO_2$ and $H_2O$ Formation and Modification Processes* **[#2426]** The high-elevation extent of gullies on Mars matches the high-elevation extent of where GCM results predict temperature and pressure conditions above the $H_2O$ triple point at 35° obliquity with perihelion at the southern hemisphere summer solstice. |

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|---|---|---|
| 11:26 a.m. | Butcher F. E. G. * Arnold N. S. Conway S. J. Berman D. C. Davis J. M. et al. | *Potential for Sampling of Subglacial and Englacial Environments in Mars' Mid Latitudes, Without Deep Drilling* **[#1231]**<br>Do compression lines / On Mars' glaciers contain / Debris from the bed? |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[F505]**

## Friday, March 19, 2021
## ORGANICS: EARLY SYNTHESIS AND DETECTION

## 11:00 a.m. Track 5

## Chairs: Annemarie Pickersgill and James Lyons

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| 11:00 a.m. | | *Presenter Introductions* |
| 11:05 a.m. | Elmasry W. * Kebukawa Y. Shibuya T. Kobayashi K. | *Abiotic Synthesis of Organic Matter in Aqueous Environments Simulating Parent Bodies of Meteorites and the Effects of Minerals on the Production of Amino Acids* **[#1775]**<br>Minerals affected the formation of amino acids in aqueous environments in small solar system bodies and that the amino acids could have different response behaviors according to different minerals. |
| 11:08 a.m. | Legett S. A. * Yeager C. M. Gasda P. J. Nellessen M. A. Crossey L. J. et al. | *Ribose Stability in Solutions with Borate and Borate-Bearing Clays: Implications for Origins of Life on Earth and Mars* **[#1600]**<br>If RNA life / Ribose needs stability / Borate plus clays help? |
| 11:11 a.m. | Hausrath E. M. * Rampe E. B. Ming D. W. Archer P. D. Millan M. | *Reactive Transport Modeling to Interpret Environmental Conditions that May Preserve Organic Molecules on Mars* **[#1561]**<br>Here, we perform reactive transport modeling of Glen Torridon and Vera Rubin ridge to examine conditions that may degrade or preserve organic matter. This work can help detect environments that may preserve biosignatures, important for sample return. |
| 11:14 a.m. | Oehler D. Z. * Salvatore M. Etiope G. Allen C. C. | *Focusing the Search for Organic Biosignatures on Mars* **[#1353]**<br>One of the best places on Mars to search for well-preserved organics, including potential biomarkers, is in the subsurface of S. Acidalia Planitia. And surface-accessible samples of those organic-rich strata may have been provided by mud volcanism. |
| 11:17 a.m. | Kivrak L. * Williams A. J. Buch A. He Y. | *Trimethylsulfonium Hydroxide (TMSH) Thermochemolysis with Py-GC-MS as a Method of Organic Biosignature Detection: Optimization for Nucleobase Detection* **[#2468]**<br>Life without caffeine? / No. New chemical coldly / Methylates xanthine. |

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|---|---|---|
| 11:20 a.m. | Lewis J. M. T. * Eigenbrode J. L. Wong G. M. McAdam A. C. Archer P. D. et al. | *Assessing Mars Pyrolysis Data for the Presence of Organic Salts* **[#2567]** Flight-like pyrolysis studies of organic salts in the laboratory support hypotheses that such phases may have contributed to many of the carbon dioxide evolutions detected by the Sample Analysis at Mars instrument suite in Gale Crater. |
| 11:23 a.m. | Millan M. * Williams A. J. McAdam A. Eigenbrode J. L. Freissinet C. et al. | *Organic Molecules Revealed in Glen Torridon by the SAM Instrument* **[#2039]** Detection of a high variety and abundance of organic molecules including new S-bearing organics in the Glen Torridon clay-bearing unit, in Gale Crater, Mars. The origin and sources of the organics are under investigation and will be discussed. |
| 11:26 a.m. | Williams A. J. * Eigenbrode J. L. Millan M. Williams R. H. Buch A. et al. | *Organic Molecules Detected with the First TMAH Wet Chemistry Experiment, Gale Crater, Mars* **[#1763]** The first TMAH wet chemistry experiment has been performed by the SAM instrument on the Curiosity rover. A variety of organic molecules were generated, with sources under investigation. |
| 11:29 a.m. | | *Q&A* |
| 12:00 p.m. | | *End of Session* |

**[F521]**

## Friday, March 19, 2021
## DECADAL SURVEY (LIVE PRESENTATIONS)

### 12:30 p.m. Track 1

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| 12:30 p.m. | | *TBD* |

**[F551]**

## Friday, March 19, 2021
## LUNAR VOLCANISM AND TECTONICS

### 2:30 p.m. Track 1

### Chairs: Carl Agee and Sarah Valencia

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Vannier H. * Horgan B. Stopar J. | *Investigating the Mineralogy and Origin of Irregular Mare Patches with Spectra from Moon Mineralogy Mapper* **[#1727]**<br>Using VNIR spectra from the Moon Mineralogy Mapper, we aim to determine the mineralogical composition of three irregular mare patches — Ina, Sosigenes, and Cauchy-5 — in order to place constraints on the formation mechanism of these features. |
| 2:38 p.m. | Wan S. * Qiao L. Ling Z. C. | *Morphometry, Morphology, and Topography of Volcanic Cones in Marius Hill, the Moon* **[#1958]**<br>Using the new SLDEM2015 topography and other new data sets, we conducted a systematic search for volcanic cones features in Marius Hill. Using morphometric parameters and morphometric ratios, the cones' morphology is summarized and quantified. |
| 2:41 p.m. | Wagner R. V. * Robinson M. S. | *Occurrence and Origin of Lunar Pits: Observations from a New Catalog* **[#2530]**<br>We are releasing a catalog of all known lunar pits, and have used those observations to evaluate formation theories. While at least one pit may be related to a lava tube, there is likely no generally-applicable formation mechanism. |
| 2:44 p.m. | Garrick-Bethell I. * Seritan M. R. K. | *Laccolith Model for Lunar Ring-Moat Dome Structures* **[#2369]**<br>We show that small-scale intrusive events at shallow buried craters can explain the topography of thousands of low-lying domes on the Moon. |
| 2:47 p.m. | Bickel V. T. * Aaron J. Manconi A. Loew S. Mall U. | *Global Drivers of Lunar Rockfall* **[#1437]**<br>We correlate a global, deep learning-generated catalog of 136,610 lunar rockfalls with 17 geophysical maps to study the long- and short-term drivers of lunar rockfall and, thus, the endo- and exogenic activity of the Moon itself. |
| 2:50 p.m. | Karthi A. * Arivazhagan S. | *Analyses of Compositional and Topographical Characters of the Wrinkle Ridge and Dark Holo Crater on Mare Orientale Basin* **[#1807]**<br>Compositional and topographical characteristics of wrinkle ridge and dark halo crater of the Orientale Basin studied by using Ch- 1 - Moon Mineralogy Mapper(M3) and LROC-WAC. |
| 2:53 p.m. | Liang W. * Andrews-Hanna J. C. | *Exploring the Source of the Lunar Linear Gravity Anomalies* **[#1844]**<br>A possible source of a 350-km long linear gravity anomaly found by GRAIL is intrusive dikes and sills. Our MCMC model was able to fit to the power spectrum of the anomaly reasonably well and constrain the top depth of the structures to ~11-15 km. |
| 2:56 p.m. | Maxwell R. E. * Nimmo F. | *Variations in Lunar Elastic Thickness from Spectral Admittance Analysis and Synthetic Noise Tests* **[#1766]**<br>Variations in / Lunar elastic thickness / How certain are we? |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[F552]**

## Friday, March 19, 2021
## SMALL BODY REGOLITH AND INTERIORS: LABORATORY STUDIES AND MODELING

### 2:30 p.m. Track 2

### Chairs: Ronald Ballouz and Dylan Hickson

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Goodrich C. A. * Bottke W. F. Walsh K. J. Daly R. T. | *Almahata Sitta is No More Exotic Than any Other Polymict Ureilite* **[#1331]** Almahata Sitta (asteroid 2008 TC3) and typical polymict ureilites most likely formed in the same regolith on a ureilitic rubble pile. |
| 2:38 p.m. | Nagaashi Y. * Aoki T. Nakamura A. M. | *Cohesive Force Measurements of Meteorite Powders* **[#1426]** We measured the cohesive forces of tens of micron-sized meteorite particles to estimate those of asteroidal particles. |
| 2:41 p.m. | Jardine K. J. * Dove A. D. Tetard L. T. | *AFM Measurements of Asteroid-Relevant Particle Adhesion* **[#2559]** Our scientific goal is to experimentally model asteroid surfaces, specifically by understanding the cohesive forces that act at the nanoscale as a glue to hold rubble piles/strengthless bodies together and influence particle motion. |
| 2:44 p.m. | Hildebrand A. R. * Hanton L. T. J. Ciceri F. | *Coefficient of Restitution / Leeb Hardness for Six Meteorites and HCCL-1 Simulant* **[#2677]** Coefficients of restitution have been measured for six meteorites representing a range of asteroidal lithologies using a small hand held tool. This method may be used to widely survey meteorites in collections. |
| 2:47 p.m. | Susorney H. C. M. * Teanby N. A. | *The Potential Role of Asteroid Class on Surface Slopes: Investigating the Effects of Density and Spin Period* **[#1438]** We investigate the relationship of slope, spin period, and shape for small rubble-pile asteroids and find that C-class rubble-piles are likely to be more sensitive to spin changes than S-class rubble-piles. |
| 2:50 p.m. | Haynes M. S. * Fenni I. Gim Y. Davidsson B. Raymond C. et al. | *Small Body Radar Inverse Scattering in Monostatic and Bistatic Geometries* **[#1281]** A radar inverse scattering algorithm for interior dielectric imaging of solar system small bodies is developed and demonstrated in 2D simulation for monostatic and bistatic source geometries and different probing bandwidths. |
| 2:53 p.m. | Dmitrovskii A. A. * Khan A. Boehm C. Bagheri A. van Driel M. | *Geophysical Constraints on Phobos' Interior Structure* **[#2186]** We carried out modelling of the Phobos tidal deformation for the set of suggested interior structure models. We explore the possibility of distinguishing interior structures of the satellite on the basis of surface deformation patterns and magnitude. |
| 2:56 p.m. | Pou L. * Nimmo F. | *Tidal Dissipation in Binaries of Asteroid Pairs* **[#2202]** |

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|---|---|---|
| | | We constrain the tidal dissipation in binary systems within asteroid pairs. Tidal despinning and circularization gives upper bounds on Q/k2 for most secondaries, lower bounds for most primaries, and a possible range for a secondary of (3749) Balam. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[F553]**

## Friday, March 19, 2021
## MARTIAN METEORITES: PETROLOGY AND PETROGENESIS

## 2:30 p.m. Track 3

## Chairs: Erin Walton and Arya Udry

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Udry A. * Ostwald A. M. Howarth G. H. Paquet M. Foreman L. V. et al. | *The Plagioclase-Bearing Poikilitic Shergottite Northwest Africa 12241, a Not-So Shocked Martian Meteorite* **[#1033]** Northwest Africa (NWA) 12241 is one of the rare martian shergottite meteorites that still contain plagioclase, indicating that this meteorite samples a new location at the martian surface. |
| 2:38 p.m. | Nicklas R. W. * Day J. M. D. Udry A. Vaci Z. | *Petrogenesis of Northwest Africa (NWA) 8686, a New Olivine-Phyric Shergottite* **[#1040]** NWA 8686 is a new olivine-phyric shergottite characterized by a highly fractionated REE pattern depleted in both HREE and LREE over MREE, and showing low Mg olivine macorcrysts (Fo51) out of equilibrium with the bulk rock. |
| 2:41 p.m. | Benaroya S. * Gross J. Burger P. Eckley S. A. | *Crystallization History of Martian Meteorite Northwest Africa 13227: A New Olivine Gabbroic Shergottite* **[#2399]** Northwest Africa (NWA) 13227 is an olivine gabbroic shergottite that appears to be the most primitive gabbroic shergottite to date. We present preliminary petrography and mineral chemistry data and describe crystallization conditions. |
| 2:44 p.m. | Che S. * Brearley A. J. Shearer C. K. | *Late-Stage Oxidation of Yamato 980459 Shergottite: Evidence from Chromite + Silica Trails in Olivine* **[#1136]** Our microstructural and microchemical study of chromite + silica trails in Yamato 980459 shergottite olivine suggests a late-stage oxidation event during the magma ascent. |
| 2:47 p.m. | Chowdhury P. * Brounce M. Boyce J. W. McCubbin F. M. | *The Oxidation State of Sulfur in Apatites from Martian Meteorite — Shergotty* **[#1584]** We use S-XANES to look at sulfur speciation in apatites of martian meteorite Shergotty. We find that |

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| | | the sulfur speciation is sulfide only, consistent with the crystallization oxygen fugacity of this meteorite. |
| 2:50 p.m. | Ostwald A. M. * Udry A. Gazel E. Payré V. Wu P. | *The Role of Assimilation and Fractional Crystallization in Evolved Martian Crustal Compositions* **[#1132]** On early Mars, some / Magma melted crust to make / Evolved volcanics. |
| 2:53 p.m. | Humayun M. * Yang S. Irving A. J. Righter K. | *Assimilation of Fossil Hydrothermal Sulfide by Early Amazonian Martian Magmas: Implications for Ore Mineralization on Mars* **[#1390]** Early Amazonian (2.4 Ga) igneous meteorites assimilated older Fe-Zn-Pb sulfides plausibly linked to hydrothermal massive sulfide deposits associated with a Noachian ocean. Immiscible sulfide removed Ni and Co creating new mineral deposits on Mars. |
| 2:56 p.m. | Yang S. * Humayun M. Righter K. Irving A. J. Hewins R. H. et al. | *Elemental Partitioning Constraints on the Mineralogy of the Martian Mantle* **[#1646]** The elemental partitioning in martian igneous rocks was compared to that in terrestial igneous rocks using logarithmic concentration plots. This comparative study shows martian mantle in more garnet enriched than terrestial mantle (15-20% vs. ~10%). |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[F554]**

## Friday, March 19, 2021
## ICE AT THE MARTIAN POLES

### 2:30 p.m. Track 4

### Chairs: Alan Howard and Margaret Landis

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| Times | Authors (*Denotes Presenter) | Abstract Title and Summary |
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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Buhler P. B. * Piqueux S. | *Mars' Obliquity-Driven Mobile $CO_2$ Inventory Derived from Polar Stratigraphy* **[#2218]** We develop a Mars cap-atmosphere-regolith $CO_2$ exchange climate model that outputs predicted polar $CO_2$/$H_2O$ ice stratigraphies based on obliquity forcing. A total $CO_2$ inventory of 100 (–34, +80) mbar yields model stratigraphies closest to observation. |
| 2:38 p.m. | Smith I. B. * Schlegel N. Larour E. Isola I. Buhler P. et al. | *$CO_2$ Glaciers on the South Polar Layered Deposits of Mars* **[#2573]** Based on evidence of thick $CO_2$ deposits, we test a hypothesis of $CO_2$ glacial flow using a three |

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| | | dimensional glacial model. We find that our results predict the bulk volume, distribution, and srtatigraphy of the observed deposits. |
| 2:41 p.m. | Raguso M. C. * Nunes D. C. | *Monitoring of $CO_2$ Seasonal Variations at the Martian Polar Ice Caps Using SHARAD Data* **[#2438]** The waxing and the waning of the $CO_2$ seasonal caps is one of the global processes that characterize the red planet. SHARAD Data spanning over seasons are used to analyze sounder ability to record the seasonal pattern of $CO_2$ deposition/sublimation. |
| 2:44 p.m. | Karimova R. * Smith I. B. | *Experimental Setup to Record the Bidirectional Reflectance Distribution Function of $CO_2$ Ice Under Polar Martian Conditions* **[#1577]** Grow $CO_2$ ice / Under martian conditions / Record reflectance. |
| 2:47 p.m. | Cartwright S. F. A. * Calvin W. M. Seelos K. D. Seelos F. P. | *Identification of Spectral Endmembers in the Martian South Polar Residual Cap* **[#2169]** These icy pixels / Though far flung they look alike / And make up eight groups. |
| 2:50 p.m. | Pascuzzo A. C. * Bramson A. M. Becerra P. Mustard J. F. | *Development and Evolution of Exposed Icy Layers at Mars' North Pole Through Space and Time* **[#2721]** By combining observations and modeling, we investigate the processes and factors contributing to the evolution of the north polar cap in an attempt to gain insight into recent amounts of sublimation at the north pole. |
| 2:53 p.m. | Lauro S. E. * Pettinelli E. Caprarelli G. Guallini L. Rossi A. P. et al. | *New Radar Evidence of Subglacial Liquid Water Below the Martian South Pole* **[#2061]** The detection of liquid water has reinvigorated the debate about the origin and stability of liquid water under present-day martian conditions. Here we present and discuss the results obtained by the analysis of the MARSIS data at Ultimi Scopuli. |
| 2:56 p.m. | Lalich D. E. * Hayes A. G. Poggiali V. | *Explaining Bright Radar Reflections in the Martian SPLD Without Liquid Water* **[#2392]** Water at the pole? / Maybe it's interference. / Who can say for sure. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[F555]**

## Friday, March 19, 2021
## MICROBES: WHERE WE LIVE

### 2:30 p.m. Track 5

### Chairs: Shelbie Legett and Mark Fox-Powell

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| 2:30 p.m. | | *Presenter Introductions* |
| 2:35 p.m. | Gentry D. M. * Iraci L. Barth E. McGouldrick K. Jessup K.-L. | *Habitability of Cloudy Worlds: Intersecting Constraints and Unknowns* **[#2691]**<br>Why clouds are not green: / Where there's water, there is life* / *Exceptions apply. |
| 2:38 p.m. | Stoker C. R. * Glass B. J. Dave A. I. Stucky T. R. | *A Drilling Mission to Search for Biosignatures of Life on Mars Simulated in Atacama Chile* **[#2521]**<br>We describe a field experiment to simulate a drilling mission to search for biosignatures of life on Mars performed in Atacama, Chile with a remote science team located in California directing the operation and interpreting the results. |
| 2:41 p.m. | Macey M. C. * Fox-Powell M. Ramkissoon N. K. Baharier B. Oliver J. A. W. et al. | *The Identification of Sulfide Oxidation as a Potential Metabolism Driving Primary Production on Late Noachian Mars* **[#1139]**<br>By characterising an analogue environment, a saline and sulfurous spring system in the Canadian High Arctic, in combination with modelling and simulation experiments, we identified sulfur oxidation as a potentially viable martian metabolism. |
| 2:44 p.m. | Rucker H. R. * Price R. E. Ely T. D. LaRowe D. E. | *Habitability of Eridania Lake: An Ancient Mars Lacustrine Hydrothermal Vent, Compared to an Icelandic Analogue Fjord Site* **[#2370]**<br>We created a model of a putative, Noachian hydrothermal vent system in the Eridania Basin to conduct bioenergetics calculations and investigate potential habitability of Noachian vent systems as compared to an Icelandic analogue. |
| 2:47 p.m. | Ryan C. H. * Daly M. G. Brady A. L. Slater G. F. Lim D. S. S. | *Alteration-Associated Spatial Distribution of Organic Biosignatures in Mars-Analogue Volcanic Rocks* **[#2221]**<br>Zeolites and clays / Host trace organic markers / In Mars-like lavas. |
| 2:50 p.m. | Musilova M. * McAdam A. C. Richardson J. A. Young K. Bleacher J. E. et al. | *Lunar and Martian Lava Tube Research Simulation at HI-SEAS* **[#2600]**<br>Lava tubes are of interest for astrobiology and habitability research on both the Moon and Mars. However, they can also be dangerous for robotic and human operations, which is why they need to be studied and explored during simulated space missions. |
| 2:53 p.m. | Weng M. M. * Zaikova E. Millan M. Willams A. McAdam A. et al. | *Life in the Dark: The Blue Dragon Flow as an Analog for the Martian Subsurface* **[#2738]**<br>We investigated the Blue Dragon Flow at Craters of the Moon National Monument and Preserve (CotM), Idaho as a terrestrial analog for lava tube environments in the martian subsurface using a range of geological, geochemical, and biologic techniques. |
| 2:56 p.m. | Wang J. * Dragone N. Avard G. Hynek B. M. | *Microbial Survival in an Extreme Martian Analog Ecosystem: Poás Volcano, Costa Rica* **[#1673]**<br>Our longitudinal work at the Poás Volcano, an early Mars analog, highlights genetic adaptations that confer survival in an extremely dynamic volcanic environment and assesses martian microbiology. |
| 2:59 p.m. | | *Q&A* |
| 3:30 p.m. | | *End of Session* |

**[F561]**

**Friday, March 19, 2021**
**SPACE WEATHERING ON AIRLESS PLANETARY BODIES: BEYOND LUNAR-STYLE SPACE WEATHERING**

**4:00 p.m. Track 1**

## Chairs: Michelle Thompson and Brett Denevi

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Morrissey L. M. * Tucker O. J. Killen R. M. Nakhla S. Savin D. W. | *Simulating Solar-Wind-Ion Sputtering of Sodium from Silicate Minerals: The Importance of the Surface Binding Energy* **[#1458]** This study considers the importance of the surface binding energy when simulating the yield and energy distribution of sputtered sodium atoms from Mercury's surface by solar wind impacts. |
| 4:08 p.m. | Szabo P. S. * Biber H. Jäggi N. Wappl M. Stadlmayr R. et al. | *Experimental Investigation of the Space Weathering of Phobos by Planetary Oxygen Ions* **[#1512]** We present measurements on the sputtering of Phobos analogs by martian planetary O ions, where we quantify sputtering yields and also observe O implantation. Our results support that Phobos is significantly eroded by these planetary ions. |
| 4:11 p.m. | Glotch T. D. * Thompson M. S. Dukes C. A. Loeffler M. J. | *Micro-FTIR Imaging and Spectroscopy of Experimentally Space Weathered CM2 Chondrite Murchison* **[#2004]** Space weathered chondrite: / Micro-infrared data / Show lots of changes. |
| 4:14 p.m. | Laczniak D. L. * Thompson M. S. Christoffersen R. Dukes C. A. Clemett S. J. et al. | *Understanding Space Weathering of Carbonaceous Asteroids Through H+ and He+ Ion Irradiation of the Murchison Meteorite* **[#2361]** Solar wind in the asteroid belt / Helium, hydrogen ions, they pelt / Experiments we make / And measurements we take / To determine the damage they dealt. |
| 4:17 p.m. | Chaves L. C. * Thompson M. S. Shuvo S. N. | *Space Weathering Features in a Sulfide Grain from Asteroid Itokawa* **[#1770]** Sulfur depletion was identified in a pyrrhotite grain from asteroid Itokawa as a result of space weathering processes. |
| 4:20 p.m. | Christoph J. M. * Bu C. Minesinger G. M. Dukes C. A. Elkins-Tanton L. T. | *Laboratory Simulations of Troilite Space Weathering by Solar Wind Ion Irradiation: Surface, Composition, and Spectral Effects* **[#2715]** We report results of irradiation experiments simulating solar wind ion bombardment of troilite nodule inclusions from two iron meteorites, and characterization with electron and atomic force microscopy and X-ray and VNIR spectroscopy. |
| 4:23 p.m. | Minesinger G. M. * Christoph J. M. Dukes C. A. Bu C. Elkins-Tanton L. T. | *Modeling the Effect of Solar Ion Irradiation of Troilite with SDTrimSP—Implications for (16) Psyche* **[#2534]** We found SDTrimSP to be a useful modeling tool for atomic/molecular sputtering, as it quantitatively confirmed XPS-detected solar ion-induced sulfur depletion of troilite, which then allowed predictions for Psyche's regolith. |
| 4:26 p.m. | Sen A. * Clark B. E. Zou X.-D. Li J.-Y. Barucci M. A. et al. | *Latitude Dependence of Spectral Properties on Bennu: Relevance to Space Weathering* **[#1538]** Spectral reddening, a decrease in 1064-nm normal albedo, and a 9% decrease in H content are observed on the equator of organic-rich Bennu. Space weathering, in the form of carbonization of organics, could neatly unify and explain these observations. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[F562]**

## Friday, March 19, 2021
## SMALL BODY EVOLUTION: FORCES OF HEAT AND LIGHT

### 4:00 p.m. Track 2

### Chairs: Oleksiy Golubov and Hannah Susorney

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Ruesch O. * Patzek M. | *Experiment on Thermal Fatigue of Near-Earth Asteroids and Lunar Surfaces Using Representative Temperature Conditions and Samples* **[#1464]** In this study, we highlight the need for improved understanding of rock breakdown due to temperature excursions and describe a laboratory experiment designed to characterize it. Preliminary results of the experiment will be presented. |
| 4:08 p.m. | Toliou A. * Granvik M. Tsirvoulis G. | *Minimum Perihelion Distances and Dwell Times During the Dynamical Evolution of NEOs* **[#2717]** We have derived a look-up table that provides the probability that an NEO with given orbital elements and absolute magnitude H has had a minimum q value lower than a given threshold during its orbital history as well as the associated dwell times. |
| 4:11 p.m. | McFadden K. D. * Howell E. S. Vervack R. J. Jr. Fernandez Y. R. Magri C. et al. | *Modeling Thermophysical Properties of 2100 Ra-Shalom* **[#1788]** We used the shape-based thermophysical model SHERMAN to investigate the thermal properties of 2100 Ra-Shalom and compared our data with the published thermal values from Shepard et al. (2008). |
| 4:14 p.m. | Fenucci M. * Novaković B. Vokrouhlický D. Weryk R. J. | *Unexpected Thermal Properties of the Near-Earth Object (499998) 2011 PT* **[#1416]** 2011 PT is a near-Earth asteroid of about 40 meters that rotates in only 11 minutes. Unexpectedly, we found that the measured Yarkovsky drift can be achieved only if the thermal inertia is low, suggesting the presence of regolith on its surface. |
| 4:17 p.m. | Kanamaru M. * Sasaki S. Morota T. Cho Y. Tatsumi E. et al. | *YORP Effect on Asteroid 162173 Ryugu and Its Spin Evolution* **[#1769]** Thermal recoil torque, i.e., the YORP effect, changes a spin state of an asteroid. We simulated the thermally induced spin alteration of asteroid Ryugu and investigated the dynamical and geological history. |
| 4:20 p.m. | Ciarniello M. * Fulle M. Tosi F. Capaccioni F. Filacchione G. et al. | *Modeling the Seasonal Evolution of 67P/Churyumov-Gerasimenko Water Loss Rate* **[#2031]** We model the seasonal evolution of 67P/Churyumov-Gerasimenko water loss rate by applying the water-driven activity model for a nucleus made of cm-sized pebbles (Fulle et al., 2020), which assumes no free parameters. |
| 4:23 p.m. | Ren J. * Hesse M. A. Lucas M. P. Dygert N. | *Asteroid Thermal Evolution with Fragmentation and Reassembly into a Rubble Pile* **[#2620]** |

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| | | We propose a thermal model for asteroid fragmentation and reassembly which reconciles high-temperature cooling and low-temperature cooling rates. Fragmentation and reassembly produce fast initial cooling but slow the low-temperature cooling. |
| 4:26 p.m. | Peng B. * Valencia D. | *Modeling Carbon Outgassing from Anhydrous Planetesimals* **[#2036]**<br>We present preliminary results of 1-D themochemical models of porous, anhydrous planetesimals to simulate the production and outgassing of $CO_2$ from its interior, and discuss the fate of carbon in early-forming carbonaceous planetesimals. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

**[F563]**

## Friday, March 19, 2021
## LUNAR GEOCHEMISTRY AND PETROLOGY

### 4:00 p.m. Track 3

### Chairs: Nicholas Dygert and Stephanie Krein

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Agee C. B. * Ross A. J. Ziegler K. Spilde M. N. | *Ghadduwah 001: Uniquely Unbrecciated Ferroan Anorthosite Lunar Meteorite* **[#2314]**<br>We report here the discovery of a uniquely unbrecciated ferroan anorthosite lunar meteorite, Ghadduwah 011, which is the first known unbrecciated rock from the lunar highlands. |
| 4:08 p.m. | Hayden T. S. * Barrett T. J. Zhao X. Degli-Alessandrini G. Anand M. et al. | *Chlorine and Hydrogen in Brecciated Lunar Meteorites: Implications for Lunar Volatile History* **[#1550]**<br>New Cl and H isotope data in apatite from brecciated lunar meteorites indicate a more heterogeneous lunar interior. |
| 4:11 p.m. | Burney D. * Neal C. R. | *Moderately Volatile Elements in Lunar Basalts; New Insights on LMO and Source Region Evolution* **[#2395]**<br>Moderately volatile elements show degassing of lunar material both in the LMO stage as well as upon eruption. Analyzing the ratios of these elements also show distinct mantle source regions. |
| 4:14 p.m. | Gleißner P. * Salme J. Becker H. | *Magmatic Fractionation and Degassing of Siderophile Volatile Elements in Lunar Magmatic Rocks* **[#1487]**<br>Siderophile volatile element data on lunar magmatic rocks constrain the magnitude of magmatic degassing and fractionation of the source regions. |

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| 4:17 p.m. | Madera A. * Gross J. | *Provenance of Lunar Basaltic Meteorite Northwest Africa 8632 and Related Meteorites* **[#2686]**<br>We are utilizing remote sensing observations in combination with geochemical data to provide potential source location(s) for the meteorites NWAs 8632, 032, 4734, and LAP 02205 clan to better understand any potential relationships between them. |
| 4:20 p.m. | Stadermann A. C. * Jolliff B. L. Krawczynski M. J. Hamilton C. W. Barnes J. J. | *Apollo Sample 12032,366-18: Characterization and Experimental Investigation of a Chemically Evolved Lunar Basalt* **[#2661]**<br>A Th-enriched, KREEP-bearing basalt may be unique in the Apollo collection, possibly from a young mare basalt flow in western Oceanus Procellarum. Petrologic experiments confirm silicate liquid immiscibility. |
| 4:23 p.m. | Ireland S. M. * McLeod C. L. Gawronska A. J. Brum J. T. Shaulis B. J. | *New Insights into the Geological Evolution of the Moon via Petrologic Investigation of Lunar Basalt Meteorites Dominion Range 18262 and Dominion Range 18666* **[#2646]**<br>Lunar meteorites are a random distribution of lunar materials. Two lunar meteorite samples are analyzed in 2D and 3D to characterize the Moon's geologic history. |
| 4:26 p.m. | Gawronska A. J. * McLeod C. L. Blumenfeld E. H. Hanna R. Zeigler R. A. | *A New Dimension to Lunar Magmatism: New Interpretations of Apollo Basalt Petrogenesis from X-Ray Computed Tomography* **[#1090]**<br>Nondestructive X-ray computed tomography was used to evaluate the petrogeneses of basaltic Apollo samples in 3D. Results support previous conclusions gained via traditional 2D methods, and add insight regarding magma eruption and emplacement. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

## [F564]

## Friday, March 19, 2021
## ICY MARS GEOMORPHOLOGY

## 4:00 p.m. Track 4

## Chairs: Isaac Smith and Michelle Kirchoff

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| 4:00 p.m. | | *Presenter Introductions* |
| 4:05 p.m. | Landis M. E. * Byrne S. Hayne P. O. Piqueux S. Wilcoski A. X. | *Interannual Variability of Ice Within North Polar Layered Deposits Craters on Mars* **[#1653]**<br>We present evidence that ice deposits within <250 m diameter craters on the NPLD are changing, and quantify these changes. |
| 4:08 p.m. | Howard A. D. * | *Pervasive Ice-Related Erosion of Mid-Latitude Martian Craters* **[#1149]** |

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| | | The inner and outer rims of craters in the martian mid-latitudes have often been strongly eroded by lateral backwasting at the contact between ice bodies and the crater wall. |
| 4:11 p.m. | Melendez L. E. * Jawin E. R. Panzik J. E. | *Quantifying the Environmental Response to Deglaciation in Martian Craters During the Late Amazonian* **[#2284]**<br>Glaciers dwelled here once / In ancient tilted Mars, now / Paraglacial grounds. |
| 4:14 p.m. | Woodley S. Z. * Butcher F. E. G. Clark C. D. Ng F. Davis J. M. et al. | *Multiple Sites of Amazonian Wet-Based Glaciation Identified in West Tempe Terra, Mars* **[#1245]**<br>More eskers in rifts / In Tempe Terra on Mars / Regional melting? |
| 4:17 p.m. | Conway S. J. * Morino C. Peignaux C. Lucas A. Svennig K. et al. | *Molards — A New Landform Revealing Ice-Ejecta Interactions on Mars* **[#2386]**<br>Molards are conical mounds formed by the loss of cementing ice from blocks of sediment transported in periglacial landslides on Earth. We compare molards with similar-looking conical mounds in Hale Crater ejecta (Mars) to infer ejecta behaviour. |
| 4:20 p.m. | McGlasson R. A. * Bramson A. M. Morgan G. A. Sori M. M. | *Subsurface Radar Observations of Outlier Polar Ice Deposits on Mars* **[#1649]**<br>We present subsurface radar mapping of outlying ice deposits within three craters near the north and south polar layered deposits. Comparing icy outliers in the two hemispheres will provide new insights to aid in interpreting Mars' climate history. |
| 4:23 p.m. | Levy J. S. * Cipolli W. Ishraque F. Johnson J. Kuentz L. et al. | *Boulder Bands on Lobate Debris Aprons: Debris-Covered Glacier Growth at Martian Mid-Latitudes Spans Multiple Glaciations* **[#1537]**<br>Boulder bands on Mars / Glaciers. Ice waxes and wanes. / Revealing ice ages. |
| 4:26 p.m. | Cook C. W. * Byrne S. Sori M. M. | *Deformation of the Banded Terrain of Hellas Planitia, Mars* **[#1624]**<br>We perform quantitative modeling to test the hypothesis that banded terrain may be formed by subglacial till deformation. The location of peak velocities in a Hellas ice sheet and the scale of till deformation modeled support this hypothesis. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

## [F565]

## Friday, March 19, 2021
## ENVIRONMENTS: HABITABILITY AND ORGANIC PRESERVATION

## 4:00 p.m. Track 5

## Chairs: Aaron Regberg and Carol Stoker

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| 4:00 p.m. | | *Presenter Introductions* |

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| 4:05 p.m. | Kring D. A. * | *Enlarging the Geographical Domain of the Impact Origin of Life Hypothesis* **[#1161]**<br>Impact-generated hydrothermal environments suitable for prebiotic chemistry and the early evolution of life may occur in widely distributed impact eject blankets, not just crater interiors. |
| 4:08 p.m. | Pickersgill A. E. * Christou E. V. Lee M. R. | *A Preliminary Simulation of the Hydrothermal System at the Boltysh Impact Structure* **[#2139]**<br>Used Hydrotherm 3 / Made Boltysh a nice hot tub / Stayed hot for a while. |
| 4:11 p.m. | Weber J. M. * Barge L. M. | *Exploring the Reactivity of Metabolically Relevant Precursors Under Hydrothermal Analog Settings* **[#1146]**<br>Chemical gardens can be analogs of hydrothermal settings. We explored if such structures could catalyze prebiotic reactions with alpha keto acids as well as the effect of the organics on the growth of the structures. |
| 4:14 p.m. | Christou E. V. * Hallis L. J. Daly L. Pickersgill A. E. Keller T. et al. | *Fluid Flow in the Martian Subsurface During the Early Amazonian Period Constrained via Numerical Simulations: Implications for Habitability* **[#2556]**<br>Our research aims to determine via numerical simulations whether fluid flow and water-rock reactions on Mars during the early-mid Amazonian period have been sufficient to produce a bioenergetic yield. |
| 4:17 p.m. | Bravenec A. D. * Bromiley G. D. Montgomery W. Cousins C. R. Ward C. R. et al. | *Molecular Biosignature Preservation Potential in Subsurface Martian Brines* **[#1999]**<br>It is critical that biosignatures used to evidence past or present life on Mars are not only biogenic or thermogenic, but discernable from abiotic compounds despite diagenetic or fluid alteration processes. We present an experimental approach. |
| 4:20 p.m. | Judge L. E. * Williams A. J. Lanza N. L. Ollila A. M. Spilde M. N. et al. | *Determining the Biosignature Preservation Potential of Manganese Oxides Using Laboratory and Spaceflight Analysis Techniques* **[#2293]**<br>A suite of spaceflight-like analyses is being used to determine the potential of manganese oxides as biosignatures on Mars. Techniques for organics detection, trace element trends, and total organic carbon are tested on Mars Mn-oxide analogs. |
| 4:23 p.m. | Slank R. A. * Chevrier V. F. | *Experimental Investigation of Deliquescence-Driven Liquid Brine Formation with Calcium Perchlorate in a Mars-Like Environment* **[#2338]**<br>Experiments were conducted which focused on the deliquescence process in a layer of JSC Mars-1 regolith simulant with varying concentrations of calcium perchlorate in a Mars simulation chamber. |
| 4:26 p.m. | Craddock M. L. * Lewis J. M. T. McAdam A. C. Eigenbrode J. L. Achilles C. N. | *Investigating the Potential of X-Ray Diffraction Coupled with Evolved Gas Analysis in Our Search for Organic Salts on Mars* **[#2138]**<br>Organic material on Mars is likely susceptible to destruction and transformation to organic salts like oxalates. This study assesses how such salts, guided by XRD analysis, register through SAM-like pyrolysis in our search for alien organic matter. |
| 4:29 p.m. | | *Q&A* |
| 5:00 p.m. | | *End of Session* |

## *iPosters*

*Posters will be displayed in the iPoster gallery in the virtual conference environment. Attendees are encouraged to view posters between oral sessions and during breaks.*

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|---|---|---|
| Special Session: Apollo Next Generation Sample Analysis: Artemis | Mars: Surface and Interior InSights | Mercury: Big Science in a Small Planet |
| Special Session: Scientific Exploration of the Lunar South Pole | Martian Volcanic Landforms | Venus Atmosphere, Emissivity, and Weathering |
| Lunar Geophysics: Shake, Rattle, Roll, and Fracture | Analyzing Chondrites and Their Components: Novel Methods | Venus Volcanism, Tectonics, and Global Evolution |
| Lunar Petrology and Geochemistry | Carbonaceous Chondrites: Parent Body Processing and Organic Matter | Venus Instrumentation and Airborne Exploration |
| Lunar Remote Sensing: From the Lab to Orbit | Chondrites — Physical Properties and Experiments | Exoplanets |
| Lunar Surface Interactions with the Space Environment | New Chondrites | Great Balls of Fire: Explosive Volcanism Across the Solar System |
| Lunar Volcanism | Characterization, Parent Body Origins, and Petrogenesis of Achondrites | Planetary Volcanism: Morphologies, Emplacement, and Evolution |
| Lunar Volatiles | Chondritic Meteorite Melange: E, O, and C | Planetary Differentiation |
| Change’4 and Change'5 Results | Martian Meteorites: Igneous and Surface Processes | Atmospheres: Dynamics, Evolution, and Composition |
| Mission Concepts: Moon | Presolar Grains, IDPs, Genesis, Stardust, Hayabusa | Space Weathering: Know More, Knowledge Gaps |
| Mission Concepts: Earth | Solar Nebular Processes | Astrobiology Analogs: Chemistry and Fluids |
| Mission Concepts: Inner Solar System | Impacts: Changing Planetary Bodies Beyond Earth | Biomarkers: How to Find Us |
| Mission Concepts: Outer Solar System and Beyond | Impacts: Finding and Analyzing Earth's Craters | Microbes: Where We Live |
| Special Session: Mars 2020 Initial Results I | Impacts: Crater Formation and Processes on Earth and Beyond | Astrobiology: Instrument and Mission Concepts |
| Special Session: Mars 2020 Initial Results II | Impacts on the Moon | Analogs: Mars, the Moon, and More |
| MSL Curiosity Results | Impacts: Studying Ejecta on Earth | Intrinsic and Spectroscopic Properties of Analog Materials |
| Gale Crater Geochemistry | Impacts: Things Get Shocked (Shocked Minerals) | Instruments: Dust, Plume, and Unique |
| ExoMars | Special Session: Exploring the Myriad of Ocean Worlds | Instruments: Orbital and Atmospheric Measurements |
| Geochemistry: The Things Microbes Care About | Geology and Geophysics of Satellites and Ocean Worlds | Instruments: RAMAN and Laser/LIBS |
| Fans, Deltas, and Lakes on Mars | Crack, Boom! Active and Eruptive Satellites and Ocean Worlds | Instruments: Surface and Subsurface Measurements |
| Mars Geomorphology | Surface-Atmosphere Interactions on Icy Worlds: A Volatile Session | Planetary Spatial Data Infrastructure (PSDI) posters |
| Modern Mars: Earth, Wind, and Ice | Shaken and Stirred: Physical and Compositional State of Satellites and Ocean Worlds | Machine Learning Applied to Planetary Surfaces: "I'm Afraid I CAN Do That!" |
| Martian Geochemistry | Giant Planets, Rings and Dynamics — Oh My! | A Diverse and Inclusive Workforce: Who We Are and Can Be |
| Icy Mars Geomorphology and Geochemistry | Ceres and Vesta | Education and Audience Engagement: Building |

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| | | Bridges to Audiences |
| Ice at the Martian Poles | Small Body Observations: Near and Far | Education and Outreach in a Pandemic: Pivoting to Virtual Engagement |
| Martian Hydrated Minerals and Aqueous Alteration | Small Body Surfaces: Boulders, Craters, and Regolith | Education and Workforce Training: Preparing the Next Generation |
| Mars: Optimizations and Lab Based Studies | Small Body Laboratory Studies and Modeling | |
| Mars Sample Return | Small Body Mission Support: Past, Present, and Future | |

## [P601]
## POSTER SESSION: SPECIAL SESSION: APOLLO NEXT GENERATION SAMPLE ANALYSIS: FULFILLING APOLLO GOALS AND PREPARING FOR ARTEMIS

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| Curran N. M. Cohen B. A. Valencia S. N. Corrigan C. M. Bullock E. S. | *Moon United: Measuring Cosmic-Ray Exposure Ages of Pristine Sample Horizons* **[#1592]** The Moon United team will use petrology and noble-gas ratios to constrain the exposure and regolith history of previously unopened and unstudied samples from the Apollo 17 mission, as part of the ANGSA consortium. |
| Cato M. J. Simon S. B. Shearer C. K. Gross J. Sharp Z. et al. | *Exploring a Lunar Landslide Deposit in the Taurus-Littrow Valley (LTV). Variations in Mineralogy and Mineral Volatile Traps* **[#1622]** Recently opened / Lunar soil minerals / Are being studied. |
| Colina-Ruiz R. A. Ishii H. A. Gillis-Davis J. J. Sokaras D. Kroll T. et al. | *Oxidation State Studies of the Effects of Simulated Space Weathering* **[#1713]** X-ray spectra and electron energy loss spectra were collected on minerals subjected to laser irradiation to simulate space weathering. Effects of space weathering on oxidation states will be presented, as well as theoretical simulations. |
| Amick C. L. Lewis E. K. Mitchell J. L. Davis R. E. Collins D. L. et al. | *Cleaning the ANGSA Cold Curation Apollo-Era Glovebox — Training the Next Generation* **[#2506]** This abstract details the modifications to existing cleaning procedures in preparation for the first cold curation sample processing at Johnson Space Center. |
| Parai R. Rodriguez J. Meshik A. Pravdivtseva O. Will P. et al. | *A Gas Extraction Manifold for the Apollo 17 73001 Core Sample Vacuum Container* **[#2665]** Apollo 17 sample 73001 was sealed on collection and presents an opportunity to study lunar volatiles. We discuss the design and implementation plan for a gas extraction manifold to store, distribute, and characterize the head space gas from 73001. |

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| Regberg A. B. Amick C. L. Davis R. E. Lewis E. K. Mazhari F. et al. | *A Method to Reduce Bioburden in Astromaterials Curation Facilities Without Introducing Unwanted Contamination* **[#2491]**<br>Disinfect your lab / With hydrogen peroxide / It won't taint samples.. |

## [P602]
## POSTER SESSION: SPECIAL SESSION: SCIENTIFIC EXPLORATION OF THE LUNAR SOUTH POLE

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| Lemelin M. Lucey P. G. Camon A. | *Foundational Data Products for the Exploration of the Lunar Polar Regions: Iron, OMAT, and Mineralogy Using the Kaguya Spectral Profiler and the Lunar Orbiter Laser Altimeter* **[#1038]**<br>The abundance of FeO, minerals, nanophase iron, and OMAT at 1 km in both polar regions derived using data from the entire set of Spectral Profiler orbits (~8000) can be used to plan future missions or help interpret rover based data. |
| Sato H. Goossens S. Ohtake M. Daket Y. | *Polar Color Mosaic Production from Kaguya MI Data* **[#1032]**<br>We derived a new MI polar color mosaic using the new SPK and evaluated the accuracy of derived reflectance. |
| Kletetschka G. Klokočník J. Hasson N. Kostelecký J. Bezděk A. | *Location of Water Deposits in the Polar Regions of the Moon* **[#1368]**<br>Our method detected regions near the north and south poles that point to the presence of significant volume of pore space that hold significant amounts of water as ice, necessary for resource extraction in-situ and use during future planned missions. |
| Sanin A. B. Mitrofanov I. G. Litvak M. L. | *Updated LEND Hydrogen Mapping in the Lunar Southern Polar Region* **[#1966]**<br>We will present an updated WEH map for the lunar southern polar region and estimate WEH for the both permanently shadow and neutron suppression regions. New method of LEND/LRO data reprocessing will be discussed. |
| Krasilnikov S. S. Ivanov M. A. Head J. W. | *Geological Map of the South Pole of Moon* **[#1428]**<br>Here, we present a new geologic map of the southern polar region that extends from the pole up to 70°S and compiled at 1:300 000 scale. This map is based on analysis of the WAC images (100 m/px res.) and LOLA-based DTMs (80-20 m/px res.). |
| Poehler C. M. van der Bogert C. H. Hiesinger H. Ivanov M. Head J. W. III | *The Lunar South Pole: A Geologcial Map of the South Pole-Aitken Basin Region* **[#1915]**<br>We present geologcial context for future missions and studies at the lunar south pole. |
| Kumari N. Ganesh I. Lang A. Bretzfelder J. M. Kring D. A. | *Geological Diversity at Two Potential Landing Sites in the Lunar South Pole* **[#1197]**<br>Diversity in terms of illumination, volatile presence, excavated ejects blankets by small craters, boulder distribution, and comparison with South Ray and North Ray craters of two potential sites selected for Artemis III exploration in recent report. |

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| Bernhardt H. Robinson M. S. | *Preliminary Geomorphic Map (1:10,000) of Artemis III AoI 001 and 004 on the Shackleton-de Gerlache Ridge* **[#1264]**<br>Geomorphic map units include various stages of slope-related resurfacing and potential impact melt. Six crater classes were mapped according to apparent age. Existing traverse planning was improved to include a fresh crater and units of interest. |
| Bretzfelder J. M. Lang A. Ganesh I. Kumari N. Kring D. A. | *Geological Analysis and Possible EVA Targets for an Artemis III Landing Site Bounded by Shackleton and Slater Craters* **[#1148]**<br>ISRU and / Science opportunties / For Artemis III. |
| Speyerer E. J. Thompson T. J. Robinson M. S. | *Assessing Solar Illumination and Earth Visibility at the Lunar South Pole: Resource and Constraint for Future Exploration* **[#2558]**<br>Solar illumination and Earth visibility are not only a resource for a mission near the lunar poles, but also constrain the landing location. In this work, we investigate the lighting and viewing geometry over time to identify potential landing sites. |
| Roush T. L. Colaprete A. Cook A. Bielawski R. Ennico-Smith K. et al. | *The Volatiles Investigating Polar Exploration Rover (VIPER) Near Infrared Volatile Spectrometer Sys-tem (NIRVSS)* **[#1678]**<br>The Volatiles Investigation Polar Exploration Mission Rover (VIPER) Near-Infrared Volatile Spectrometer System (NIRVSS) capabilities are described. A concept of operations is outlined, including synergy with other VIPER science payload components. |
| Heather D. J. Sefton-Nash E. Fisackerly R. Trautner R. Barber S. et al. | *The ESA PROSPECT Payload for Luna 27: Development Status* **[#2111]**<br>We present the current status of the development of the PROSPECT package for analysis of lunar volatiles and exosphere at the south pole, scheduled for launch on Luna 27 in 2025. |
| Evans M. E. Graham L. D. | *An Alternate Approach to Lunar Human Exploration: The Flexible Lunar Architecture for Exploration (FLARE)* **[#1304]**<br>Using a SpaceTug / Between Earth and Moon orbits / Opens new options. |
| Stooke P. J. Ahmed S. M. Subramanian S. | *Chandrayaan-1 Moon Impact Probe: Impact Location Refined* **[#1013]**<br>Chndrayaan-1's Moon Impact Probe took images as it descended on 14 November 2009. Past attempts to locate the impact compared lower resolution images with a Clementine map. We use LROC images and the last few MIP images to refine the impact site. |
| Hickman J. M. Oriti S. M. Wilson S. D. Clarke E. S. | *Dynamic Power Generation for Human and Scientific Exploration of the Lunar South Pole* **[#2700]**<br>NASA is investing in the development in Dynamic Radioisotope Power Systems that could power a lunar surface mission as early as the late 2020's. |
| Voecks G. Barmatz M. Lux J. Gavalas G. Hoppe D. et al. | *Approaches for Extracting Volatiles from Regolith Using Electromagnetic Radiation* **[#1202]**<br>Descriptions of extracting water from martian and lunar simulant regolith via two approaches are discussed. Modeling of a scaled-up parallel plate reactor for space applications is also presented. |
| Naids A. J. Bergman H. R. Hood A. D. Walker M. L. Newton H. P. et al. | *Developing Geology Sampling Tools for the Artemis Program* **[#1314]**<br>A suite of geology sampling tools is currently being developed at NASA JSC to support the science objectives of the Artemis Program. |
| Elvis M. Krolikowski A. Milligan T. | *Concentration and Crowding for Lunar Sites* **[#2462]**<br>Lunar resources concentrate into a few (10s) of small areas (~km). Interference and |

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| | disputes will arise as sciencific and commercial actors crowd the sites, e.g. south pole. Now is the time to develop rules, before vested interests gain a hold. |
| Kuhns R. Metzger P. Kuhns M. Hasnain Z. Tangsali K. | *Rocket Plumes and Aeolian-like Bedforms in Regolith* **[#2671]** CFD Models and tests by Masten's VTVL rocket have produced aeolian-like bedforms in the regolith simulant. Under lunar conditions, all aeolian processes are related to plume effects. The studies examine regolith changes from rocket plume effects. |
| Mirmalek Z. Lim D. S. S. Colaprete A. | *Remote Science Work Support, Context, and Approach on NASA's VIPER Mission* **[#1734]** This presentation is on the context and development of work support for science operations on NASA's VIPER mission. |
| Chandrachud R. A. | *'LUNAFILT' Mechanism for the Filtration of Lunar Dust* **[#2042]** Considering potential damaging nature of lunar dust, 'LUNAFILT' Mechanism provides a solution for multiple problems arising in near future. This system mainly uses electric charge and ceramic filter. |
| Cremons D. R. Sun X. Denny Z. Wake S. W. Hoffman E. D. et al. | *Optical Characterization of CLPS Miniature Laser Retroreflector Arrays* **[#1629]** Here, we present the optical characterization results of Laser Retroreflector Arrays for Lunar Landers developed under the CLPS program. These arrays are manifested on all CLPS landers and will act as fiduciary markers on the surface for decades. |
| Ferrari-Wong C. M. Lucey P. G. Wright R. Honniball C. I. Hayne P. O. et al. | *1-Meter Resolution Hyperspectral Thermal Infrared Imager Concept for Lunar Exploration* **[#2281]** A low-cost mission concept for human-scale resolution lunar surface characterization of high-silica minerals/phosphates and molecular water at the lunar south pole. |
| Montalvo P. E. Hirabayashi M. King D. T. Jr. | *Contributions of Impact Mixing to the Spatial Distribution of Water Ice in Permanently Shaded Lunar South Polar Craters* **[#1477]** In this study, we analyze the spatial distribution of material mixing due to impact cratering in areas that host surface water ice and provide interpretations of the thickness of water ice deposits and their distribution. |
| Mishra A. Kumar P. S. | *New Report of Young Lobate Scarps and Recent Mass Wasting Events in the Lunar South Polar Region with Implication for Seismic Hazard Assessment to Upcoming Landing Mission* **[#1862]** The current study is focused on the lunar south polar region to assess potential seismic hazards to the upcoming landing mission by identifying young lobate scarps and sites containing evidence of young mass wasting events around the polar region. |
| Ahrens C. J. Petro N. Li S. | *Preliminary Observations on the Relationship Between Fe-Signatures and PSR Locations at the Lunar South Pole* **[#1478]** Iron-bearing rocks / May unintentionally / Keep the ice spots warm. |
| Li Y. Basilevsky A. T. Kreslavsky M. A. Sanin A. B. Mitrofanov I. G. et al. | *Analysis of Surface Roughness vs WEH Values in the Regolith of the Lunar South Pole Area* **[#1871]** This study shows no correlation between the surface topographic roughness in the lunar south pole area and values of water equivalent of hydrogen, which probably account for their low level of water ice content. |
| Joshi D. R. Eustes A. W. III Rostami J. | *Testing Lunar Regolith Characterization Algorithms with Simulated Subsurface Samples and Digital Twin Data* **[#2604]** This work describes the testing of a material characterization while drilling an algorithm |

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| | on a simulated 3D water-bearing lunar subsurface sample. Such testing can prepare the lunar drilling missions for the complex subsurface conditions. |
| Potter R. W. K. Deutsch A. N. | *Modeling the Formation of Simple Craters in Ice-Rich Polar Targets on the Moon* **[#1881]** How is (near) surface ice redistributed by small impact events at the lunar poles; can it be excavated to, and preserved at, the lunar surface? This has important implications for the stratigraphies, ages, and sources of surface ice observed today. |
| Matsuo Y. Demura H. Ohtake M. Daket Y. Sato H. | *Image Completion for Shaded Area Around Lunar Poles* **[#1824]** This research proposed a method to complete MI images by estimating correct values in shaded areas and to plausibly fill the invalid pixels using GANs, Deep Learning. Our experimental results showed good performance in metrics; PSNR, SSIM, MS-SSIM. |
| Kendall J. D. Petro N. E. | *Scratching at the Lunar Surface: Determining Regolith Compositions and Provenance at Probable Artemis Landing Sites Using Impact Hydrocode and Ejecta Modeling* **[#2113]** We present a method for combining successive hydrocode and ejecta models to understand the cratering record of the south pole region and determine the likely regolith composition found at potential landing sites chosen for robotic or human missions. |
| Mortimer J. I. Barber S. J. Abernethy F. A. J. Grill L. Gscheidle C. et al. | *Experimental Methods to Inform Modelling of Volatile Preservation During Lunar Subsurface Icy Sample Collection: In Support of ESA's 'PROSPECT' Package* **[#2383]** To support ESA's PROSPECT lunar subsurface volatile exploration and analysis package, members of the Science Team are conducting experiments to feed inputs into a detailed sample chain model to assess volatile preservation during sample collection. |
| Chandrachud R. A. | *Fuel Powered In-Situ Resource Utilization on the Moon* **[#2224]** This paper investigates the possibilities for the establishment of Fuel Powered ISRU Units on the lunar surface. The important technological aspects regarding probable fuel are also described here. |
| Lanctot S. I. Figueroa L. Cooke J. Phipps B. Trujillo S. et al. | *Sole Morphing Astronaut Boots (SMAB) for Lunar Dust Mitigation* **[#2772]** The Sole Morphing Astronaut Boots have two primary tasks as a passive technology for mitigating dust with respect to the 'Spacesuit Dust Tolerance and Mitigation' category. It will minimize dust clouds and provide stability to the astronaut and prevent falls. |
| van der Bogert C. H. Poehler C. M. Kring D. A. Hiesinger H. | *Absolute Model Ages for Geological Units in Schrödinger Basin: Context for the 2024 PRISM CLPS Mission* **[#2351]** We measure and examine CSFDs for geological units in Schrödinger Basin and find that the pyroclastic and mare deposits formed in the early to mid-Imbrian period — generally earlier than previously thought. |

## [P603]
## POSTER SESSION: LUNAR GEOPHYSICS: SHAKE, RATTLE, ROLL, AND FRACTURE

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|---|---|
| Ruiz-Bonilla S. Eke V. R. Kegerreis J. A. Massey R. J. Teodoro L. F. A. | *The Effect of Pre-Impact Spin on the Moon-Forming Collision* **[#2000]** We simulate collisions between the proto-Earth and a Mars-sized impactor. Collisions that differ only in the impactor's initial spin reveal a wide variety of outcomes: A merger, a grazing hit-and-run, or the creation of an orbiting proto-Moon. |
| Lompa T. Wünnemann K. Miljković K. Wahl D. | *Linking Gravity Data of Basins on the Lunar Farside with Numerical Formation Models* **[#1254]** We present the results of a systematic modeling study and gravity modeling of lunar farside basins. From Bouguer gravity data, we derive for each basin transient crater size, basin size, the impactor's size, and thermal state at the time of impact. |
| Patton R. L. | *Lunar Reference Model Inferred from Gravity, Topography, and Seismicity* **[#1199]** Global lunar gravity-topography spectra are consistent with a radial structure featuring a 200-km-thick lithosphere, a 500-km-thick tectosphere, and a 1350-km-thick mesosphere. |
| Chaffee T. M. Tikoo S. M. | *Size Thresholds for Unidirectional Remanence Within Lunar Magnetic Anomalies* **[#1642]** Lunar rocks cooling / Are complexly magnetized / For larger bodies. |
| Rajasekhar R. P. Arya A. S. Amitabh Suresh K. Islam B. et al. | *Investigation of a Plausible Lobate Scarp Mapped in the Mare Fecunditatis Region Using Datasets of Terrain Mapping Camera (TMC-2) Onboard Chandrayaan-2 Mission Acquired at a Low Sun Angle* **[#2183]** Investigation of a plausible lobate scarp mapped in the Mare Fecunditatis region is carried out using datasets of the Terrain Mapping Camera (TMC-2) onboard the Chandrayaan-2 mission acquired at a low Sun angle. |
| Bickel V. T. Valantinas A. | *The Search for Lunar Present-Day Tectonic Activity Using LO and LRO Images* **[#1285]** The correlation of pre-Apollo LO and modern LRO images does not reveal any present-day lunar tectonic (surface) activity — but the search continues! |
| Ruj T. Komatsu G. Kawai K. Okuda H. Xiao Z. et al. | *Boulder Tracks Within Finsen Crater: Evaluation of Triggers* **[#1334]** We noticed that part of the SPA Basin is still geologically active. It preserves lobate scarps and recent boulder falls. |
| Kreslavsky M. A. Bondarenko N. V. Head J. W. | *Ubiquity of "Elephant Hide" Texture on the Moon* **[#1826]** Subtle decameter-scale topographic texture occurs on all lunar slopes steeper than ~8° except the youngest. Its formation mechanism remains unknown. |
| Mahanti P. Clark J. D. Watters T. R. Banks M. E. Robinson M. S. | *Standardized Representation of Lunar Lobate Scarp Topography — Initial Results* **[#2408]** Lunar lobate scarp topography is represented by a standardized model. |
| Martin E. S. Watters T. R. | *Exploring Lunar Graben Formation with Displacement-Length Scaling* **[#2419]** Graben in mare / Are restricted by basalts / Highlands graben aren't. |
| Ahrens C. J. Banks M. E. Petro N. | *The Spatial Relationship of Graben and Pit Craters at Rimae Daniell and the Implications of Scarp Formation* **[#1481]** Weird lunar rimae / Pit craters next to grabens / What really happened here? |
| Phillips D. Weber R. C. | *Shallow Surface Velocity at the Apollo 17 Landing Site* **[#1709]** Moon's shallow surface / Velocity results range / New study brings light. |

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| Khatib A. S. Schmerr N. C. Feist B. Plescia J. B. Petro N. E. | *Near Surface Structure from an Active-Source Seismology Study of Apollo 11 Astronaut Activities* **[#2520]** Seismic studies / Depend on knowing all of / The uncertainties. |
| Martella C. H. Lauro S. E. Mattei E. Cosciotti B. Pettinelli E. | *Reanalysis of the Active Seismic Experiments Performed on the Moon During Apollo 14 and 16 Missions* **[#1483]** In the present work, we analyzed active seismic data collected during Apollo 14 and 16, applying a modern seismic approach from which we were able to estimate seismic velocities and shallow stratigraphy only using thumper source data. |
| Turner A. R. Hawthorne J. C. | *Slip Directions in the A01 Deep Moonquake Nest* **[#2129]** We determine if a tidal stress is larger than a long-term lunar tectonic stress by identifying the number of slip directions among events in the A01 deep moonquake nest. |
| Nunn C. Bugby D. Calcutt S. B. Currie D. Dell'Agnello S. et al. | *The Lunar Geophysical Package (LGP): A "Suitcase Science" Approach to Building a Long-Lived, Human-Deployed, Lunar Network* **[#1829]** The Lunar Geophysical Package (LGP) is a long-lived surface package, combining seismic, electromagnetic, heat flow, and laser ranging measurements. |
| Basilevsky A. T. Malenkov M. I. Volov V. A. Abdrakhimov A. M. Nadezhdina I. E. et al. | *Estimation of Bearing Capacity of Lunar Soil from the Depth of Tracks of the Lunokhod Wheels* **[#1825]** Here we describe measurements of depth of the Lunokhod-1 and 2 wheel tracks in TV panoramic images and from them estimate bearing capacity of the upper layer of lunar soil. These results are compared with those for Chinese Yutu and Yutu-2 rovers. |
| Viswanathan V. Mazarico E. Goossens S. | *A Simulation Study for Extending Lunar Laser Ranging Science* **[#2651]** A simulation study to assess the extension of science return from Lunar Laser Ranging data. |
| Rossi C. Muccino M. Gallegos N. Filomena L. Malhotra S. et al. | *First Observation of Apollo Laser Retroreflectors with the Lunar Reconnaissance Orbiter Camera and NASA's Moon Trek Software* **[#1924]** This research shows the first observation of the Lunar Retroreflectors (LRR) in images acquired by NASA's LROC by the identification of 95 candidate nominal lighting conditions reflected off an LRR of Apollo 11, 14, and 15 in LROC data. |
| de Veld F. T. Saadia B. Birkett S. Braun A. | *GRASIMU: A Software Toolbox for Gravity Modelling and Survey Design in Lunar Exploration* **[#1814]** Research is on the development of a portable, interactive software toolbox for preliminary field survey design in gravity anomaly detection, primarily in the context of subsurface lunar lava tube detection with surface measurements. |

## [P604]
## POSTER SESSION: LUNAR PETROLOGY AND GEOCHEMISTRY

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| Konecke B. A. Boyce J. W. Jakubek R. S. Righter K. McCubbin F. M. et al. | *Revisiting the Origin of Macromolecular Carbon (MMC) in Lunar Basalts 15556 and 10044* **[#1701]** The observation of macromolecular carbon within returned lunar samples highlights the potential need for a rigorous reassessment of sample handling and processing techniques and/or the reevaluation of the indigenous lunar carbon budget. |
| Wieler R. Bochsler P. Marty B. | *Do Lunar Regolith Samples Testify of a Contribution of Cometary Xenon onto the Moon?* **[#1085]** We discuss the hypothesis that lunar soil samples contain a minor addition of cometary Xe depleted in 134,136-Xe. |
| Meshik A. Pravdivtseva O. Rauch B. F. | *Indigenous Lunar Gases from the Earth Wind — An Experimental Verification* **[#2268]** The ongoing experiment is intended to estimate the strength of the Earth wind, a proposed contributor to the lunar volatile inventory. |
| Jones B. M. Orlando T. M. Alexandrov A. Hibbitts C. A. Dyar D. | *Formation, Transport, and Release of Volatiles from Packed Lunar Regolith Grains* **[#2713]** In this work, we report controlled measurements of the formation, transport, and release of molecular water and hydrogen from lunar regolith grains. |
| Rezes D. | *Possible Source Region of Northwest Africa (NWA) 13637 Lunar Regolith Breccia in Connection with Glass Spherules and Basaltic Clasts* **[#2439]** Based on the results of the study, it seems that the source region of NWA 13637 lunar feldspathic breccia meteorite is similar to the material that covers the landing site of the Apollo 16 mission, which was confirmed by the composition of glass beads. |
| Duerr T. A. Becker H. Schwarz W. H. Vanderliek D. | *Testing the Origin of Impactites at the Apollo 17 Landing Site: U-Pb Ages of Baddeleyite in Breccia 77035* **[#1951]** Baddeleyites in KREEP rich impact melt from Apollo 17 breccia 77035 crystallized at 3.93 Ga — more Imbrium ejecta in the North Massif? |
| Schuindt S. Darling J. R. Staddon L. G. Schwarz W. H. Dunlop J. et al. | *Microstructural Geochronology of Lunar Feldspathic Breccia Northwest Africa 10272: A Major Event at ~3.48 Ga in the Lunar Crust?* **[#2021]** In this study, we combined microstructural and U-Pb isotopic analysis of baddeleyite grains to characterize the magmatic, shock metamorphic, and thermal history of the lunar breccia meteorite NWA 10272. |
| Liu Y. Ma C. Morgan M. | *Preliminary Results of a New Lunar Impact-Melt Breccia Meteorite Northwestern Africa (NWA) 13638* **[#1501]** Preliminary results of a new lunar impact-melt breccia meteorite. |
| Treiman A. H. | *Lunar 'KREEP' is Diverse and Local* **[#1579]** KREEPs are not the same / Nor everywhere on the Moon. / Odd fruits, different roots. |
| Torcivia M. A. Neal C. R. | *Evidence for an Initial LREE-Depleted LMO from the Youngest Ferroan Anorthosite Suite Sample 62236* **[#2193]** Plagioclase equilibrium liquids from the youngest FAS sample indicate that the LMO was initially depleted in the light rare Earth elements. |
| Zhang J. Y. Head J. W. Liu J. Z. Potter R. W. K. | *Analysis of Thorium Concentration Anomalys on the Lunar Surface* **[#1744]** There are obvious heterogeneity of the thorium distribution on the lunar surface. We use |

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| | impact craters and basins superposed on lunar crust to document the extent of Th in PKT and SPA in order to establish the potential evolution of the KREEP layer. |
| Demidova S. I. Ryazantsev K. M. Badekha K. A. | *Evolved Rock Clast in Luna-24 Soil Samples* **[#2132]**<br>We report preliminary results of petrological investigation of evolved rock clast from the impact melt breccia of Luna-24 soil samples. |
| Shearer C. K. Simon S. B. Petro N. Moriarty D. Papike J. J. et al. | *The Evolution of the Lunar Crust I. A Multi-Perspective Approach to Understanding the OrigIn of FAN and Mg-Suite Lithologies at the Luna 20 Landing Site* **[#1155]**<br>Here, we examine the crystalline lithologies returned by the Luna 20 mission and integrate orbital and sample data to gain additional insights into the composition and origin of the crust surrounding the Crisium Basin. |
| Simon S. B. Shearer C. K. Haggerty S. E. Papike J. J. Petro N. E. et al. | *The Evolution of the Lunar Crust II. A Multi-Perspective Approach to Understanding the Origin of Spinel-Bearing Lithologies at the Luna 20 Landing Site* **[#1672]**<br>We examine spinel-bearing Luna 20 lithic fragments, compare mineral chemistries and assemblages to those of other lunar samples, and discuss petrogenetic processes and conditions of formation of lunar spinel-bearing lithologies. |
| Ruzicka A. M. Hutson M. L. Ziegler K. | *Lunar Meteorite Northwest Africa 13531: Chip Off of a Different Kind of Block* **[#2234]**<br>Northwest Africa (NWA) 13531 is a newly-classified lunar feldspathic breccia that differs in important ways from other lunar meteorites. |
| Astudillo Manosalva D. A. Elardo S. M. | *Assessing Crystallization Modelling Software's Accuracy for the Determination of Multiple Saturation Points in Lunar and Martian Basalts* **[#2356]**<br>Moon, Mars melting deep / Will machine succeed to show / How these melts were formed? |
| Liu Y. H. Ling Z. C. Wu P. P. Wang J. T. Cao H. J. et al. | *Mineralogy of Lunar Meteorite Northwest Africa 10480 by Raman Spectroscopic Studies* **[#2003]**<br>In this study, Raman spectroscopy was utilized to characterize lunar meteorite NWA (Northwest Africa) 10480 found in 2015. By collecting and analyzing the Raman spectra, the modal mineralogy and mineral composition in the meteorite were derived. |
| Valenciano J. L. Neal C. R. Demidova S. I. | *Crystal Size Distributions of Ilmenite in Basalt Clasts from Luna 16* **[#1750]**<br>A study on crystal size distributions of ilmenite in Luna 16 samples. |
| Webb S. Neal C. R. Demidova S. I. | *Crystal Size Distribution of Plagioclase in Basalt Grains from Luna 16* **[#2563]**<br>Quantitative textural analysis of plagioclase crystals in basaltic grains obtained by Luna 16 in 1970. |
| De Oliveira J. H. C. Neal C. R. | *Placing the Apollo 12 Basalts in Their Geological Context* **[#2621]**<br>A comprehensive review of Apollo 12 geology with an emphasis on the origins of feldspathic basalt material. |
| Borden M. W. Neal C. R. | *Understanding the Geologic Context of the Apollo 11 Basalt Suite by Synthesizing Remote Sensing Data and Sample Geochemistry* **[#2666]**<br>Integrating remote sensing data and sample geochemistry to develop the understanding of the geologic context of the Apollo 11 basalt samples. |
| De Oliveira J. H. C. Neal C. R. Blumenfeld E. H. | *Understanding Orientation and Formation: Using XCT Data to Quantify Void Space in Lunar Samples* **[#2628]**<br>Void space proportions derived from XCT slices of 12038,7 and 15556,0 produce graphs with implications for orientation of lunar samples at formation. |

**[P605]**
**POSTER SESSION: LUNAR REMOTE SENSING: FROM THE LAB TO ORBIT AND A BETTER UNDERSTANDING OF THE LUNAR SURFACE**

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Wohlfarth K. Wöhler C. Bauch K. D'Amore M. Hiesinger H. et al. | *A Fractal Rough Thermal Model for Emissivity Retrieval of MERTIS Lunar Flyby Spectra* **[#1241]** The MERTIS instrument that acquired the first space-based thermal infrared spectra of the Moon on 10th April 2020. We present a fractal rough thermal model that is used to calibrate the emissivity spectra. |
| Hiesinger H. Helbert J. Bauch K. D'Amore M. Maturilli M. et al. | *The Mercury Radiometer and Thermal Infrared Spectrometer (MERTIS) at the Moon — First Results and Status Report* **[#1494]** In October 2020, BepiColombo performed a flyby maneuver at the Moon. The Mercury Radiometer and Thermal Infrared Spectrometer (MERTIS) was among the few instruments that could observe the Moon. We report on first preliminary results. |
| Thesniya P. M. Rajesh V. J. Saranya R. | *Spectrochemical Characteristics of Chromium Spinels from the Sittampundi Anorthosite Complex, Southern India: Implications for Remote Identification of Lunar Spinels* **[#2277]** The present study aims to understand the spectrochemical characteristics of the Chromium spinel present in chromitite bodies associated with Sittampundi Anorthosite Complex, southern India. |
| Curtis R. J. Warren T. J. Bowles N. E. Donaldson Hanna K. L. Paige D. A. | *Measuring and Interpreting Bidirectional Reflectance Distribution Functions for Apollo Lunar Regolith Samples Using the Visible Oxford Space Environment Goniometer* **[#1056]** This talk will discuss the methodology and implications of a new BRDF study — of Apollo 11 (10084) and 16 (68810) regolith samples, with known surface roughness profiles and porosity values — using the Visible Oxford Space Environment Goniometer. |
| Meen J. K. Barker D. C. Martinez M. R. Obasi C. Mueller K. | *Thermal Reduction of Surface Rocks on Airless Planets* **[#2749]** Thermal reduction of rocks on airless planets is discussed and experimental and theoretical rationale given for the belief that this process can yield metals and oxygen for colonization. |
| Culley E. Jollif B. L. Watkins R. N. Hahn T. | *Assessing the Anorthosite Composition at Sites of Purest Anorthosite Spectral Identification Using LROC Narrow Angle Camera Photometry* **[#2404]** We use single scattering albedo determined using LROC NAC photometry to assess the composition of lunar uplift structures where purest anorthosite has been spectrally identified. Most locations analyzed contain material more mafic than anorthosite. |

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| St. Clair M. Million C. Ianno A. | *Updates to the Chandrayaan-1 Moon Mineralogy Mapper Archive* **[#2626]**<br>We have produced a Planetary Data System Version 4 (PDS4) bundle that modernizes M3's crucial data archive in order to improve accessibility, discoverability, and maintainability. We discuss bundle features, background, and conversion methodology. |
| Barker M. K. Karpenko M. Mazarico E. Smith D. E. Sun X. et al. | *Measuring Photometric Surface Roughness with the Lunar Orbiter Laser Altimeter (LOLA)* **[#1369]**<br>We present some preliminary results from the LOLA high-phase photometric campaign to study how the small-scale structure of the lunar surface affects its photometric properties. |
| Kumaresan P. R. Saravanavel J. | *Estimation of Optical Maturity and Evolutionary History of Inter-Basinal Region Between Imbrium and Serenitatis Basin* **[#1645]**<br>The study is related to space weathering processes on the lunar surface. Clementine bands were used for optical maturity calculation. Finally, evolutionary history of the study region was brought out. |
| Nagori R. Arya A. S. | *Retrieving Photometric Properties of Apollo 16 Landing Site Using TMC Onboard Chandrayaan-2: Prospects* **[#1885]**<br>TMC-1 dataset was used to assess the TMC-2 dataset requirement over Apollo 16 landing site for retrieving photometric parameters using physical model. Working procedure was applied over sample TMC-2 dataset and to be used over other datasets. |
| Dhingra D. Chauhan P. Bhatt M. Kumar A. Thangjam G. et al. | *Spectral Observations from Imaging Infrared Spectrometer (IIRS) Onboard Chandrayaan-2 Orbiter: Radiance Data Comparisons* **[#2436]**<br>Preview of new Vis-NIR observations of the Moon from Chandrayaan-2 mission. |
| Warren T. Curtis R. Shirley K. Donalson Hanna K. Sefton-Nash E. et al. | *Investigating the Thermal Infrared Emission Phase Function of the Lunar Surface Using the Diviner Lunar Radiometer* **[#1890]**<br>The emission phase function of the Moon — it is not isotropic. What does that tell us about the Moon? |
| Bhattacharya S. Dagar A. K. Kumar A. Patil A. Banerjee A. et al. | *Mineralogical Diversity and Hydration Feature at Crater Aristarchus as Revealed by Chandrayaan-2 Imaging Infrared Spectrometer (IIRS)* **[#1848]**<br>Chandrayaan-2 IIRS data over western part of crater Aristarchus has been analyzed for its mineralogical diversity and the presence of hydration feature. The 3000-nm doublet feature possibly indicates the existence of hydroxyl at the study's site. |
| Karthi A. Arivazhagan S. | *Investigation of Highland Lithologies in Finsen and Kovalevskaya Craters on the Far Side of the Moon* **[#1808]**<br>To study the distribution of lunar anorthosites and their associated mixtures in the mare emplaced Finsen and Kovalevskaya craters on the far side of the Moon. |
| Turchinskaya O. I. Slyuta E. N. | *Titanium and Iron Probable Reserves in the Lunar Soil* **[#1667]**<br>The aim of this work is to identify and distinguish several main categories of ilmenite content from low-titanic to high-titanic lunar rocks based on mapping the $TiO_2$ distribution from the spectral data of the Clementine spacecraft. |
| Amitabh Gupta A. Suresh K. Prashar Ajay K. Iyer K. V. et al. | *High Resolution DEM Generation from Chandrayaan-2 Orbiter High Resolution Camera Images* **[#1396]**<br>This study provides the very high resolution DEM (<0.30 m) generation capability from Chandrayaan-2 Orbiter High Resolution Camera multiview (Stereo) images of few specific areas of Moon surface. |

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| Bauch K. E. Morlok A. Hiesinger H. Reitze M. P. Schmedemann N. et al. | *Unmixing of Laboratory IR Spectral Reflectance Measurements of Labradorite-Enstatite-GlassMineral Mixtures.* **[#1567]**<br>We present results of spectral unmixing analyses of labradorite-enstatite-glass mineral mixtures using a non-linear unmixing model. |
| Prem P. Blewett D. T. Patterson G. W. Virkki A. | *Modeling the Polarization Properties of Icy Regolith Analogs at Optical and Radar Wavelengths* **[#1637]**<br>We model the coherent backscatter opposition effect (CBOE) in order to better understand radar observations of the lunar surface, and compare model results to lab measurements of planetary surface analogs at optical wavelengths. |
| Maturilli A. Wohlfarth K. Alemanno G. Woehler C. D'Amore M. et al. | *Spectral Signatures of Glass on Lunar Analogue Rocks* **[#2085]**<br>Two lunar soils: basalt and anorthosite, three glasses: synthetic glass, basalt glass, and obsidian measured in emissivity at 140°C. Soil with 20 µm glass on top was measured too, then heated to 900°C for four hours and then again measured in emissivity. |
| Bourget A. B. Daly M. D. Blewett D. B. | *Optical Polarization Studies of Suspended Beads in Aqueous Solution: An Analog for Radar Scattering in Icy Regoliths* **[#2535]**<br>The presence of ice mixed within the polar regolith of planetary bodies of Mercury and the Moon has been theorized for years. Radar observations of the poles of Mercury, the Moon, and Mars result in unusually high circular polarization ratio. |
| Allen C. C. Ghent R. Gallinger C. Paige D. A. | *Lunar Regolith Evolution Rates Derived from Thermophysical Properties* **[#2456]**<br>This study uses the thermophysics of crater ejecta to constrain lunar regolith evolution rates on a scale of kilometers. |
| Caudill C. M. Cloutis E. Potin S. Manigand S. | *Raman Spectroscopy for the Moon: Development of a Lunar-Relevant Raman Spectral Library* **[#1868]**<br>A lunar-relevant Raman spectral library is in development to support: (1) science and technology development, and (2) implementation of flight-ready Raman spectral instruments suitable for future lunar rover missions. |
| Warren P. H. Korotev R. L. | *Caveat! Calibration Complexities for Reflectance Spectroscopy of Anorthositic Lunar Soils* **[#2262]**<br>In anorthositic soils, reflectance spectroscopy appears to under-gauge mafic abundance. The technique does not measure, in a representative way, the bulk soil. |
| Blewett D. T. Basic G. Wiker J. Newhook J. Sniderman A. et al. | *Planetary Surface Texture Lab: Imaging Polarization and Photometric Studies of Regolith Analogs* **[#1176]**<br>We are developing a goniometer facility for imaging photometric and polarimetric studies of regolith analogs. The data will help to provide a foundation for interpretation of phase-ratio and polarization-parameter images of planetary surfaces obtained by spacecraft. |
| Wohlfarth K. Wöhler C. Bauch K. D'Amore M. Hiesinger H. et al. | *The Lunar EPI-Regolith — A Hypothesis to Explain the Lunar Flyby Data of MERTIS* **[#1236]**<br>The lunar infrared spectra (7–14 µm) acquired by MERTIS on 10th April 2020 exhibit an unexpected maximum at 9 µm. We formulate a new hypothesis and perform radiative transfer modeling to explain the unusual shape of the spectra. |
| Kumamoto A. Ishiyama K. | *Derivation of Lunar Subsurface Loss Tangent from SELENE Lunar Radar Sounder* **[#1510]**<br>By applying chirp-split method to SELENE LRS data, we estimated subsurface loss |

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| | tangent as 0.014 and ilmenite abundance as 16 wt% at (23E, 20N) in Mare Serenitatis. Based on them, the evolution of the ilmenite abundance in lava flow was discussed. |
| Sato H. Hapke B. Robinson M. S. | *New Extended Range WAC $TiO_2$ Map of the Moon* **[#1031]** We derived a new WAC $TiO_2$ map with no limit of the valid range based on a new algorithm proposed by Hapke et al.(2019), and we compared it with two pre-existing $TiO_2$ maps. |
| Sklute E. C. Domingue-Loren D. Glotch T. D. Rucks M. Ye C. | *A New Open-Source Hapke Radiative Transfer Program for Determining Optical Constants and Anayzing Phase Behavior* **[#1258]** We present a new version of our Hapke-based Matlab code for optical constant determination. Phase contributions are separated from grain size contributions, leading to more robust results and allowing for phase investigations of any multi-phase data. |
| Morlok A. Charlier B. Reitze M. P. Renggli C. J. Klemme S. et al. | *BepiColombo and MERTIS @Moon: A Very First Comparison of Mid-Infrared (7-14 μm) Spectra* **[#1964]** We present a comparison of mid-infrared spectra from the MERTIS instrument on ESA/JAXA BepiColombo from the lunar flyby and compare them to laboratory data. |
| Suresh K. Amitabh Iyer K. V. Prashar A. K. Islam B. et al. | *Triplet Camera Based Digital Elevation Model Generation of Lunar Surface from Chandrayaan-2 Terrain Mapping Camera-2 (TMC-2) Imagery — Quality Improvements and Results* **[#1397]** The objective of this paper is to demonstrate the capability of Chandrayaan-2 TMC-2 triplet images for Digital Elevation Model (DEM) generation using three camera images, and to provide the details of quality improvements in TMC-2 DEMs. |
| Chakraborty T. Bhiravarasu S. S. Das A. Pandey D. K. Putrevu D. et al. | *Probing Lunar Polar Impact Craters Using Foll-Pol L-Band Chandrayaan-2 Dual-Frequency SAR (DFSAR)* **[#1447]** Dual-Frequency Synthetic Aperture Radar (DFSAR) on-board Chandrayaan-2 is the first fully-polarimetric (FP) SAR in lunar orbit. Here, we exhibit some results of DFSAR L-band FP observation towards exploring physical behavior of lunar impact craters. |
| Marshal R. Wohlfarth K. Ruesch O. | *Insights on Pixel and Sub-Pixel Scale Rock Abundance on the Moon with LROC/NAC* **[#1457]** In this study, we estimate the sub-pixel rock abundance (over regions of flat topography) that could cause variations in pixel to pixel reflectance values. We model rocks as mounds and use a ray tracing technique to calculate shadows. |
| Poggiali V. Hayes A. G. Lalich D. E. Soderblom J. M. Raguso M. C. | *Surface Clutter Simulations and Super Resolution Processing of the SELENE (Kaguya) Lunar Radar Sounder Data* **[#2156]** We implemented an EM wave propagation simulator to distinguish subsurface echoes from synchronized returns received from surface features in SELENE Lunar Radar Sounder data and used it in combination with an algorithm of range resolution enhancement. |

## [P606]
## POSTER SESSION: LUNAR SURFACE INTERACTIONS WITH THE SPACE ENVIRONMENT

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| Authors (*Denotes Presenter) | Abstract Title and Summary |
|---|---|
| Phipps P. H. Stubbs T. J. Looper M. D. Spence H. E. | *Galactic Cosmic Ray Proton Radiation Dosage Near a Simple Lunar Crater* **[#1500]** The Moon has a harsh radiation environment that poses significant challenges to future science and exploration activities. Topography can reduce radiation dosage by at least 40 percent at crater floor and at least 10 percent just outside crater. |
| Poppe A. R. Garrick-Bethell I. Fatemi S. | *Fractionation of Solar Wind Minor Ion Precipitation by the Lunar Paleo-Magnetosphere* **[#1255]** We report simulations of solar wind (SW) minor ion fractionation by the lunar paleo-magnetosphere. Model results suggest paleo-magnetic fields strongly fractioned SW minor ions. We discuss the implications of these findings for lunar sample analyses. |
| Wang H. Z. Shi Q. Q. Xiao C. Zhang J. Guo R. L. et al. | *Energetic Neutral Atoms Distribution on the Lunar Surface and Its Relationship with Solar Wind Condition* **[#2185]** In this study, we intend to study the ENA distribution and its relationship between the ENA differential flux and solar wind parameters, such as density, velocity, and dynamic pressure. |
| Carmichael C. C. Griffin G. G. Cook M. C. Matthews L. S. M. Hyde T. W. H. | *Lunar Swirl Formation in an Irregular-Shaped Dusty Plasma Medium* **[#1676]** Lunar swirl formation is an area of great interest for observation of charged particles dynamics in a magnetic field. This work looks at the viability of reproducing lunar swirls and the role of charged dust in a magnetic field, for dust mitigation. |
| Griffin G. G. Carmichael C. C. Matthews L. M. Hyde T. H. | *Determining Diagnostic Capabilities of Dust by Exploring Lunar Swirls* **[#2208]** This project examines the lofting of lunar simulant under varying experimental conditions and a second series of charging mechanisms. |
| Mendoza A. Herrera T. Matthews L. S. Hyde T. W. | *Determining Electrostatic Forces on Lunar Dust Regolith* **[#2726]** A numerical simulation of the time-varying charging of the dusty lunar surface is used to predict the lofting of lunar dust. |

**[P607]**
**POSTER SESSION: LUNAR VOLCANISM**

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| Authors (*Denotes Presenter) | Abstract Title and Summary |
|---|---|
| Ford J. S. Sharif K. Jones H. L. Whittaker W. L. | *Planetary Pit Photogrammetry: Accuracy, Coverage, and Science Value* **[#2631]** |

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| | Small rovers could explore, image, and model lunar pits as precursors to future exploration. By modeling a terrestrial analog pit, we evaluate the coverage, accuracy, and scientific usefulness of such models. |
| Heemskerk M. V. Pouwels C. R. Heemskerk R. S. Kerber S. Foing B. H. | *CHILL-ICE (Construction of a Habitat Inside a Lunar-Analogue Lava Tube): Building and Testing of a Deployable Habitat in Icelandic Lava Tubes for Space Exploration Purposes* **[#2762]**<br>CHILL-ICE (Construction of a Habitat Inside a Lunar-Analogue Lava tube — Iceland Campaign of EuroMoonMars) is setting up the prototype habitat for human lunar subsurface settlement inside a lava tube on Iceland. |
| Michael G. G. Basilevsky A. T. | *Lunar Crater Ina: Analysis of the Morphology of Interior Landforms* **[#1632]**<br>We study crater morphology in and around the Ina Crater depression, looking for evidence of impact into magmatic foam, and examine regolith accumulation at the foot of interior hills and boundary slopes. Findings consistent with recent formation. |
| Bringeland S. M. Braun A. | *Modelling and Assessing Rover-Based Ground Penetrating Radar to Identify and Map Lunar Lava Tubes* **[#1699]**<br>The potential efficacy of rover-based ground penetrating radar to detect and map lunar lava tubes was assessed using forward-modelling software. |
| Zhang F. Meng Y. Bugiolacchi R. | *Implications for Lunar Mare Volcanism Indicated from RMDS-Bearing Mare Domes in Tranquillitatis* **[#1762]**<br>Multiple morphologic and rheological parameters of 57 RMDS-bearing lunar domes in Mare Tranquillitatis and their dome-forming magmas were estimated, aiming to study the mechanism of RMDS-associated emplacement of mare basalts. |
| Hon E. Stopar J. | *Investigation of Young Mare Deposits in the Lichtenberg and Flamsteed Regions* **[#1660]**<br>We search for young mare deposits in the Lichtenberg and Flamsteed regions of Oceanus Procellarum using crater size frequency distributions, stratigraphy, and composition to distinguish the presence of subunits within the mare. |
| Giguere T. A. Boyce J. M. Gillis-Davis J. J. Stopar J. D. | *Determination of Lunar Lava Flow Ages in Northeastern Oceanus Procellarum: The Need for Calibrating Crater Counting Procedures Across the Field* **[#1091]**<br>The Chang'E 5 landing site in NE Oceanus Procellarum hosts ~3.0 +0.2/–0.3 Ga mare basalts with intermediate composition ($TiO_2$ 4.6–7.7 wt%). The sample core may reveal horizontal regolith layers and distal ejecta with ages in the 1.8–2.6 Ga range. |
| McGovern P. J. Kramer G. Y. Neumann G. A. | *Emplacement and Tectonism of the Non-Basin Lunar Mare Provinces Tranquillitatis and Frigoris* **[#2516]**<br>The lunar Mare provinces Frigoris and Tranquillitatis do not fill circular impact basins, but rather overlie primordial rifts. We examine tectonic scenarios. |
| Pauw L. Hiesinger H. van der Bogert C. H. Früh T. | *Mapping and Investigation of Lunar Wrinkle Ridges in Mare Serenitatis* **[#2119]**<br>This work deals with wrinkle ridges in Mare Serenitatis. With high-resolution imagery, we selected over 470 wrinkle ridges and mapped them on the basis of their orientations, lengths, appearances, and distributions of boulder fields. |
| Bhatt H. Chauhan P. Solanki P. | *Geological Evolution of the Largest Shield Volcano Bearing Mare of the Moon, Mare Tranquillitatis: Based on Detailed Morphological, Mineralogical, Topographic Studies Using Multiple Data Sets* **[#1827]**<br>This work investigated geological evolution of Mare Tranquillitatis by using multiple |

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| | data sets. We mapped this area based on detailed mineralogy, topography, and morphology. We also concluded the origin of largest shield volcano of Moon. |
| U (Uu) K. Ogawa M. Hasumi H. | *Effects of Magma-Generation and Transport of Heat and Heat Producing Elements by Migrating Magma on the Thermal History of the Moon* **[#1160]**<br>A thermal history model of the spherically symmetric mantle of the Moon is developed, taking account of thermal diffusion, magma-generation and migration, and transport of heat-producing elements by magma. |
| Lang A. N. M. Gregg T. K. P. | *Holes in the Moon: Copernicus Crater Collapse Pits* **[#1997]**<br>Preliminary analysis of over 35 collapse pits on the floor of Copernicus Crater show that many pits are aligned with linear depressions. |
| Paul D. Porwal A. Thangjam G. | *Compositional Variability of Mare Humorum and Insights into Diverse Geologic Units of Mare Volcanism* **[#2312]**<br>Understanding the petrogenetic evolution of Humorum Basin. Comparing the algorithm results with standard scatterplots and then to infer the results of the study area. Thus, to understand how this area fits into the broader context of lunar history. |
| Farrand W. H. | *Analysis of Mantled Lunar Domes, Rille Flanks, and Anomalous Regions* **[#2362]**<br>An investigation into mantled lunar domes, areas near rilles, and other anomalous regions is described. These mantled regions have, in some instances, not been listed among known pyroclastic deposits. |
| Shirley K. A. Glotch T. D. Bowles N. | *Investigating Lunar Silicic Volcanism at Lassell Massif Using Diviner Emissivity Spectral Properties* **[#2622]**<br>Diviner can tell / Lassell Massif volcano / Is highly evolved. |
| Christopher H. Kumari N. Shanmugapriya K. Vijayan S. | *Gerard Q Crater Region, Moon: KREEP Induced Volcanism in Mare-Highlands Boundary?* **[#1809]**<br>We report the findings of our investigation of the Gerard Q Region of the Moon. Topographical, morphological, mineralogical, and chronological analyses revealed the presence of iron rich mare units likely emplaced during the last stages of lunar volcanism. |
| Bramson A. M. Carter L. M. Patterson G. W. Jozwiak L. M. Morgan G. A. et al. | *The Lunar Schiller-Schickard Mare and Cryptomare as Seen by Arecibo and Mini-RF Radar* **[#2275]**<br>We analyzed radar backscatter of lunar mare and cryptomare in Arecibo and Mini-RF data across the Schiller-Schickard area. We find many distinct radar boundaries that do not follow previously-mapped units based upon surface geology and spectroscopy. |
| Cahill J. T. S. Hayne P. O. Patterson G. W. Greenhagen B. T. Wieczorek M. A. | *The Unusual Atlas/Hercules Region of the Moon* **[#2114]**<br>An examination of the unique Atlas/Hercules apparent thermophysical anomaly. |
| Velichko S. Korohin V. Kaydash V. Shkuratov Y. | *Phase-Ratio and Phase Dependence of Albedo of Irregular Mare Patch Maskelyne Obtained from LROC NAC Data* **[#2280]**<br>Maskelyne is one of unusual and large IMPs, composed of bleb-like mounds surrounded by hummocky and blocky terrains. Phase ratio and phase dependences of albedo show significant differences in the optical properties of Maskelyne and surrounds. |
| Chauhan M. Tiwari P. S. Chauhan P. | *Geological Investigation of Petavius Crater, Moon Using High-Resolution Datasets from Recent Lunar Missions* **[#1843]**<br>The study presents investigation of a floor fractured crater, Petavius, for interpreting its |

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| | geology in terms of mineralogical analysis and morphological observation using high-resolution datasets from lunar missions. |
| Avent W. M. II Lee P. | *New Candidate Pits and Caves at High Latitudes on the Near Side of the Moon* **[#2733]** 35 new candidate pits are identified in Anaxagoras and Philolaus, two high-latitude impact structures on the near side of the Moon. |

## [P608]
## POSTER SESSION: LUNAR VOLATILES

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Smolka A. Gscheidle C. Biswas J. | *Investigation of Transient Volatile Migration in Lunar Regolith for the Lunar Volatile Scout* **[#2283]** Transient migration of volatiles through lunar regolith was investigated in the context of the Lunar Volatiles Scout. Interaction of heat and mass transport was modelled to characterize mass loss to the exosphere and the distribution of temperature. |
| Moye C. G. Lee P. | *Lunar Polar Water Ice: A Terrain Classification System and Optimal Sites for Moon Exploration* **[#2759]** Classify lunar polar terrain with three factors: $H_2O$ ice detection within the top 1m of regolith, inside/outside PSR, and subsurface $H_2O$ ice thermodynamic stability allowed by models. |
| Ambili K. M. Choudhary R. K. | *Three Dimensional Map of Lunar Ionosphere Using Physics Based Ionospheric Model* **[#1418]** Three dimensional map of lunar ionosphere is generated using physics based ionospheric model. The model calculations are supported by Chandryaan 1 neutral density and electron density measurements. |
| Farrell W. M. McLain J. L. Zimmerman M. I. Hartzell C. M. Fester Z. T. | *Lunar Dust-to-Suit Electrostatic Interactions: Insulating vs. Conducting Space Suits* **[#1937]** We explore the possibility that space suits may develop large plasma-induced E-fields at the scale size of 10's of microns within the suit weave. |
| Shahi C. B. Haun R. Coplan M. A. Su J. J. Lutz L. et al. | *Cellular Array Neutron Detector for Lunar and Planetary Missions* **[#2153]** We present new techniques for locating water and hydrogenic volatiles within one meter of the Moon's surface. |
| Losekamm M. J. Poeschl T. | *A Compact Cosmic-Ray and Neutron Spectrometer to Search for Water Ice on the Moon* **[#2302]** In this contribution, we present the ongoing development of the Lunar Cosmic-Ray and |

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| | Neutron Spectrometer (LCNS), one of three major scientific instruments developed for the LUVMI-X rover, which will search for water deposits at the lunar poles. |
| Hibbitts C. A. Runyon K. Nord M. | *How the State of Water Affects Its Use as an In-Situ Lunar Resource* **[#2690]** The state of water determines its abundance and for multiple reasons, its utility as a resource. Water ice is the only form of water viable as an in-situ resource. |
| Huang Z. H. Nomura K. N. Wang J. W. | *Modeling Solar Wind Implantation and Its Contributions to Volatile Formation on Lunar Surface* **[#1798]** We investigated the solar wind implantation induced water formation process by molecular dynamics. By utilizing the state-of-the-art reactive force-field (ReaxFF), we can capture chemical reactions as well as mechanical collisions in our simulation. |
| Pugacheva S. G. Feoktistova E. A. Shevchenko V. V. | *Clavius Crater Water* **[#1411]** We investigated the illumination condition and temperature regime in the Clavius Crater area. |
| Yamashita N. Prettyman T. H. | *Identification of Volatile Elements for Lunar Science, Resource Utilization, and Landing Site Selection* **[#1633]** We seek to improve our knowledge of volatile elements Rn, Na, and H on the Moon to better characterize subsurface geochemistry and to understand the delivery and storage mechanism of volatile species. |
| Grava C. Hurley D. M. Feldman P. D. Retherford K. D. Greathouse T. K. et al. | *LRO/LAMP Observations of Lunar Exospheric Helium: Constraints on Its Thermal Accommodation and Outgassing Rate* **[#2025]** We present a paper (published in MNRAS) summarizing observations of the lunar exospheric helium with LRO's LAMP. Helium has a full thermal accommodation with the lunar surface, and a source rate from the lunar interior of 1.5d6 cm^-2 s^-1. |
| Martin A. C. Denevi B. W. Speyerer E. J. Thompson T. J. Brown H. M. et al. | *Comparison of Images with Direct and Indirect Illumination: Lunar Permanently Shadowed Region Analog Images* **[#2349]** Understanding how albedo differences observed under direct and indirect illumination conditions will aid in the understanding of images of LROC PSRs. |
| Luchsinger K. M. Chanover N. J. | *From Transient to Sequestered: Vertical Transport of Water Ice in Seasonally Shadowed Regions* **[#2540]** With sunrise, lunar / Water flies. But at the poles / Winter shadows grow... |
| Alfaro C. Tran A. Carr K. A. Azubuike O. Carreira C. et al. | *The Effect of Isotopic Composition and Surface Residence Times on Lunar Volatile Transport* **[#2258]** Moon gets gas sometimes / Simulation can tell all / What goes where, and when? |
| Tucker O. J. McLain J. Farrell W. M. Hurley D. M. | *Global Transport Modeling of Impact Released Volatiles from Lunar Soils* **[#2363]** Exospheric simulations of water products released from meteoroid impacts. |
| Ehlmann B. L. Klima R. L. Bennett C. L. Blaney D. Bowles N. et al. | *Lunar Trailblazer: A Pioneering Smallsat for Lunar Water and Lunar Geology* **[#1740]** Lunar Trailblazer is a confirmed NASA smallsat mission that will collect simultaneous shortwave and midwave infrared imaging data to map volatiles on the sunlit and permanently shadowed regions of the Moon. Flight system delivery at the end of 2022. |
| Grishakina E. A. Slyuta E. N. | *Probable Reserves of Water Ice in the Lunar Polar Regions* **[#1882]** An estimation of the probable reserves in certain identified fields with known coordinates and area, and with the maximum concentration of water ice, is given. |

# [P609]
# POSTER SESSION: CHANGE'4 AND CHANGE'5 RESULTS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Liu T. Michael G. Zhu M. Wünnemann K. | *Predicted Sources of Samples Returned from Chang'E-5 Landing Region* **[#1225]** The China's Chang'E-5 mission brought back ~2 kg samples from the Moon. We apply a numerical model to trace the evolving distribution of components and to estimate the abundance of different components in the samples and their plausible origin. |
| Liu C. Q. Ling Z. C. Liu L. Chen J. Cao H. J. et al. | *Fe-Rich Pyroxene and Mg-Rich Olivine at Chang'e-4 Landing Site Constrained by Spectral Characteristics of Lunar Soil Analogs Using VNIS Prototype* **[#1963]** VNIS prototype spectra of lunar soil analogs were analyzed to constrain the investigation of CE-4 spectra. The mineralogy at CE-4 landing site is dominated by Fe-rich pyroxene and Mg-rich olivine, which may form in rapid-cooling magmatic systems. |
| Yang Y. Li S. Zhu M. H. Liu Y. Wu B. et al. | *Impact Remnants Detected by the Chang'E-4 Rover on the Moon* **[#1956]** The Yutu-2 rover on board the Chang'E-4 mission may have detected the remnants from a carbonceous chondrite impact within the center of a fresh 2-m diameter crater. |
| Penasa L. Pozzobon R. Massironi M. Kang Z. Hu T. et al. | *3D Geologic Model of the Shallow Subsurface of Chang'E 3 Landing Site (Sinus Iridum, Moon)* **[#1857]** This work demonstrates the application of predictive 3D geological modelling based on Chang'e 3 radargrams of the lunar subsurface. The methods are fully documented and reproducible as freely available python notebooks. |
| Qian Y. Xiao L. Head J. W. van der Bogert C. H. Hiesinger H. et al. | *China's Chang'e-5 Landing Site: An Overview* **[#1306]** Chang'e-5 mission is China's first lunar sample return mission, landed on the Moon on December 1 and returned back ~1731 g of samples on December 17, 2020. The current research aims to provide the backgrounds of the landing site to help sample analysis. |
| Sun L. Lucey P. | *Mineralogy and Mg# of the Chang'E 5 Landing Region* **[#1796]** We report the mineralogy and Mg# of the Chang'E 5 landing region. The major minerals and Mg# show no significant variation at 24-160 m depth as excavated by nearby craters. |
| Yin C. X. Fu X. H. Hou X. T. Zhang J. Zou Y. L. | *The Geology of the Chang'E-5 Landing Site in the Northeastern Oceanus Procellarum* **[#1927]** We obtained the geochemical compositions of the mare basalts in the Chang'e-5 landing site and performed the stratigraphic investigations of this region. |
| Hou X. T. Fu X. H. Yin C. X. | *The Chronology of Pythagoras and Sharp B Craters in the Adjacent Highlands of the Chang'E-5 Landing Site* **[#2006]** We studied that the ejecta of Chang 'e-5 landing site may be from highlands and dated the Pythagoras Crater and Sharp B Crater. |
| Qian Y. Head J. W. Wilson L. Xiao L. | *The Longest Sinuous Rille on the Moon (Rima Sharp) and Its Relationship to the Young Procellarum Mare Basalts: Implications for the Chang'e-5 Returned Samples* **[#2492]** |

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| | Rima Sharp is the longest sinuous rille on the Moon in Northern Oceanus Procellarum, ~15 km from the Chang'e-5 landing site. Our study found that Rima Sharp is more complex than previous thought, and it is the major source for the Chang'e-5 samples. |
| Cao H. J. Qi X. B. Chen X. H. Fu X. H. Ling Z. C. et al. | *Compositional and Mineralogical Snalysis of Mare Basalts in Northern Oceanus Procellarum: Landing Site of the Chang'e-5 Mission* **[#1839]** The distinct spectra, composition, and mineralogy indicate that Chang'e-5 mare basalt represents a special type of basalt different from known mare basalt, profoundly improving our understandings of late lunar thermal evolution and impact history. |

## [P610]
## POSTER SESSION: MISSION CONCEPTS: MOON

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Biswal M M K. Annavarapu R N. | *Report on the Loss of Vikram Lander of Chandrayaan 2 Mission* **[#1039]** To date, no reports were released concerning the failure of Vikram lander. So, in this paper, we have interpreted the possible causes responsible for the failure of Lander "Vikram" of India's Chandrayaan 2 mission based on the lander's trajectory. |
| Laflèche É. A. Kells K. P. J. Lambier S. J. Neish C. D. Osinski G. R. et al. | *Proposed Lunar Sample Return Mission at Tsiolkovskiy Crater* **[#1363]** We propose a sample return mission to the Moon's Tsiolkovskiy Crater during the Artemis era and present a new traverse plan addressing key science objectives. |
| Jhoti E. Paige D. A. Carroll K. A. | *An Orbital Dynamics Model for an Ultra-Low Altitude Lunar Orbiter* **[#1548]** Gravity data / Guide Moon spacecraft to new lows / For enhanced science. |
| Hiesinger H. van der Bogert C. H. Wedler A. Jaumann R. Mall U. et al. | *The Rima Bode Region — Candidate for a Future Lunar Landing Site* **[#1485]** We present a mission concept utilizing a lander/rover to comprehensively study lunar volcanic deposits south of crater Bode C. |
| Qiao L. Head J. W. Wilson L. Ling Z. | *Conceptual Lunar Missions to the Ina Lunar Irregular Mare Patch: Distinguishing Between Ancient and Modern Volcanism Models* **[#1799]** We define a range of conceptual robotic-human lunar missions to the Ina feature to resolve the critical issue of the two (old and young) origins of Ina, a significant controversy concerning the geological and thermal evolution of the Moon. |
| Battler M. Raimalwala K. Cross M. Faragalli M. Smal E. et al. | *I-SPI: Intelligent Sensing and Perception in Infrared* **[#2767]** An overview of a novel AI-integrated infrared imaging instrument, for lunar volatiles, thermal properties, and mineralogy. |
| Almaeeni S. Els S. G. Almarzooqi H. | *To a Dusty Moon: Rashid's Mission to Observe Lunar Surface Processes Close-Up* **[#1906]** The ELM is an initiative taken by MBRSC to design and develop the UAE's first robotic |

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| | mission to another celestial body. The rover is designed to traverse a distance of several hundred meters giving it the ability to approach objects of interest. |
| Pozzobon R. Rossi A. P. Ferrari S. Massironi M. Pajola M. et al. | *Marius Hills Skylight Hazard Characterization as a Possible Landing Site for Lunar Subsurface Exploration* **[#1886]** Landing site characterization of the surroundings of the Marius Hills skylight on the Moon. Hazard and trafficability evaluation. Contextually, hazard of the floor of the skylight is also characterized in terms of boulders presence and abundance. |
| Lee P. Sims M. Bickel V. Colaprete A. Elphic R. et al. | *SCHRODINGER CAT: A Mobile Instrument Suite to Explore a Volcanic Vent and Permanently Shadowed Region in the Schrodinger Impact Basin, Far Side, Moon* **[#2771]** The Schrödinger CAT experiment is a proposed multi-instrument rover investigation of the geology of the Moon at a large volcanic pyroclastic vent with permanently shadowed regions in Schrodinger Basin on the far side of the Moon. |
| Bessone L. Carnelli I. Fontaine M. Sauro F. | *ESA Sysnova Lunar Caves Challenge: Ideas and Technologies for a Mission to Lunar Caves* **[#1120]** The Sysnova Lunar Caves Challenge was an innovation campaign seeking novel ideas and technologies to address detecting, mapping, and exploring caves on the Moon. |
| Borrmann D. Nüchter A. Bredenbeck A. Zevering J. Arzberger F. et al. | *Lunar Caves Exploration with the DAEDALUS Spherical Robot* **[#2073]** The DAEDALUS mission design concept aims at exploring and characterising the entrance of lunar lava tubes within a compact, tightly integrated spherical robotic device, with a complementary payload set and autonomous capabilities. |
| Lichtenheldt R. Staudinger E. Adeli S. Vera J. P. P. Giudice G. et al. | *A Mission Concept for Lava Tube Exploration on Mars and Moon — The DLR Scout Rover* **[#1443]** Caves are among the least explored and pristine terrestrial environments of our planet. On other planetary bodies, they pose a great potential for planetary sciences. Therefore, we propose a novel mission scenario based on a robust rimless wheel rover. |
| Noeker M. Karatekin Ö. Ritter B. | *Accessing the Lunar Underground: The LAva-TUbe iNvestigAtion (LA-TUNA) Mission Concept* **[#1574]** Here, we present the LAva-Tube iNvestigAtion (LA-TUNA) mission concept for a robotic lunar underground exploration mission, the first mission ever to access an extra-terrestrial lava tube. |
| Ximenes S. W. Shaffer A. Hooper D. M. Wells R. | *Leto Mission Concept for Green Reconnaissance of the Marius Hills Lunar Pit* **[#2640]** Leto is a robotic mission concept for “green reconnaissance” for entering skylights, pits, and lava tubes in a non-disturbing way during fist contact that preserves the science inherent in the pristine environment of these features. |
| Whittaker W. L. Jones H. L. Ford J. S. Sharif K. Wong U. Y. | *Skylight: A Mission Concept for In-situ Investigation of the Morphology, Geology, and Mineralogy of Lunar Pits* **[#2644]** The Skylight Mission roves a pit rim with a micro-rover, peers into the pit, acquires images of walls, floor, and caverns, and generates pit models. It is a low-cost, high-return, economical enterprise and deployable on the small landers of our time. |
| Hollosi D. H. | *LEAPS: Lunar Expedition to Ascertain Philolaus Skylights* **[#1842]** LEAPS (Lunar Expedition to Ascertain Philolaus Skylights) aims to use state of the art technology concerning commercial lander and micro-rovers to send a network of robots to firstly ascertain and then explore the Philolaus Skylights. |

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| Das N B. Biswal M M K. | *Project Crescent: A Proposal to Build a Sustainable Moon Base* **[#2416]** This paper proposes a detailed plan for building a sustainable Moon base and establishing a permanent human settlement on the Moon. The primary intent of the paper is to answer the question, "If we started today, how we would build a moonbase?" |
| Cartwright S. F. A. Bretzfelder J. M. | *The Lunar Season Calculator: An Accessible Tool for Future Mission Planning* **[#2533]** She sways to and fro / Plunging us into darkness / When will summer come? |
| Herkenhoff B. K. Lanctot S. I. Fisher J. M. Serda N. Bjorkman T. S. et al. | *Preliminary Design Concept of Locust Inspired Jumping Moon Robot Swarm* **[#2754]** The swarm of jumping locust-inspired robots would provide a new platform to perform missions over a large area, such as terrain mapping or lava tube exploration on Moon. |
| Mikolajewski S. Hiesinger H. van der Bogert C. H. Schmedemann N. | *Landing Site Evaluation Inside Mare Moscoviense* **[#2087]** We present a survey of possible landing site locations inside the Moscoviense Basin. We examined four candidate sites according to lander saftey and scientific relevance. |

## [P611]
## POSTER SESSION: MISSION CONCEPTS: EARTH

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Ishimaru R. Sakamoto Y. Fujita S. Kobayashi M. Okudaira O. et al. | *ASTERISC Project: CubeSat Mission for Observation of Cosmic Dust with a New Large Film Type Dust Sensor* **[#1712]** In this study, we propose a new large film type dust sensor system to observe cosmic dusts. The dust sensor system will be mounted on our second CubeSat "ASTERISC" which is scheduled to be launched in FY2021 by the JAXA Epsilon rocket. |

## [P612]
## POSTER SESSION: MISSION CONCEPTS: INNER SOLAR SYSTEM

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|---|---|
| Pommier A. McEwen A. S. Keszthelyi L. P. | *Investigating the Interior of Terrestrial Planets and Moons Using Electrical* |

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| | *Laboratory Measurements* **[#2226]**<br>The electrical conductivity of mantle and core analogues is particularly relevant to investigate the structure and dynamics of planetary interiors, and it can be used to constrain the compositional and thermal state of terrestrial planets and moons. |
| Cohen B. A. Young K. E. Zellner N. E. B. Zacny K. Yingst R. A. et al. | *In Situ Geochronology for the Next Decade* **[#1488]**<br>Discitur historia iubendo uas ad planetis. Ad luna! Ad mars! Ad asteroidem! |
| Vander Kaaden K. E. Ernst C. M. Chabot N. L. Klima R. L. Indyk S. J. et al. | *Landing on Mercury: A Geochemical Perspective* **[#1087]**<br>Geochemistry / We need in situ data / Land on Mercury. |
| Ernst C. M. Chabot N. L. Klima R. L. Kubota S. Rogers G. et al. | *The Mercury Lander Mission Concept Study: Enabling Transformative Science from the Surface of the Innermost Planet* **[#2565]**<br>Groundbreaking science / Through the long Mercury night / A fiery end. |
| Benkhoff J. | *The BepiColombo Mission to Explore Mercury — Status Update and First Results from Science Activities During Cruise* **[#2734]**<br>In April 2020 BepiColombo has passed Earth and on 15th October 2020 Venus. The next planetary flybys will be at Venus and at Mercury in 2020. A status of the mission and a summary of first results will be given. |
| Arredondo A. Hodges A. Abrahams J. N. H. Bedford C. C. Boatwright B. D. et al. | *VALENTInE: A Concept for a New Frontiers Class Long Duration In-Situ Balloon Mission to Venus* **[#1526]**<br>We present a variable altitude balloon mission concept for Venus. VALENTInE will passively float in Venus's atmosphere, acquiring atmospheric data at varying locations and mapping the surface geomorphology and mineralogy across multiple terrains. |
| Smrekar S. E. Hensley S. Dyar M. D. Helbert J. Andrews-Hanna J. et al. | *VERITAS (Venus Emissivity, Radio Science, In-SAR, Topography, and Spectroscopy): A Proposed Discovery Mission* **[#2211]**<br>VERITAS Step 2 / Is Earth oddity or norm? / Venus offers truths. |
| Sweeney D. Ao C. Vergados P. Renno N. Kass D. et al. | *Addressing Mars Atmospheric Science and Exploration Knowledge Gaps with Smallsat Radio Occultations* **[#2437]**<br>We present a mission concept that utilizes smallsats to perform radio occultation measurements in order to provide unprecedented coverage to safely land payloads to the surface of Mars. |
| Davis R. Haltigin T. | *International Mars Ice Mapper Mission: The First Human Exploration Reconnaissance Mission to Mars* **[#2614]**<br>The International Mars Ice Mapper mission will detect near-surface water ice. A multi-national collaboration, this initiative would be the first dedicated reconnaissance mission to Mars, designed to focus on "what we need to know before humans go." |
| Komatsu G. Brož P. | *Southern Chryse Planitia on Mars as a Potential Landing Site: Investigation of Hypothesized Sedimentary Volcanism* **[#1164]**<br>We propose an area with clusters of possible sedimentary volcano landforms in southern Chryse Planitia for a potential future Mars landing mission, presenting a great opportunity for various in-situ investigations on geology and astrobiology. |
| Biswal M M K. Gómez D. Das N B. Annavarapu R N. | *Conceptual Design of Mars Sub-Surface Habitat for Sustaining Thermal Stability* **[#1280]**<br>We propose a novel Mars Sub-Surface Habitat for sustaining thermal stability of habitat over the critical or hostile planetary environment. This proposition is based on the necessity required for an extended human presence on Mars. |

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| Shepard J. Fevig R. | *Permanent Capture of Minimoons in Libration Point Orbits: A Case Study on Capturing Asteroid 2006 RH120 and 2020 CD3* **[#1378]**<br>The purpose of this study is to understand the feasibility of capturing minimoons into Earth-Moon libration point orbits. The use of invariant manifolds will be investigated to provide a model for future rendezvous missions to minimoons. |
| Lim L. F. Barbee B. W. Bos B. J. Brambora C. Hewagama T. et al. | *Reconnaissance of Apophis (RA): A Rendezvous Mission Concept for Exploring the Potentially Hazardous Asteroid Apophis During Its 2029 Earth Encounter* **[#2204]**<br>The Reconnaissance of Apophis (RA) spacecraft mission concept is a rendezvous mission concept to survey the PHA Apophis during its April 2029 extremely close approach to Earth. |
| Bell J. F. III Papsidero L. Ware J. W. Rice J. W. Jr. Linn T. et al. | *Apophis Pathfinder: A Smallsat Mission to Characterize the Potentially Hazardous Asteroid (99942) Apophis* **[#2110]**<br>We describe the MILO Space Science Institute's Apophis Pathfinder mission, designed to flyby and characterize the ~370-m wide potentially hazardous asteroid (99942) Apophis in advance of its April 13, 2029, extremely close encounter with Earth. |
| Hernandez S. Bandyopadhyay S. Haynes M. S. Karimi R. R. Stuart J. R. et al. | *Small Spacecraft Swarms Enabling Asteroid Radar Observations: Apophis Mission Study* **[#1794]**<br>Simultaneous measurements of radar reflections observed from diverse angles using independent spacecraft can allow us to fully map the interior structure of small bodies. We study optimal spacecraft configuration for a mission scenario to Apophis. |
| Perna D. Pajola M. Casalino L. Ivanovski S. Lavagna M. et al. | *ANIME: The "Asteroid Nodal Intersection Multiple Encounters" CubeSat Mission to Explore Near-Earth Asteroid Diversity* **[#1106]**<br>The ANIME CubeSat mission aims to explore three NEAs, presenting both peculiar/unexplored physical regimes and planetary protection issues. The trajectory is optimized to encounter the targets at their orbital nodes. |
| Parker A. H. Durda D. D. Whizin A. D. Walsh K. J. Shoffner M. et al. | *BORE-II Suborbital Demonstration of Microsatellite-Scale Magnetic Asteroid Regolith Sample Collection System* **[#2454]**<br>Two Clockwork Starfish / Took magnetic maws to space / To taste regolith. |

## [P613]
## POSTER SESSION: MISSION CONCEPTS: OUTER SOLAR SYSTEM AND BEYOND

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| Thaler P. Niebur C. | *Temporal Trends in Planetary Mission Announcements of Opportunity and Proposal Evaluations* **[#1277]** |

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| | How have NASA's Announcements of Opportunity and perceived mission proposal quality changed over time for the Discovery and New Frontiers programs? |
| Denk T. McEwen A. S. Helbert J. IVO Team | *Survey of Jovian Irregular Moons with IVO (Io Volcano Observer)* **[#1841]** The potentials of the IVO mission for a survey of Jupiter's irregular moons are presented. IVO might determine rotation periods for the vast majority of the currently known 71 objects, plus two to three dozen pole/shape solutions and phase curves. |
| Achkar M. M. | *CAUSTIC.IO (Characterize Activity and Understand Seismic, Tidal, and Internal Constitution of IO)* **[#2667]** This abstract will motivate and outline a multiple flyby mission to Io, CAUSTIC.IO (Characterize Activity and Understand Seismic, Tidal, and Internal Constitution of IO), as a reference to the Moon's scorching environment and its innovative venture. |
| Overy R. D. Sadler G. G. | *Radioisotope Power for Scientific Exploration* **[#2770]** Based on proven technology from Voyager, Cassini, and New Horizons, NASA is investing in technology developments that increase the power output for deep space exploration. |
| Bairstow B. K. Lee Y. H. Howell S. Donitz B. Choukroun M. et al. | *Radioisotope Power System Waste Heat Mitigation for Ice and Ocean World Surface Exploration* **[#1075]** Analysis of a heat rejection system that could be required for RPS-enabled exploration of Ocean and Ice Worlds, to avoid impacting science measurements and violating planetary protection requirements. |
| Holler B. J. Runyon K. D. | *Evaluating Trans-Neptunian Dwarf Planets as Targets for an Interstellar Probe Flyby* **[#2525]** NASA's Interstellar Probe mission concept would study the properties and shape of the heliosphere. Such a mission would pass through the solar system on the way out, providing opportunities to fly by a trans-Neptunian dwarf planet. |
| Lisse C. M. Zemcov M. B. Poppe A. R. Szalay J. R. Draine B. T. et al. | *What Can an Interstellar Probe Mission at Large Heliocentric Distances Achieve with Remote Imaging and In Situ Dust Measurements?* **[#2581]** We summarize the transformative science to be done by an Interstellar Probe Explorer s/c flying a VISIR spectroscopic mapper + Dust chemical analyzer out to distances > 400 AU from the Sun. |
| Kumar S. Thomas L. D. Cassibry J. T. | *Nuclear Thermal Propulsion for Outer Planets Robotic Exploration* **[#1613]** Nuclear Thermal Propulsion (NTP) can be the game changing technology for outer planets exploration and beyond. The paper presents Jupiter rendezvous mission concept using NTP system and discusses its advantages w.r.t payload delivery and trip times. |

## [P614]
## POSTER SESSION: SPECIAL SESSION: MARS 2020 INITIAL RESULTS I: MINERALOGY, GEOCHEMISTRY, AND IMAGES

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| Brown A. J. Wiens R. C. Maurice S. Uckert K. Tice M. et al. | *Mars2020 In Situ Investigation of Alteration at Jezero Crater* **[#1749]** We report on a team effort to utilize the M2020 instrument suite to assess the mineralogy of the units we encounter at Jezero. Here, we focus on the possibility of testing orbital observations and hypotheses regarding the olivine-carbonate lithology. |
| Shkolyar S. Jaret S. J. Cohen B. A. Johnson J. R. Ollila A. M. et al. | *Detecting Shock Effects on Mars Using Mineral Spectroscopy* **[#1717]** Some samples analyzed by Mars2020 will be cached for MSR. Shock may lower caching value for geochronology studies. Shock is seen with Raman and luminescence spectroscopy. We discuss spectral shock indicators and challenges to informing MSR decisions. |
| Garczynski B. J. Horgan B. Kah L. C. Balci N. Gunes Y. et al. | *Expected Results of Carbonate Investigations by the Perseverance Rover in Jezero Crater: Lessons from a Fluviolacustrine Analog at Lake Salda, Turkey* **[#2235]** Mineralogical studies of a Jezero paleolake analog may help inform our rover investigations of carbonate-bearing deposits in Jezero and determine depositional origin. |
| Heirwegh C. M. Liu Y. Clark B. C. Elam W. T. O'Neil L. P. et al. | *Calibrating PIXL for Elemental Analysis on Mars* **[#1260]** This abstract describes the approach and methods used in calibrating NASA's Perseverance Rover's Planetary Instrument for X-ray Lithochemistry (PIXL) to perform elemental analysis of the martian regolith. |
| Pedersen D. A. K. Henneke J. Jørgensen J. L. Liu Y. Hurowitz J. A. et al. | *PIXL Multicolor Capability: False-Color Imaging and Iron-Bearing Mineral Detection* **[#1198]** Application of PIXL multi-spectral capability to false-color imaging and iron-bearing mineral detection. |
| Siebach K. L. Costin G. Jiang Y. | *Identifying Mineral Candidates in High-Resolution Geochemical Data with Application to PIXL on Mars 2020* **[#1263]** Finding minerals / From geochemistry of / Martian rocks and sand. |
| Meyer M. J. Milliken R. E. Hurowitz J. A. Robertson K. M. | *Primary Depositional and Secondary Diagenetic Fabrics in Evaporite Rocks as Seen by Perseverance Rover's PIXL Instrument* **[#1461]** Will PIXL capture the diagnostic features of rocks encountered by Perseverance rover in Jezero Crater? We characterized terrestrial siliciclastic-evaporite samples to find out! |
| Nachon M. Ewing R. C. Tice M. M. Williford B. | *Microbial Biosignature Investigation in Aeolian Environment Using μXRF (X-Ray Fluorescence) Analyses that Simulate the PIXL Instrument Onboard the Perseverance Rover from NASA's Mars 2020 Mission* **[#1723]** Our pipeline enables the investigation of key parameters on the analysis of biosignature-bearing outcrops via the PIXL (Planetary Instrument for X-ray Lithochemistry) instrument onboard the Perseverance rover (NASA Mars 2020 mission). |
| Anderson R. B. Forni O. Clegg S. M. Cousin A. Frydenvang J. et al. | *SuperCam Laser Induced Breakdown Spectroscopy (LIBS) Data Processing, Calibration, and First Results* **[#1606]** This abstract presents an overview of SuperCam LIBS capabilities, data processing, and the approach used for quantifying the abundance of major elements. |
| Fouchet T. Johnson J. R. Forni O. Reess J.-M. Bernardi P. et al. | *Supercam Visible/Near-Infrared Spectroscopy Onboard the Perseverance Rover* **[#1939]** We will present the science objectives and intrument performances of the passive visible/infrared spectroscopy function of the SuperCam instrument suite. We will report on the first spectra that should have been acquired by the time of the conference. |

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| Legett C. IV Newell R. T. Reyes-Newell A. L. Bernardi P. Forni O. et al. | *Optical Characterization of SuperCam Below 900 nm* **[#1516]** Instrument response / And wavelength calibration / We're ready for Mars. |
| Gasnault O. Virmontois C. Maurice S. Wiens R. C. Le Mouélic S. et al. | *What Supercam Will See: The Remote Micro-Imager Aboard Perseverance* **[#2248]** We present the performances of the remote micro-imager (RMI), one of the subsystems of the SuperCam instrument aboard Perseverance, landing in Jezero Crater, Mars, in February. |
| Beyssac O. Ollila A. M. Arana G. Angel S. M. Benzerara K. et al. | *SuperCam's Time-Resolved Raman and Luminescence Spectroscopy Onboard the Perseverance Rover* **[#1499]** This abstract presents the Raman and Luminescence techniques of SuperCam onboard the Perseverance rover. |
| Johnson J. R. Bell J. F. III Kinch K. M. Kristensen J. Merusi M. et al. | *Initial Mastcam-Z Multispectral Visible/Near-Infrared Observations of Mars 2020 Perseverance Rover Calibration Targets* **[#1213]** Laboratory visible/near-infrared spectra of the Mastcam-Z and SuperCam calibration targets on the Mars 2020 rover Perseverance will be compared to initial multispectral data acquired on Mars by the Mastcam-Z stereo imaging system. |

## [P615]
## POSTER SESSION: SPECIAL SESSION: MARS 2020 INITIAL RESULTS II: ATMOSPHERE AND ENVIRONMENT

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| McConnochie T. H. Fouchet T. Montmessin F. Beck P. Chide B. et al. | *Mars Atmospheric Science with SuperCam's Visible and Near-Infrared Passive Spectroscopy Modes* **[#1367]** We present plans to use SuperCam's passive visible and near-infrared ("VISIR") spectroscopy technique for atmospheric science by observing solar radiation scattered by the martian sky. Measurement objectives include $O_2$, CO, $H_20$, and aerosols. |
| Murdoch N. Lorenz R. Chide B. Cadu A. Stott A. et al. | *Predicting Signatures of Dust Devils Recorded by the SuperCam Microphone* **[#1658]** The SuperCam Microphone (with a bandwidth from 100 Hz to 10 kHz) has the potential to observe and characterize convective vortices. The form of the vortex signals will also provide an indication of the closest approach distance of the vortex. |
| Toledo D. Apéstigue V. Arruego I. Smith M. D. Lemmon M. et al. | *Aerosol Retrievals from MEDA RDS* **[#1845]** In this work, we will present some the retrieval procedures that will be used for the analysis of MEDA-RDS observations on Mars, and the results obtained during a terrestrial field campaign for which RDS retrievals were compared against a photometer. |
| Mezilis J. A. | *Initial Acoustic Results from Mars 2020 Perseverance Entry, Descent, and Landing Camera [EDLCAM] Microphone System* **[#2305]** Mars 2020 Perseverance will capture the first unadulterated audio data from the martian |

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| | atmosphere as part of the Entry, Descent, and Landing Camera operations during the EDL sequence. These data are expected to be received by early March 2021. |
| Gómez F. Conrad P. Pla-García J. Rodríguez-Manfredi J. A. | *Astrobiological Implications from MEDA Atmospheric Measurements* **[#1530]** MEDA instrument onboard Perseverance rover is made up of a set of meteorological sensors including wind sensor, pressure, a relative humidity, temperature, and radiation among others. First results and astrobiological implications will be presented. |
| Chide B. Lanza N. L. Alvarez C. Angel S. M. Bernardi P. et al. | *The SuperCam Microphone and Expected First Sounds at Jezero Crater, Mars* **[#1127]** This presentation aims to show the expected first results from the SuperCam microphone onboard the NASA Perseverance rover. |

## [P616]
## POSTER SESSION: MSL CURIOSITY RESULTS: SEDIMENTARY GRAINS, ROCKS, AND PROCESSES IN GALE CRATER

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Christian J. R. Arvidson R. E. Mellon M. T. Vasavada A. R. Weitz C. M. | *High-Resolution Thermophysical Mapping of Glen Torridon and Gale Crater, Mars* **[#1215]** Thermal inertia is mapped at high resolution in Gale Crater using CRISM data, with ground truth observations derived from Curiosity. Spatial variations are correlated with units visited by Curiosity. |
| Caravaca G. Mangold N. Dehouck E. Schieber J. Bryk A. B. et al. | *Evidence of Depositional Settings Variation at the Jura/Knockfarril Hill Members Transition in the Glen Torridon Region (Gale Crater, Mars)* **[#1455]** The Jura/Knockfarril Hill mbr transition (Glen Torridon region, Gale Crater) is investigated as a change in depositional settings is hinted by lateral and vertical variations observed in the sedimentary, stratigraphic, and geochemical records. |
| Minitti M. E. Rivera-Hernández F. Bennett K. A. Gupta S. Wiens R. C. | *Rock Textures and Grain Sizes in the Glen Torridon Region (Gale Crater, Mars) Observed by the Mars Hand Lens Imager (MAHLI) and ChemCam* **[#2435]** We describe MAHLI observations of rock textures, and ChemCam measurements of grain size throughout the clay-bearing Glen Torridon region of Gale Crater. |
| Caravaca G. Le Mouélic S. Mangold N. Le Deit L. | *Using Virtual Reality Tools to Characterize and Measure Sedimentary Series in Gale Crater: A Case Study* **[#1169]** This work presents advances made towards the realization of virtual Rreality “field work” campaigns on planetary outcrops (digitally reconstructed using orbital and ground-based probes data) to assess the local sedimentology and geomorphology. |
| Weitz C. M. Sullivan R. J. Baker M. Grant J. A. | *Aeolian Bedform Grain Properties at Gale Crater from Vera Rubin Ridge to the Sands of Forvie* **[#1596]** Grain sizes were measured at several aeolian bedforms, with sand grains 50-150 µm in |

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| | length the most abundant on and within active aeolian bedforms. Larger ripple crests had coarser grains, inactive bedforms had granules and pebbles armoring them. |
| Moreland E. L. Arvidson R. E. | *Compositional Variance of Aeolian Deposits in Gale Crater, Mars* **[#2397]** Investigation of mineral abundances within the Bagnold Dunes and Sands of Forvie in Gale Crater. Preliminary models of CRISM spectral data show key differences in composition between the two locations of interest. |
| Le Mouélic S. Gasnault O. Rapin W. Bryk A. B. Dietrich W. E. et al. | *Housedon Hill — A ChemCam RMI Mega Mosaic to Investigate Distant Features in Gale Crater* **[#1408]** We describe the long distance imaging campaign performed by ChemCam Remote Microscopic Imager onboard Curiosity between sols 2878 and 2921. It covers 50° in azimuth from the bottom layers of Mount Sharp up to VRR, and reveal several layered units. |
| Newsom H. E. Scuderi L. A. Gallegos Z. E. Williams J. M. Dimitracopoulos F. D. et al. | *Evidence for Glacial and Fluvial Processes on Gale Crater Rim — Dulce Vallis* **[#2256]** The Gale Crater rim exhibits evidence for glacial processes in the form of U-shaped valleys and a late fluvial episode that is represented at Dulce Vallis by V-shaped sapping valleys that cut the earlier valleys. |

## [P617]
## POSTER SESSION: GALE CRATER GEOCHEMISTRY

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Johnson J. R. Bell J. F. III Wiens R. C. Maurice S. Gasnault O. et al. | *New Iron Meteorite Detections by the Mars Science Laboratory Curiosity Rover in the Southern Glen Torridon Region* **[#1212]** The MSL Curiosity rover identified 3 large (~1m) iron meteorite candidates on Sols 2958–2970 in the southern Glen Torridon region using visible/near-IR spectroscopy (Mastcam multispectral, ChemCam passive) supported by Remote Micro-Imager images. |
| Henley T. L. J. Schmidt M. E. Bray S. L. Zheng J. J. | *An Update on Martian Dust Coverage and Contribution to APXS Elemental Concentration and Bedrock Composition for Rock Targets in Gale Crater* **[#2241]** This abstract updates findings from dust coverage analysis and the impacts it has on bedrock composition and elemental concentration. Demonstrates the downward trend in overall dust coverages throughout the mission. |
| Zhao S. Shi Y. Karunatillake S. Xiao L. | *Computational Photoanalysis Software for Martian Soil Granulometry* **[#1959]** We developed a semi-automated image segmenting software that could conduct fast grain segmenting and granulometry measurement of the MAHLI and MI images and provide results comparable to other commonly used methods. |
| Nikiforov S. Y. Djachkova M. V. Mitrofanov I. G. | *Pixel Map Interpretation of the MSL DAN Passive Measurements* **[#2159]** |

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| Litvak M. L. Lisov D. I. et al. | This work presents DAN pixel representation of passive data. This dataset can be useful to perform much better interpretations of local water-rich spots in correspondence with geomorphological variations of the Gale Crater surface. |
| Berger J. A. VanBommel S. J. V. Clark B. C. Gellert R. House C. H. et al. | *Manganese- and Phosphorus-Rich Nodules in Gale Crater, Mars: APXS Results from the Groken Drill Site* **[#2194]** Dark Mn- and P-rich nodules found by Curiosity are consistent with Mn(II)-bearing phosphate and add further evidence of Mn and P mobility in Gale Crater fluids and constraints on geochemical conditions. |
| Gasda P. J. Anderson R. Cousin A. Forni O. Clegg S. M. et al. | *A Multivariate Manganese Calibration Model for ChemCam* **[#1272]** A refined model to predict manganese composition on Mars with ChemCam. |
| Comellas J. M. Essunfeld A. Lanza N. Gasda P. J. Delapp D. et al. | *Geologic Interpretations of Elevated-Mn ChemCam Targets in the Bradbury Rise, Gale Crater, Mars* **[#2176]** Manganese on Mars / Formed there? Or secondary / fluid deposit? |
| Essunfeld A. Comellas J. M. Lanza N. Gasda P. Delapp D. et al. | *Attribute Recognition for Grouping Elevated-Manganese ChemCam Targets by Visual Characteristics* **[#2180]** Classify without / Your process-driven bias? / A problem no more. |
| Nikiforov S. Y. Djachkova M. V. Mitrofanov I. G. Litvak M. L. Lisov D. I. et al. | *Water Estimation in Vera Rubin Ridge and Glen Torridon Based on Measurements of the MSL/DAN Instrument* **[#2152]** MSL/DAN measurements in Glen Torridon region by Sol 2900 show notable increase in WEH values in comparison to previous observations with MSL/DAN passive and active measurements. |
| Mittal S. Hanley J. Horgan B. Carmack R. | *Reinvestigating Gale Crater with New NIR Spectral Parameters* **[#2017]** The presence of hydrated chlorine salts on the martian surface implies a higher water stability on Mars, which could indicate better habitability. Seven CRISM images from Gale Crater were analyzed to see if hydrated chlorine salts were present. |
| Gellert R. Berger J. A. Boyd N. I. O'Connell-Cooper C. D. McCraig M. et al. | *The Sulfate Unit at Gale Crater: What to Expect There and How to Explore It* **[#1732]** We discuss in which settings sulfates have been detected by landed missions on Mars so far and discuss their relevance for Gale Crater, where Curiosity will soon enter the area that shows evidence for sulfates. |
| Parente M. Saranathan A. M. Itoh Y. Bishop J. L. Weitz C. M. | *Characterizing Aqueous and Mafic Mineralogy at Gale Crater, Mars with New Hyperspectral Algorithms* **[#2736]** Improved image processing has enabled identification of distinct outcrops of Fe/Mg-smectites, poorly crystalline smectites, polyhydrated, and monohydrated sulfates, and an additional weakly hydrated material at Gale Crater near the rover traverse. |
| Clark J. V. Lanza N. Rampe E. B. Archer P. D. Morris R. V. et al. | *Evolved Gas Analysis of Manganese-Bearing Phases and Implications for the Sample Analysis at Mars (SAM) Instrument on Board the Curiosity Rover in Gale Crater, Mars* **[#1206]** High Mn abundances were detected in a rock that was drilled in the Glen Torridon region called "Groken." We characterized the evolved gas profiles of several Mn-bearing phases on SAM-like laboratory instruments and compared to data from Groken. |
| David G. Cousin A. Forni O. Meslin P. Y. Dehouck E. et al. | *Chemical Characterization of Fe-Rich Diagenetic Nodules with ChemCam in the Glen Torridon Region, Gale Crater, Mars* **[#1433]** Iron abundances in nodular bedrock probed with the ChemCam instrument were refined |

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| | in order to study the potential relationship and formation process with other diagenetic features found in Vera Rubin Ridge. |
| Dehouck E. Cousin A. Mangold N. Frydenvang J. Gasnault O. et al. | *Leaving Glen Torridon: Bedrock Geochemistry Measured by ChemCam en Route to the Sulfate Unit of Gale Crater* **[#1858]** We report the findings of the ChemCam LIBS instrument during the last stretch of the Glen Torridon campaign, from Bloodstone Hill to the Sands of Forvie, as Curiosity approaches the transition into the sulfate-bearing unit. |
| Turner S. M. R. Schwenzer S. P. Bridges J. C. Sutter B. Bedford C. C. | *Modeling Water-Rock Reactions Beneath the Greenheugh Pediment, Gale Crater, Mars* **[#2440]** Thermochemical modeling to investigate water-rock reaction hypotheses for alteration in the Murray formation below the Greenheugh Pediment in Gale Crater. |
| Khan S. Y. Stack K. M. | *Geochemistry and Stratigraphic Classification of Sandstones Observed by the MSL Curiosity Rover* **[#2560]** Geochemistry / Of sandstones in Gale Crater / Match stratigraphy? |
| Haber J. T. Horgan B. Fraeman A. A. | *Using Color to Map Diagenesis in Gale Crater: Comparing the Rover and Orbital Perspective* **[#1607]** Weird rocks on the ground / May be found elsewhere in Gale / Looks cool in HiRISE. |
| Ettenborough I. E. Thomson B. J. Weitz C. M. Bishop J. L. Seelos K. D. | *Monohydrated and Polyhydrated Sulfates in Southeastern Aeolis Mons* **[#2308]** Gale Crater is hypothesized to have hosted an ancient lake on Mars. Looking at the presence and distribution of monohydrated and polyhydrated sulfates within Gale can provide insight into the past depositional environment. |

## [P618]
## POSTER SESSION: EXOMARS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Sefton-Nash E. Fawdon P. Orgel C. Balme M. Quantin-Nataf C. et al. | *Team Mapping of Oxia Planum for the ExoMars 2022 Rover-Surface Platform Mission* **[#1947]** We report on the group based high resolution geologic mapping campaign of the Oxia Planum landing site for the ESA-Roscosmos ExoMars 2022 Rover Surface Platform Mission. |
| Hauber E. Tirsch D. Adeli S. Acktories S. Steffens S. et al. | *Regional Geologic Mapping of the Oxia Planum Landing Site for the Exomars 2022 Mission* **[#2057]** A rover will land / In a small landing ellipse / But more is around. |
| Bontognali T. R. R. Kuhn N. J. Kuhn B. Josset J.-L. Hofmann B. et al. | *The CLUPI Science Operation Testing Facility: Preparatory Activities for Acquiring Ideal Close-Up Images During the ExoMars 2022 Mission* **[#1861]** |

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| | Identification of optimal lighting conditions to visualise rock structures associated with past microbial with the ExoMars close-up imager (CLUPI) carried out in the CLUPI Science Operation Testing Facility ("Marslabor") of the University of Basel. |
| McNeil J. D. Fawdon P. Balme M. R. Coe A. L. | *Mounds in the ExoMars 2022 Landing Site* **[#1417]**<br>Approximately 100 decametre-scale mounds exist in and around the ESA ExoMars 2022 landing site. Here, we present our preliminary investigation into their place in the stratigraphy, and identify their relationship to other regional units important to the rover. |
| Silvestro S. Tirsch D. Pacifici A. Salese F. Vaz D. A. et al. | *Change in the Wind and Climate at the ExoMars 2022 Landing Site in Oxia Planum (Mars)* **[#1442]**<br>Here, we firstly describe a Periodic Bedrock Ridge (PBRs) pattern from the ExoMars 2022 landing site. Formative paleowind directions are extrapolated from PBRs and TARs providing evidence for an Amazonian change in the wind regime. |
| Favaro E. A. Balme M. R. Davis J. Grindrod P. M. Fawdon P. et al. | *The Aeolian Environment of the Landing Site for the ExoMars Rosalind Franklin Rover in Oxia Planum, Mars* **[#1873]**<br>Sediment, winds, whoosh / Transport, abrade, create. Wow! / Is it windy now? |
| Frigeri A. De Sanctis M. C. Altieri F. Ammannito E. Ferrari M. et al. | *Integrating Drill Telemetry in Ma_MISS Science Onboard the ExoMars 2022 Rover* **[#1462]**<br>The ExoMars 2022 drill will explore the layering at Oxia planum up to 2 meters of depth. Here, we report our activity towards the integration of the drill's telemetry and spectrometer data to define a litho-mechanical stratigraphy at the drill site. |
| Früh T. Hauber E. Adeli S. Tirsch D. Nass A. | *Northern Xanthe Terra: A Reference Site to Test Hypotheses Related to the Oxia Planum Landing Site for ExoMars 2022* **[#1977]**<br>ESA's ExoMars rover will land in the Oxia Planum region in 2022. To test the hypothesis that Oxia Planum is representative on a regional/global scale, we selected a site in northern Xanthe Terra to investigate key geologic features. |
| Altieri F. Frigeri A. De Sanctis M. C. Ferrari M. De Angelis S. et al. | *Spectral Classes Investigation on Oxia Planum, the EXOMARS 2022 Landing Site, by Means of CRISM/MRO Data* **[#2040]**<br>CRISM/MRO data are used to investigate the spectral variability of the hydrated terrains on Oxia Planum, the ExoMars 2022 landing site, with particular focus on the distribution of the 2.4 and 2.53 micron absorption bands. |
| Woodley S. Z. Fawdon P. Balme M. R. Rothery D. A. Favaro E. | *Tectonic Features in Western Arabia Terra and Their Implications for the ExoMars 2022 Rover Landing Site* **[#1234]**<br>Look! Wrinkle ridges / In Arabia Terra / North-south trend. Phases? |
| Formisano M. De Sanctis M. C. Federico C. De Angelis S. Ferrari M. et al. | *Thermophysical Modeling of Oxia Planum, Landing Site of ExoMars 2022* **[#1894]**<br>In this work, we performed numerical simulations of the landing site of ExoMars 2022 of: I) the influence of the thermal inertia on the (sub)surface temperature, and II) the evaluation of the heat released in the subsurface by the drilling operations. |
| Apuzzo A. Schmidt G. W. Cianfarra P. Frigeri A. Salvini F. | *Tectonic-Related Fractures in Oxia Planum (Mars) and Their Implication for Life Investigation* **[#2082]**<br>We explore the possible tectonic origin of the fractures of the Exomars 2022 landing site. We mapped the fractures that characterize the clays soils of Oxia Planum and we statistically analyzed them. |
| De Silva G. Horgan B. Kinzelman P. Van Buskirk M. Forss J. | *Identifying Fracture Networks at Oxia Planum and Mawrth Vallis, Mars* **[#2553]**<br>ExoMars study fractures / Which preserve biosignatures / So, how did they form? |

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| Turchinskaya O. I. Agapkin I. A. Dmitroskiy A. A. Slyuta E. N. | *Analysis of the Terrain and Surface Slopes of the Potential Landing Area of the ExoMars Spacecraft Oxia Planum* **[#2442]** In our study, we used a map (by the MOLA Laser Altimeter) to provide a general topographic characterization of the Oxia Planum and Mawrth Vallis landing sites and to estimate the spatial and frequency distribution of long-wave slope. |

## [P619]
## POSTER SESSION: GEOCHEMISTRY: THE THINGS MICROBES CARE ABOUT

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|---|---|
| Goodale C. D. Lynch K. L. Bond R. J. Peretyazhko T. S. | *A Thermodynamic Model for Ancient Perchlorate-Driven Ecosystems on Mars* **[#1273]** The energetic feasibility of biological perchlorate reduction is evaluated for Pilot Valley, Utah, a martian analog environment known to harbor naturally occurring perchlorate salts as well as a microbial community capable of reducing perchlorate. |
| Ramkissoon N. K. Turner S. M. R. Macey M. C. Schwenzer S. P. Reed M. H. et al. | *Geochemical Energy Available to Microbes in Martian Impact Craters* **[#1518]** Martian impact craters are considered suitable locations for life. We have used thermochemical modelling and thermodynamic calculations to show impact crater environments have the potential to support microbial cell numbers similar to those observed on Earth. |
| Pál B. | *Global Deliquescence Possibility on Present Day Mars from Model Calculations* **[#1864]** Deliquescence, the transient formation of salty brines through adsorbing water vapor from the atmosphere, is a potential way for liquid water to exist on present day Mars. In this work, the global chance for deliquescence is illustrated with maps. |
| Jusino M. Cleaves H. J. II | *Modeling Global Geochemical Cycling of Phosphorus and Sulfur on Terrestrial Planets* **[#2756]** The behavior of phosphorus and sulfur in abiotic environments, how distinct reservoirs interact with each other, and how the distribution of these chemical species changes through time are not completely understood. |
| Navarro-González R. Coll P. Szopa C. Freissinet C. Buch A. et al. | *Search of Phosphine in the Evolved Gases from Hypophosphite/Phosphite Minerals in Lacustrine Sedimentary Rocks at Gale Crater by the Sample Analysis at Mars* **[#1358]** We use the fragmentation patterns of the ion mass ratios P+/$PH_2$+, P+/PH3+, and $PH_2$+/PH3+ to search for the release of PH3 in the evolved gas analyses by SAM. |
| Litvak M. L. Mitrofanov I. G. Sanin A. B. Bakhtin B. N. Golovin D. et al. | *The Measurements of Neutron Radiation Dose During Mars Odyssy Cruise to Mars* **[#2058]** We analyzed HEND/Mars Odyssey measurements and modeled spacecraft neutron |

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| | spectral density to estimate equivalent neutron dose rates during Odyssey cruise phase, which corresponds to the solar maxim period. |

## [P620]
## POSTER SESSION: FANS, DELTAS, AND LAKES ON MARS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Wilson S. A. Morgan A. M. Howard A. D. Grant J. A. | *A Global Inventory of Craters with Alluvial Fans and Deltas on Mars* **[#2703]** We conducted a systematic survey of CTX data and present a global inventory of craters on Mars that host alluvial fans and deltas. |
| De Toffoli B. Plesa A.-C. Hauber E. Breuer D. | *Global Mapping of Martian Delta Deposits* **[#1505]** This work aims to provide a complete mapping of martian delta deposits in order to examine the distributions of past standing bodies of water and thus water availability throughout time. |
| Silva D. C. A. Vaz D. A. Di Achille G. | *Towards an Improved Morphometric Database of Valleys and Fans on Mars* **[#2084]** We present a new detailed morphometric and volumetric survey of fans and valley networks on Mars. The aim of this project is to extend and improve the existing database in order to understand how and when the martian fan-shaped deposits formed. |
| Tebolt M. A. Goudge T. A. | *Investigation of the Depositional Environment of Martian Sedimentary Fan Features* **[#1525]** Fifteen sedimentary fan features across the surface of Mars are analyzed for evidence of a stratigraphic slope break. At least one fan does show evidence of a slope break, and is classified as a delta. |
| Suárez J. Guerrero D. Soler N. Rámirez D. Escobar C. et al. | *Hydric Evolution of Two Deltas in the Ismenius Cavus System, Mars* **[#1177]** The analysis of two martian deltas close to Mars north hemisphere dichotomy shows that terrains close to this limit underwent different types of hydric regimes, and illustrates the transition from a water rich Mars to the current frozen desert. |
| Mason D. P. Scuderi L. A. Li H. Yang X. Newsom H. E. | *Gobi Desert Deltas as an Analogue Environment for Jezero Delta Mars* **[#1664]** Much like the Jezero delta, the deltas of the Gobi Desert exhibit classic river-dominated lobate features, and may provide high quality analogues for Jezero and other river-dominated deltas on Mars. |
| Ando J. K. Rivera-Hernández F. Palucis M. | *Does the Morphology of Alluvial Fan Drainage Basins Reflect their Climate?: A Case Study of Terrestrial Basaltic Fans* **[#1593]** The circularity function developed by Stepinski and Stepinski (2005) is used on alluvial fan drainage basins in basaltic terrains, to examine whether climate plays a dominant role in basin morphology. |

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| Bamber E. B. Goudge T. A. Fassett C. I. Osinski G. R. | *Formation of Inlet Valleys into Crater-Hosted Lakes on Mars* **[#1793]** Intriguing inlets / Traverse Mars' crater basins; / Shape to reveal: How? |
| Nussbaumer J. W. | *Evidence for a Paleolake in Galaxias Chaos, NW Elysium Planitia, Mars* **[#2037]** A lake formed west of the Hecates Tholus volcano from water reservoirs. There are similarities between the edges of the paleolake and terrestrial shoreline complexes. |
| Baum M. Wordsworth R. Goudge T. | *Consequences of Early Ocean and Shoreline Deformation Scenarios for Jezero Crater, Mars* **[#2402]** Global topographic deformation scenarios to correct the "Arabia" level on Mars submerge Jezero Crater under the proposed oceans. The oceans couldn't have existed during hydrological activity at Jezero, which was during the main VN formation period. |
| Jodhpurkar M. J. Bell J. F. III | *Mapping and Interpreting the Northern Fan Deposit in Jezero Crater, Mars* **[#2252]** We used orbital imagery to create a photogeological map of the northern fan deposit in Jezero Crater and determine whether the deposit is a remnant of the main western delta or an extension of the northern channel. |
| Neesemann A. Walter S. H. G. Gross C. Jaumann R. Gwinner K. et al. | *High-Precision Topographic Map of the Mars 2020 Landing Site as Part of the MC-13E SyrtisMajor Quadrangle Digital Terrain Model.* **[#2509]** For more than 17 years, the HRSC on board Mars Express has acquired image data of the Red Planet on a global scale and at high resolution. Here, we present the only recently finished MC-13E Syrtis Major HRSC-based DTM covering the Mars 2020 Perseverance rover landing site. |

## [P621]
## POSTER SESSION: MARS GEOMORPHOLOGY

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Niu S. Zhang F. Di K. Gou S. Bugiolacchi R. | *Dating and Morphological Characterization of Layered Ejecta Craters in the Candidate Landing Areas of China's First Mars Mission (Tianwen-1)* **[#1786]** In the two candidate landing areas for China's first Mars mission (Tianwen-1), we performed crater counting on 78 layered ejecta craters and morphological analysis of their ejecta to gain a deeper insight into the subsurface volatile conditions. |
| Shaver E. Thomson B. J. | *Quantifying Erosion Rates on Mars Using Impact Crater Statistics* **[#1760]** We examine the erosion rates on Mars by documenting the rollover diameter between erosion and production of craters across the planet's northern hemisphere. |
| Archer B. R. Hynek B. M. Robbins S. J. | *Crater Evidence Does Not Support the Late Noachian Icy Highlands for Mars* **[#2220]** Various researchers hypothesize the presence of a Late Noachian Icy Highlands (LNIH) |

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| | cold-locked glacier above 1 km equilibrium-line altitude (ELA) due to a faint young sun. This study finds no statistical evidence for a planetary scale LNIH ice cap. |
| Fastook J. L. Head J. W. | *Drainage of Moats Surrounding Lava Deposits Superposed on Martian Ice Sheets* **[#1181]** With a model of water-filled crevasse penetration to the bed of an ice sheet, an estimate of timing and behavior of melt water draining through potential crevasses from meltwater-filled moats surrounding superposed lava on ice sheets. |
| Fastook J. L. Head J. W. Scanlon K. E. Weiss D. K. Palumbo A. M. | *Hellas Basin, Mars: A Model of Rim and Wall Glaciation in the Late Noachian and Predictions for Enhanced Flow, Basal Melting, Wet-Based Glaciation and Erosion, and Generation and Fate of Meltwater* **[#1528]** An ice sheet model (UMISM) adapted to Mars, driven by GCM results for the Late Noachian Era, is used to investigate possible scenarios for ice flow into Hellas Basin, assuming different amounts of available water (GEL). |
| Heidenreich J. Rogers E. Qualizza B. Dawson H. Horgan B. | *A Possible Subaqueous Hydrothermal System in Melas Chasma, Mars* **[#2432]** In this study, we use hyperspectral orbital data and high-resolution images to constrain the origins of various morphologic features in Mars' Southwest Melas Chasma and explore the likelihood of a subaqueous hydrothermal system in its ancient past. |
| Schmidt G. W. Luzzi E. Apuzzo A. Rossi A. P. Pondrelli M. et al. | *Water Table Level Controls in Western Arabia Terra Recognized from the Characteristics of the ELDs within Becquerel Crater, Mars* **[#2778]** Two ELDs are located within Becquerel Crater (Arabia Terra, Mars). The two deposits are separated by a elevation difference of 800 m. By analyzing the structure, stratigraphy, and mineralogy of these deposits, the influence of water is constrained. |
| Chapline D. E. Salvatore M. R. | *Characterizing Geomorphic and Mineralogical Features in the Eridania Basin and Their Implications for the Geologic History of Mars* **[#1269]** We investigate the morphology, topography, and mineralogy of the Eridania Basin to elucidate its lacustrine history. Evidence suggests multiple generations of lacustrine and aqueous modification. |
| Wilson S. A. Howard A. D. | *Distribution Characteristics of Martian Southern Mid-Latitude Pollywog Craters* **[#1105]** Small craters with exit breaches and outlet channels (pollywogs) are abundant in the southern mid-latitudes of Mars, dominantly in the 1–5 km diameter range. |
| Davis J. M. Aranos L. Fawdon P. | *The Evolution of Ancient Fluvial Systems in Memnonia Sucli, Mars: Impact Crater Damming, Aggradation, and a Drying Inner Sea on the Dichotomy?* **[#1229]** Impact dams and fans / Build landscape and fill valleys / On dichotomy. |
| Nerozzi S. Tober B. S. Ortiz M. R. Holt J. W. | *Revealing the Geologic and Fluvial History of Hebrus Valles and Hephaestus Fossae on Mars* **[#2590]** Water carved old plains: / Channels, fractures, collapses. / An ancient story. |
| Coughenour C. L. Coleman N. M. | *Hydrology of Scamander Vallis, Mars* **[#1066]** Scamander Vallis is a large, anomalous channel in Arabia Terra. The vallis originated with overflow and breaching of an unnamed crater. MOLA data permit new estimates of hydraulic processes, including bankfull and eroding channel scenarios. |
| Schuring I. H. M. Foing B. F. | *Martian Valley Formation Due to Basal Melting of Ice Sheets at High Obliquity* **[#2092]** We compare geomorphological evidence for glaciation with climate and ice sheet |

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| | simulations for a high obliquity of 60 degrees to assess the likelihood of subglacial erosion as a cause for valley formation. |
| Mangold N. Tornabene L. Conway S. Guimpier A. Noblet A. et al. | *The Unexpected Origin of the Branched Ridges at Antoniadi Crater, Mars* **[#1994]** Branched ridges in Antoniadi look like fluvial landforms / Detailed morphometry discard such an origin / Viscous flows they are. |
| Brož P. Hauber E. Conway S. J. Luzzi E. Mazzini A. et al. | *The Formation of the Kilometre-Sized Flows in Chryse Planitia (Mars)* **[#1614]** Chryse Planitia on Mars contains kilometer-sized flows which might have been formed by sedimentary volcanism. By using HiRISE DEMs, we study shapes of these flows and reveal the presence of surficial features supporting their sedimentary origin. |
| Buban H. C. Okubo C. H. | *Geologic Mapping in the Southern Utopia Basin* **[#2523]** The southern Utopia Basin of Mars is home to land-forms that are commonly referred to as pitted cones, and whose origin is currently unknown. Geologic mapping is ongoing in this area to try and understand the formation and history of these cones. |
| Berman D. C. Crown D. A. Bernhardt H. | *Geologic Investigations of Barnard Crater, Southern Hellas Region, Mars* **[#2199]** We are conducting geomorphic mapping and analyses of Barnard Crater with a focus on mantling and crater infill deposits, pedestal craters, arcuate ridges, lobate flows, and sinuous ridges. |
| Crown D. A. Chuang F. C. Rice J. W. | *Geologic Mapping of Gusev Crater, Mars* **[#1759]** We have initiated a new geologic mapping investigation of Gusev Crater, designed to produce a 1:250K-scale, formal geologic map focused on the geologic evolution of the Gusev rim and floor. |
| Burr D. M. Jacobsen R. E. Lefort A. Borden R. M. Peel S. E. | *Summary of Findings from a USGS Scientific Investigations Map (SIM) at 1:500k of the Aeolis Dorsa Region, Mars* **[#1315]** The Aeolis Dorsa region, along the Mars dichotomy boundary, includes extensive fluvial and aeolian landforms. To decipher the climate transition and other regional processes reflected in its landforms, a 1:500k USGS geologic map has been created. |
| Kearney M. L. Wynne J. J. Cushing G. E. Bardabelias N. M. Barlow N. G. | *Robotic Exploration Potential of Martian Caves* **[#2078]** Martian caves are among the best locations to search for evidence of extinct/extant life, may provide access to stable water ice deposits, and offer a protected environment for human habitation. We examined the robotic exploration potential of a subset of these features. |
| Coleman N. M. Coughenour C. | *Consideration of Stream Power and the Outflow Channels of Mars* **[#1010]** Despite the lower surface gravity, stream power calculations reveal the enormous erosive power of ancient megafloods on Mars. |
| Rezza C. A. Smith I. B. | *The Transmissive Clays of Ganges Chasma: An Investigation into SHARAD Observations on a Phyllosilicate Rich Plateau* **[#2455]** Subsurface layers / Overlain by fields of clay. / Why can we see them? |

## [P622]
## POSTER SESSION: MODERN MARS: EARTH, WIND, AND ICE

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Rubanenko L. Lapotre M. G. A. Schull J. Prerz-Lopez S. Fenton L. K. et al. | *Mapping Mars' Surface Winds from the Global Distribution of Barchan Dunes Employing Artificial Intelligence* **[#1650]**<br>Machines look at dunes / Reveal the wind direction / On Mars, desert world. |
| Horton P. | *Classification and Analysis of High Resolution Dust Devil Tracks on Mars* **[#1321]**<br>Martian dust devils create ephemeral surface features that briefly reveal the underlying substrate material. Using HiRISE images, this work documents high-resolution dust devil tracks, categorizes their albedo changes, and analyzes their orientation. |
| Gary-Bicas C. E. Michaels T. I. Rogers A. D. Fenton L. K. Warner N. H. et al. | *Investigating the Role of Amazonian Mesoscale Wind Patterns on the Spatial Distribution of Martian Bedrock Exposures* **[#1203]**<br>We used regional thermal data from Thermal Emission Spectrometer (TES) and compared it to Mars Regional Atmospheric Modeling System (MRAMS) numerical wind data to understand if wind patterns are a possible mechanism for bedrock exposure on Mars. |
| Hood D. R. Ewing R. C. Roback K. P. Runyon K. Avouac J.-P. et al. | *Interpreting Airflow Dynamics from Ripple Patterns and Migration Rates on Mars* **[#2106]**<br>Ripples creeping by / Along slopes, in trailing sands / Where does the wind blow? |
| Chojnacki M. Vaz D. A. Silvestro S. Silva D. C. A. | *Global Heterogeneity of Martian Megaripples and Transverse Aeolian Ridges: Distribution and Activity* **[#2524]**<br>We surveyed the global distribution and activity of intermediate-scale aeolian bedforms and find a high proportion of migrating megaripples in the sand seas surrounding the north polar cap. |
| Harrell M. J. Zimbelman J. R. | *Analysis of Transverse Aeolian Ridge Transitions on Mars* **[#1141]**<br>We analyzed 2,166 Transverse Aeolian Ridge crest terminations and categorized them based on their interactions with nearby ripples and megaripples. |
| Vaz D. A. Silvestro S. Chojnacki M. Silva D. C. A. | *Mapping of Meter-Scale Bedform Variability at Bagnold Dune Field* **[#1926]**<br>We identify and map four different sets of meter-scale bedforms using machine learning techniques. This project aims to investigate the complexity of boundary conditions influencing the Bagnold dune field. |
| Hooper D. M. Hubbard B. E. | *Linear Deconvolution Applied to Aster Imagery of Terrestrial Dune Analog Sites* **[#2474]**<br>We evaluate seven dune fields in the western United States and Alaska as potential martian aeolian analog sites by comparing their compositional similarities and differences between morphologically similar dune landforms found on Mars. |
| Arfstrom J. D. | *The Barchan-Shaped Depressions of the Equatorial Deposits of Mars* **[#1030]**<br>The equatorial deposits are marked by 100m-to-km scale barchan-shaped depressions that may be best explained by sublimation and could be indicators of the presence of ice up to at least some 10's to 100's of meters depth. |
| Runyon K. D. Viviano C. E. Day M. Seelos K. D. | *Abraded Pyroclastic Linear Paleodunes in Syria and Daedalia Plana, Mars* **[#1683]**<br>Dune-like, light-toned ridges show evidence for aeolian abrasion. We suggest they are |

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| | wind-mobilized volcaniclastic dust dunes which became indurated and subsequently abraded. |
| Cairns K. Hiesinger H. Iqbal W. | *Geology of Craters with Pits and Dune Fields in Noachis Terra, Mars* **[#2077]** We mapped seven craters with complex co-occurrence of pits and dune fields in the Noachis Terra region on Mars using CTX images, to establish a better understanding of their mutual relationship and their formation mechanisms. |
| Guimpier A. Conway S. J. Noblet A. Mangold N. | *Geologically Recent Earthflow-Like Landslides on Mars* **[#2122]** We focused on four small martian landslides of less than 20 Ma located in the Nilosyrtis Mensae region. We compared their morphology and inferred rheology with terrestrial analogues and identified similarities to terrestrial earthflows. |
| Huang R. I. Gulick V. C. Glines N. H. | *Slope Analysis of Martian Gullies in Three High-Northern Latitude Craters* **[#2625]** Study of gullies in northern high-latitudes of Mars (>50 deg. North). Expands on previous analysis by adding another crater's gullies and investigating slope and volume analysis. |
| Rogers E. R. Gulick V. C. Glines N. H. | *Understanding Equatorial Gully Erosion on Mars: A Case Study on Krupac Crater* **[#1745]** This study explores the equatorial gullies of Krupac Crater. We examined multiple datasets to measure and map the gully systems in ArcMap and ENVI, finding that the gullies may have formed by a dry-flow process possibly aided by fluvial activity. |
| Rangarajan V. G. Tornabene L. L. Osinski G. R. Seelos F. P. Conway S. J. et al. | *Semi-Quantitative Identification of Colour Associated Gully Changes Through CaSSIS Band Ratios and Spectral Analysis Techniques* **[#2195]** Identifying new gully changes on Mars — spatially and spectrally! |
| Gulick V. C. Glines N. H. | *Studies of Martian Gully Systems and Their Potential Paleoenvironmental Settings* **[#2773]** We have carried out systematic morphologic studies of several gully sites on Mars using HiRISE DTMs and stereo images. We report on morphologic, morphometric, slope, and volumetric trends and the potential role of volatiles in gully formation. |
| Levin J. N. Dickson J. L. Lamb M. P. | *Isolating the Role of Volatiles in the Erosion of Bedrock Chutes on Mars* **[#2317]** Studying the erosion of bedrock chutes on the rims of martian impact craters, with lunar craters as a comparison. |
| Tornabene L. L. Becerra P. Cesar C. Conway S. Cremonese G. et al. | *Potential Detection of Exposed Martian Water Ice with Multispectral Images from the 2016 Exomars TGO Colour and Stereo Surface Imaging System (CaSSIS)* **[#2459]** The ultimate goal of this work is to determine if the VNIR spectral characteristics of $H_2O$ ice are sufficiently diagnostic at the multiband-level to enable its identification with the Colour and Stereo Surface Imaging System (CaSSIS). |
| Parsons R. A. | *Martian Moraines and Ice Flow Models: A Path to Constraining Amazonian Obliquity?* **[#2047]** Ice accumulation pulses on Tharsis Montes induced by obliquity swings lead to velocity surges and equatorial moraines. Moraines form during glacial advance and are preserved when overridden by the ice mass. |
| Malakhov A. V. Mitrofanov I. G. Litvak M. L. Sanin A. B. Golovin D. V. et al. | *Areas with Enhanced Water Content Observed in Equatorial Areas of MarsTrough TGO's FREND Neutron Telescope* **[#2015]** We present a study based on high resolution maps of water in the upper 1m layer from |

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| | FREND instrument. Wet areas with as much as tens of weight percent of water were identified in equatorial regions, that were earlier believed to be mostly dry. |
| Schorghofer N. Levy J. S. Goudge T. A. Tebolt M. | *High-Resolution Thermal Environment of Recurring Slope Lineae at Palikir Crater, Mars* **[#1391]** Using new thermal modelling capabilities, we study the relation of seasonal frost with RSL locations. |
| Stillman D. E. Primm K. M. Bue B. Wagstaff K. L. Lee J. H. et al. | *RSL Geostatistics Show Slopes Above the Angle of Repose and Significant Enhancement After Mars Year 34 Dust Storm* **[#1578]** RSL are steep / Increased after the dust storm / Unique dry formation? |
| Valantinas A. Becerra P. Tornabene L. L. Pommerol A. Hauber E. et al. | *Colour and Multi-Angular Observations of Martian Slope Streaks* **[#2731]** Color and multi-angular observations of martian slope streaks supply new constraints on surface texture, roughness, and grain size. |
| Munaretto G. Pajola M. Lucchetti A. Cremonese G. Simioni E. et al. | *Multiband Photometry of RSL and Dust-Devil Tracks from CaSSIS Color Images* **[#1938]** We analyze the multiband photometry of martian Recurring Slope Lineae and dust-devil tracks in the NIR, RED, PAN, and BLU CaSSIS filters. |

## [P623]
## POSTER SESSION: MARTIAN GEOCHEMISTRY

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Turner S. M. R. Fawdon P. Davis J. M. | *Mineralogy of the Oxia Planum Catchment Area on Mars and Its Relevance to the ExoMars Rosalind Franklin Rover Mission* **[#2490]** Remote sensing study to explore the mineralogy of the Oxia Planum catchment area and to compare to mineral detections made within the Rosalind Franklin rover landing site, with considerations made with regard to geological context. |
| Peña A. B. Viviano C. E. Buczkowski D. L. Seelos K. D. | *Exploring Terra Sabaea Volcanic Terrain Using CRISM Mapping-Mode Data* **[#2240]** CRISM mapping-mode data is used to validate/map the compositions present in Terra Sabaea and characterize mineralogic transitions. Our findings display a chemical evolution of pyroxene in the primary crust and trends in elevation and thermal inertia. |
| Ludyan J. C. McHenry L. J. Grundl T. J. Routson A. S. | *Lack of Diagenetic Maturity Near Home Plate, Gusev Crater, Mars Favors Short-Term Hydrothermal Activity* **[#2372]** Quartz (rather than amorphous silica) in older sinter and in hydrothermally-altered soils at Geysir and Ölkelduháls in Iceland indicates significant diagenetic maturity, and its absence in Home Plate deposits on Mars indicates short-duration hydrothermal conditions. |
| Manzari P. Marzo C. Ammannito E. | *Automated Research of 3.3 um Absorption in Some CRISM IR Data: Acidalia Mounds,* |

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| | *Alba Patera, and Orcus Patera* **[#1616]**<br>We present some results of the research of 3.3 um absorptions in some CRISM data of Alba Patera, Orcus Patera, and Acidalia Planitia. We found pixel clusters showing interesting spectral features that will be subject of a further geological study. |
| Al-Samir M. Gross C. Schubert D. | *A Plausible Formation Model for the Maja Valles Outflow Channel System* **[#1491]**<br>Water volume calculations are performed comparing ILD-volume measurements and modeling results of evaporation pocesses in order to reconstruct the amount of water needed to flood the outflow channel system Maja Valles on Mars. |
| McGroarty F. C. Duncan M. S. Weller M. B. | *Modeling the Thermal and Chemical Evolution of the Martian Lithosphere Through Time* **[#2672]**<br>Mars' crust is cooling / Composition evolving / From past to present. |
| Hughes E. B. Karunatillake S. Hood D. R. | *Global and Regional Martian Regolith Compositions Derived from GRS and TES Data* **[#2170]**<br>Infrared spectra / Chemistry from gamma rays / Regolith revealed. |
| Broz A. P. Clark J. V. Archer P. D. Sutter B. Ming D. W. et al. | *Thermal and Evolved Gas Analysis of Mars Analog Paleosols: Mineralogy and Organic Preservation* **[#2136]**<br>We examine mineralogy and organic carbon content of 33-million-year-old Mars-analog paleosols (ancient, buried subaerial deposits) from eastern Oregon using instruments configured to operate like the SAM-EGA instrument onboard Curiosity Mars rover. |
| Knight A. L. VanBommel S. J. | *Preliminary Analyses of Select Trace Element Abundances from the Mars Exploration Rover Alpha Particle X-Ray Spectrometers* **[#1377]**<br>Preliminary trace element abundance proxies for Ge, Ga, and Cu are derived from spectral modeling of MER APXS data with the ultimate goal of decreasing the detection limits and providing improved quantification for trace elements. |
| Araneda P. C. Chemtob S. M. | *Dry Oxidation of Ferrous and Mixed-Valence Smectites and Its Implications for the Oxidative History of Mars* **[#2273]**<br>This study focused on observing the structural changes in ferrous and mixed-valence Fe/Mg smectites with varying starting compositions when exposed to different oxygen fluxes under dry conditions, to better understand the redox history of Mars. |
| Feldman A. D. Hausrath E. M. Tschauner O. Rampe E. B. | *Persistence of Fe-Containing X-Ray Amorphous Material Favored in Cooler Climates* **[#1782]**<br>Terrestrial ultramafic soils have been investigated using XRD and selective chemical dissolution techniques to examine the formation and longevity of Fe-rich amorphous material and clay minerals similar to those in Gale Crater. |
| Martinez-Sierra L. M. Jun I. Ehresmann B. Hassler D. Litvak M. L. et al. | *Galactic Cosmic Ray Induced Neutrons On and Around Mars* **[#1020]**<br>The martian neutron environment depends on the galactic cosmic rays, atmospheric conditions, and solar cycle phase. Data from Mars spacecraft (orbiter and rover) helps us understand the neutron flux intensity and evolution. |

## [P624]
## POSTER SESSION: ICY MARS GEOMORPHOLOGY AND GEOCHEMISTRY

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Golombek M. Williams N. Wooster P. McEwen A. Putzig N. et al. | *SpaceX Starship Landing Sites on Mars* **[#2420]** Seven landing sites in Phlegra and Erebus Montes and Arcadia Planitia, Mars have been selected for further study for SpaceX Starship missions. |
| Kirchoff M. R. Grimm R. E. Riggs J. D. | *Preliminary Examination of the Spatial and Temporal Distribution of Equatorial Layered and Radial Ejecta Craters on Mars* **[#1536]** We compute the formation ages of adjacent layered and radial (lunar-like ballistic) ejecta craters on Mars to better understand the spatial and temporal evolution of martian subsurface equatorial ice. Preliminary results will be presented. |
| Meng T. M. Petersen E. I. Holt J. W. | *Insolation-Driven Boundary Conditions for Debris-Covered Glaciers on Mars and Earth* **[#2503]** The mountain's shadow / Only makes it colder at / The right place and time. |
| Philippe M. Conway S. J. Soare R. J. Mc Keown L. E. | *Preferential Distribution of Ice-Wedge Polygons in Relation to Regolith Properties (Utopia Planitia, Mars)* **[#2304]** Recent studies attributed an ice-related origin to some martian mid-latitude polygonal-patterned ground. Here, the preliminary results of our work show that regolith properties play a role in these polygons' distribution and morphology. |
| Scanlon K. E. Head J. W. | *Volcano-Ice Interactions at Pavonis Mons, Mars: New Insights from CTX and HiRISE* **[#1259]** We survey volcano-ice interactions at the Pavonis Mons FSD, where glaciovolcanic edifices are less obscured by mantling material than in the other FSDs and can provide more specific insight into the environments and processes that formed them. |
| Howard A. D. Moore J. M. | *Martian Decrescent Scarps Backwasted by Ice* **[#1150]** In several locations, martian mid-latitude plateaus have undergone extensive decrescent lateral erosion through basal undercutting by glacial ice. |
| Voelker M. Cardesín-Moinelo A. Martin P. Mätzler E. | *Sinuous Channels on Amazonian Impact Ejecta — Indicators for Ground Ice?* **[#1424]** The goal of this work is to understand how and why small sinuous channels evolved on top of an Amazonian impact ejecta blanket. Can they be related to terrestrial supraglacial streams? |
| Voelker M. Hauber E. Parro L. Cardesín-Moinelo A. Martin P. | *Melting Mountains on Mars? —Sheet Deposits in a Montane Environment* **[#1427]** This work addresses the question if sheet deposits on top of a mountain range are either of magmatic or volatile-based origin, and whether their formation may be related to the high internal heat flux in the region. |
| Mantegazza M. Spagnuolo M. G. | *Illumination Analysis of Louth Crater and Its Relation with Ice Deposits* **[#1492]** Louth Crater contains a water ice mound placed near the center of the crater floor, slightly shifted to the north. In this work, we attempt to establish the origin of this ice mound based on the illumination pattern under different conditions. |
| Das E. Mustard J. F. Tarnas J. D. | *Investigating the Origin of Gypsum in Olympia Undae: Characterizing the Mineralogy* |

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| | *of the Basal Unit* **[#2390]**<br>We examine the origin of gypsum in Olympia Undae by characterizing the mineralogy of the Basal Unit, which is a hypothesized potential source. We apply the novel Guided Endmember Extraction method to extract sulfate signatures in the Basal Unit. |
| Mantegazza M. Spagnuolo M. G. | *Analysis of Pit Craters on the Eastern Wall of Hale Crater* **[#1495]**<br>On the eastern outer slope of the Hale Crater we identified 72 pit craters and glacier and periglacial landforms. We aim to determine the relationship between these features and the processes of ice melting and groundwater. |
| Segura A. J. Martinez G. M. Smith M. D. | *Temporal and Spatial Variation of Hydrogen Content in the Martian Shallow Subsurface* **[#2431]**<br>We analyzed seasonal variations in the epithermal counting rates measured by the Neutron Spectrometer onboard Mars Odyssey to unveil the presence of water ice in the shallow subsurface of mid-latitude regions. |

## [P625]
## POSTER SESSION: ICE AT THE MARTIAN POLES

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| Clifford S. M. Wordsworth R. D. Greve R. | *Polar Basal Melting at Low Obliquity on a Cold Early Mars and Its Potential Implications for the Recharge of a Northern Ocean* **[#2724]**<br>The basal melting of the Late Noachian/Early Hesperian South Polar Layered Deposits is considered as a potential mechanism for the groundwater replenishment of an ice-covered northern ocean. |
| Abu Hashmeh N. Whitten J. L. Russell A. T. Putzig N. E. Campbell B. A. | *SHARAD Radar Attenuation in the South Polar Layered Deposits* **[#2522]**<br>Dusty polar ice / Radar echo fog beneath / Deep signal is weak. |
| Russell A. T. Putzig N. E. Abu Hashmeh N. Whitten J. L. | *Analysis of Radar Attenuation in the South Pole Layered Deposits of Mars with 3D Radar Imaging* **[#2536]**<br>We assess the radar attenuation in the south polar layered deposits (SPLD) using 3D radar imaging. A thickness map of the SPLD basal reflector was produced in order to perform the analysis. The low reflectivity zones (LRZs) were also mapped. |
| Broquet A. Wieczorek M. A. Fa W. | *Composition of the Martian Polar Caps from Radar, Elevation, and Gravity Data* **[#2060]**<br>We combine radar, elevation, and gravity data with a flexure model to invert for composition of the martian polar caps. Our inferred compositions suggest that, for reasonable dust content, large quantities of $CO_2$ ice are mixed in the polar deposits. |
| Cianfarra P. Schmidt G. W. Apuzzo A. Salvini F. | *Numerical Evolutionary Modeling of the Martian Polar Layered Deposits to Infer the* |

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| Balbi E. | *Role of Ice-Tectonics* **[#2526]**<br>Numerical modeling of the martian polar layered deposits by hybrid cellular automata allowed to replicate the ice internal architecture through the relative movement among blocks separated by listric shear discontinuities. |
| Innanen A. C. Landis M. E. Hayne P. O. Moores J. E. | *Mapping Swiss Cheese Terrain at the Martian South Pole to Understand its Possible Atmospheric Interactions* **[#2074]**<br>Do Swiss cheese features / Release water vapor from / The martian south pole? |
| Laferriere K. L. Bramson A. M. Smith I. B. | *3D Mapping of Migration Paths of Mars' North Polar Spiral Troughs* **[#1631]**<br>Mapping of the Trough Migration Paths, sloping unconformities in radar observations of the Northern Polar Layered Deposits, will allow for exploration of variations in shape of the paths and provide insight into Mars' polar volatile mass balance. |
| Acharya P. J. Smith I. B. | *Seasonal Variations of the Cold and Bright Anomalies on the North Polar Layered Deposits* **[#2541]**<br>Darkened polar caps / Seen during late summer / Are winds the culprit? |
| Stcherbinine A. Vincendon M. Montmessin F. Beck P. | *Evidence of an Additional North Polar Component in the Martian 3 Microns Water Band Observed by OMEGA* **[#1423]**<br>We present evidence for a new spectral component in the martian 3 microns water band that only appears under north polar latitudes, that may be of importance in the search for the origin of the strong polar increase of the surface aqueous alteration. |

## [P626]
## POSTER SESSION: MARTIAN HYDRATED MINERALS AND AQUEOUS ALTERATION

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| Adcock C. T. Hausrath E. M. Rampe E. B. Panduro-Allanson R. D. Steinberg S. M. | *In Situ Resources from Water-Rock Interactions for Human Exploration of Mars* **[#1665]**<br>Investigating the recovery of components, including hydrogen, from lunar and martian relevant materials as potential in situ resources for long-term human exploration missions. |
| Gibson C. A. Salvatore M. R. Edwards C. S. | *Is Early Mars Really More Altered than Modern Mars? A Statistical Assessment* **[#1171]**<br>We test the hypothesis that early Mars is more altered than modern Mars using a randomized and unbiased investigation of CRISM data. Our statistical results support this commonly accepted hypothesis. |
| Al-Samir M. | *Cold Vent Fluids in the Lower Crust of Juventae Chasma, Mars* **[#1448]**<br>Major fluxes of heat and mass between water and lithosphere are very complex and generally difficult to investigate, especially on Mars.An attempt was made by fluid-geochemical experiments, including leaching processes and numerical modeling. |

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| Aaron L. M. Seelos K. D. | *Investigation of Hydrothermal Clays and Sulfates in Tyrrhena Terra Martian Craters* **[#2763]**<br>Through mineralogical mapping, Mars' climate and environment during the Noachian and Hesperian period can be determined. |
| Hopkins R. J. Sklute E. C. | *Chemical and Spectral Properties of Iron-Sulfate Acid Solutions Through a Hydration/Dehydration Cycle: Implications for the Martian Regolith* **[#1534]**<br>We add representative martian regolith minerals and sodium chloride to anhydrous ferric sulfate to form an amorphous, or partially amorphous, material after a hydration/dehydration cycle. Product materials were analyzed via XRD, FTIR, and VNIR. |
| Wilk K. A. Bishop J. L. Itoh Y. Saranathan A. M. Parente M. et al. | *Characterizing Unusual Deposits at Ius Chasma, Mars* **[#1322]**<br>Ius Chasma, Mars contains layered outcrops of hydrated materials. Here we probed the mineralogy of the region, including aqueous components contributing to unique spectral features, and aimed to characterize the spectral doublet features identified. |
| Tu V. Ming D. W. Sletten R. S. | *Mineralogic Assemblages in Don Juan Pond Sediments, Antarctica Dry Valleys: Implications for Cation Exchange on Mars* **[#2053]**<br>This study's objectives were to characterize the mineralogy of these sediments to determine if there are mineralogical indicators and/or controls for the delivery of salts to DJP and understand the role of salts on Mars on these analog studies. |
| Yeşilbaş M. Bishop J. L. | *A Molecular Perspective for Transient Liquid Salty Brine Formation in Sediments from the McMurdo Dry Valleys, Antarctica, and Applications to Mars* **[#1476]**<br>This work provides a fundamental understanding for thin films of $H_2O$ in subsurface environments on Mars using samples from McMurdo Dry Valleys, Antarctica in mid-IR region. |
| Kodikara G. R. L. McHenry L. J. | *Visible-Near Infrared Spectroscopy of Lacustrine Sediments in Saline-Alkaline Playas: Implications for Paleolakes on Mars* **[#2299]**<br>We report the mineralogical and spectral analysis of evaporites from a small pond at the Panamint Basin, California, and demonstrate the capabilities and limitations of VNIR spectroscopy for the identification of evaporites in natural environments. |
| Qu HK. Wang A. Ling Z. C. | *Synthesis and Spectra of a Group of Hydroxy Ferric Sulfates Relevant to Mars* **[#2146]**<br>Two hydroxy ferric sulfates in fibroferrite-group that might occur on Mars were synthesized and spectral characterized using Raman, IR, and VNIR spectroscopy. |
| Yeşilbaş M. Bishop J. L. | *The Spectral Properties of Gypsum from -90 to 400 °C and Implications for Mars* **[#1968]**<br>This study serves an experimental approach to probe the dehydration features of gypsum mineral. This is important for interpreting the constrained water in the martian regolith to understand the geochemical history of Mars and its habitability. |
| Ju E. M. Ling Z. C. Xin Y. Q. Liu C. Q. Shi E. B. | *Synthesis and Spectral Studies of Two Calcium Sulfate Solid Solutions Related to Mars* **[#2075]**<br>In this study, two solid solutions of Ca-sulfate were successfully synthesized in the laboratory and reported their Raman spectroscopic properties. These two solid solutions are stable in ambient conditions for a long time. |
| Talla D. Bishop J. Wildner M. | *Reflectance Spectra of Monohydrated Sulfates with Variable Mg and Fe Abundance, and Implications for Their Identification on Mars* **[#1162]** |

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| | Reflectance spectra of synthetically prepared monohydrated Mg/Fe sulfate (MHS) show variability in band position based on the amount of Fe in the structure. Knowledge of these shifts can be used to infer the Fe content of MHS in martian outcrops. |
| Liu P. Liu C. Q. Xin Y. Q. Ling Z. C. | *LIBS, Raman, and VNIR Spectroscopic Studies of Hydrated Mg-Sulfates Relevant to Mars* **[#1996]**<br>We conduct a LIBS, Raman, and VNIR spectroscopic studies of Mg-sulfates with different hydration states in order to assess their potentials for determinination of the chemistry, mineralogy, and hydration states for Mars-related salts. |
| Morris R. V. Vaniman D. T. Clark J. V. Rampe E. B. Ming D. W. et al. | *Toward Understanding Ferruginous Smectite Mg-for-Ca Interlayer Cation Exchange, Crystalline Ca-Sulfates, and Amorphous Mg-Sulfates on Mars* **[#1761]**<br>We advance a pathway for precipitation of crystalline Ca-sulfates and amorphous Mg-sulfate based on experimental evidence for replacement of Ca interlayer cations in smectite SWa-1 by Mg sourced from Mg sulfate solutions. |
| Alemanno G. Carli C. Serventi G. Maturilli A. Helbert J. | *Systematic Study of Detection Limits of Hydrate and Carbonate Phases in Mixtures with Basaltic-Like Fine Regolith* **[#1465]**<br>To investigate the detection limits of hydrate or carbonates phases, we are studying the laboratory spectral behaviour of mixtures with basaltic fine regolith as Mars surface analog for the interpretation of current and new martian data. |
| Baker A. E. Gilmore M. S. | *Searching for Hydrous Carbonates on Mars: Investigation of CRISM Spectral Summary Parameters* **[#1714]**<br>Carbonates on Mars / Are they hydrated, hiding / From CRISM and us? |
| Dhoundiyal S. Porwal A. Thangjam G. | *Mapping Carbonates and Associated Minerals on Mars: A New Fuzzy System Based Approach* **[#2254]**<br>We propose a new fuzzy system based approach for mapping carbonates on Mars and present our progress in the development of new spectral parameters for identification of carbonates from CRISM hyperspectral data. |
| O'Connor R. A. Seelos K. D. Harryman J. Peña A. Viviano C. E. et al. | *Surface Minearlogic Mapping in Central Valles Marineris Using CRISM Multispectral Mapping Data* **[#1696]**<br>An investigation of the Central Valles Marineris region using CRISM mapping-mode data to identify and map mineralogy found on the valley floor. A focus on hydrated mineralogy, specifically monohydrated and polyhydrated sulfates, was used. |
| Harryman J. E. Buczkwoski D. L. Seelos K. D. Viviano C. E. | *Spectral Mapping Using CRISM Data in the Northwest Noachis Terra Region* **[#2203]**<br>CRISM measures the composition of Mars' surface and allows analysis of patterns of alteration on Mars. NW Noachis Terra's mineralogy is compared with known mineral matches and used to confirm past aqueous activity in the region. |
| Harrington E. M. Bultel B. B. Krzesińska A. M. Werner S. | *Detailed Chloride Mapping in Terra Sirenum, Mars* **[#1490]**<br>Oceans long since past / Dry, cracked ground, no trace remains / But the taste of salt. |
| Grant F. H. Bishop J. L. | *Mapping Phyllosilicates and Aqueous Alteration Products at Tyrrhena Terra, Mars* **[#1323]**<br>Analysis of martian surface mineralogy at Tyrrhena Terra using CRISM imagery and spectral data, with a focus on alteration minerals. Outcrops of phyllosilicate minerals and rarer minerals were observed to provide insight into alteration history. |
| Shubham S. Lee P. | *Noctis Landing, Mars: Regions of Interest with Diversity of Hydrated Minerals* **[#2591]**<br>Noctis Landing, a proposed human Landing Site and Exploration Zone in West Valles |

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| | Marineris, Mars, presents hydrated minerals attesting to a complex aqueous history and opportunities for future human exploration. |
| Zhang L. X. Fu X. H. Ling Z. C. | *The Coprecipitation of Akaganeite and K-Jarosite and Implications for Their Formation in Gale Crater, Mars* **[#1930]**<br>In order to constrain the aqueous environment on Mars, we synthesized akaganeite and K-jarosite, explored the upper and lower limits of $SO_4$2-concentration for the intergrowth of akaganeite and jarosite. |
| Tirsch D. * Voigt J. R. C. Viviano C. E. Bishop J. L. Lane M. D. et al. | *Spatial Trends in Mineral Abundances Across Tyrrhena Terra on Mars* **[#1193]**<br>We analyze the occurrence of various aqueous minerals in Tyrrhena Terra in relation to their occurrence in specific geomorphological units to reveal possible trends or gradients across the study region. |

## [P627]
## POSTER SESSION: MARS: OPTIMIZATIONS AND LAB BASED STUDIES

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Wang J. Liu H. S. Zhao J. N. Zhao J. W. Xiao L. | *PSI HX: A new Series of Martian Soil Simulants* **[#2479]**<br>We have developed a new series of martian soil simulants. The primary materials of PSI HX are Cenozoic basalt with different degrees of weathering. This abstract describes their composition, spectrum features, mechanical, and physical properties. |
| Becerra P. Affolter L. Pommerol A. Feller C. Lethuillier A. et al. | *Measurements of the Electrical Properties of New Planetary Soil Simulants* **[#2422]**<br>We present measurements of the electrical properties of martian and cometary analog soils, made at the University of Bern's Electrical Properties of Planetary Simulants and Ices Laboratory (EPSSIL). |
| Pandey A. Schwab P. Deng Y. Ming D. W. Rampe E. B. et al. | *Analysis of Complex X-Ray Amorphous Phase Assemblages with Potential Applications as Martian Soil Simulants* **[#1753]**<br>A robust laboratory-scale method to quantify the chemical composition of amorphous phases in mixed samples by combining chemical extraction and dissolution kinetic analyses with X-ray spectroscopy-based mass balance calculations is proposed. |
| Tian S. K. Ling Z. C. Liu C. Q. Bai H. C. Liu P. | *Laboratory Spectroscopic Characterization and Classification of Natural Kaolin-Group Minerals* **[#2188]**<br>We studied the spectral charactertistics of 13 kaolin-group minerals and rocks by VNIR, Raman, and LIBS with the intent of better identifying and classifying them using data from future Mars missions. |
| Pinet P. C. Daydou Y. H. Chevrel S. D. | *Olivine Composition and Reflectance Spectroscopy Relationship Revisited from Advanced Mgm Deconvolution Bbased on Synthetic Samples* **[#1422]** |

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| | The band center positions of the three primary olivine absorptions (M1-1, M2, M1-2) are used simultaneously to produce a constrained and improved prediction across an extended range Fo#[0-90] of olivine composition with synthetic or natural samples. |
| Xin Y. Q. Ling Z. C. Cao H. J. Liu C. Q. Bai H. C. | *Morphology, Structural, and Spectra Characterizations of Lab-Synthesized Manganese Oxides Relevant to Mars* **[#1955]** Manganese oxides relevant to Mars were synthesized in the laboratory. The SEM, EDS, XRD, and Raman were used to get their morphology, structural, and spectral characteristics. Results show that Raman spectroscopy is powerful to identify Mn-Oxides. |
| Cloutis E. Caudill C. Potin S. Applin D. Kubanek K. | *Spectroscopic Properties of Mars-Relevant Minerals: Implications for ExoMars Missions* **[#1772]** Laboratory investigations of the spectroscopic properties, both reflectance and transmission, are being undertaken to support analysis of observational data from the ExoMars Trace Gas Orbiter and Rosalind Franklin rover. |
| Wilson M. M. Milliken R. E. Gough R. V. | *Water Cycling in Clay Minerals Under Mars-Relevant Conditions: A Near-IR and Mid-IR Reflectance Spectroscopy Study* **[#2548]** COVID kept us home / But we always work remote / Mars is very far. |
| LaDouceur B. O. McCanta M. C. Sarabia G. Sharma B. | *A Raman-Dependent Methodology to Predict Oxidation State, Composition, and Viscosity of Silicate Glasses: Implications for Earth and Mars* **[#2486]** 79 synthetic silicate glasses have been used as analogs for Fe-bearing silicate melts in an effort to create a widely applicable Raman-dependent prediction model that constrains oxidation state and composition. |
| Orr K. J. Forman L. V. Hackett M. J. Hamilton V. E. Benedix G. K. | *Linear Deconvolution of Martian Meteorites Using Martian Mineralogy* **[#2679]** We linearly deconvolve martian meteorite spectra using new martian mineral spectra. We show there is a significant increase in accuracy of the modelling by using martian pyroxene and maskelynite spectra. |
| McKeeby B. E. Ramsey M. S. | *Deriving Planetary Surface Roughness: Combining Digital Photogrammetry and Thermal Infra-Red Spectroscopy* **[#1957]** Digital photogrammetry and TIR spectroscopy are combined to investigate surface roughness of Hawaiian pahoehoe samples. Variation in emission angles simulate data acquired by Routine Off-nadir Targeted Observation (ROTO) of Mars Odyssey. |

## [P628]
## POSTER SESSION: MARS SAMPLE RETURN

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| Kminek G. Meyer M. A. Haltigin T. Beaty D. W. Carrier B. L. et al. | *Mars Sample Return Science Planning Group Phase 2 (MSPG2): Overview and Interim Report* **[#1700]**<br>The MSPG2 has been chartered by NASA and ESA to continue advance planning for Returned Sample Science. This presentation will consist of a progress report on MSPG2 activities and seeks community feedback. |
| Carrier B. L. Beaty D. W. Smith A. L. Hutzler A. Meyer M. A. et al. | *Defining the Science and Curation Functionalities for a Mars Sample Return (MSR) Sample Receiving Facility (SRF)* **[#1704]**<br>The MSPG2 was chartered to work on the next stages of MSR planning, including developing a working list of requirements for the Sample Receiving Facility. Here, we present the science and curation functionalities currently envisioned for the SRF. |
| Meyer M. A. Kminek G. Beaty D. W. Carrier B. L. Spencer D. A. et al. | *Mars Sample Return (MSR) Sample Caching/Retrieval Strategy* **[#1708]**<br>The Caching Strategy Steering Committee (CSSC) was chartered by NASA and ESA to review a set of decision guidelines to inform decisions for future MSR systems and strategic planning for Perseverance. We will present a report of the CSSC work to date. |
| Holt J. M. C. Martindale A. Norbury A. O. Jones R. E. Bryon J. et al. | *A Double Walled Isolator Scanning Electron Microscope for Investigating Mars Samples in Full Biosafety Containment* **[#1450]**<br>A clock is ticking for finalising preparations of a Mars Sample Return Receiving Facility that is equipped to expedite the transition of samples through preliminary analysis and out into PI led labs. DWI is designed to support this goal. |
| Day J. M. D. | *Martian Chronology and Mars Sample Return* **[#1054]**<br>Meteorites, in-situ dates, and crater counting chronology provide a current framework for understanding martian history. MSR promises to revolutionize our understanding, but much can be done, especially on martian meteorites, between now and then. |
| Mattingly R. L. Smith A. L. II Calaway M. J. Harrington A. H. | *Tours of High-Containment and Pristine Facilities in Support of Mars Sample Receiving Facility Definition Studies* **[#2588]**<br>This presentation describes tours of select high-containment laboratories and pristine space-mission facilities to better understand their practices, capabilities, and lessons-learned to aid in planning for a potential Mars Sample Receiving Facility. |
| Deahn M. C. Morris M. M. Brooks C. L. Williams N. R. Golombek M. P. et al. | *Identifying Landing and Sample Tube Depot Sites and Characterizing Traverse Terrains for Mars Sample Return* **[#1325]**<br>Three summer interns / Helping a little rover / Return rocks from Mars. |
| Nikitczuk M. P. Bebout G. E. Geiger C. Ota T. Kunihiro T. et al. | *Nitrogenous Mars-Analog Potassic and Micro- and Mesoporous Minerals: Relevant Targets for Mars Sample Return* **[#2697]**<br>The exchange potential of atmospheric N with crustal materials (authigenic minerals) on modern or ancient Mars is important when considering planetary mineralogy, volatile outgassing, more habitable past environmental conditions, and the potential for life. |

## [P629]
## POSTER SESSION: MARS: SURFACE AND INTERIOR INSIGHTS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Panning M. P. Knapmeyer-Ednrun B. Bissig F. Joshi R. Khan A. et al. | *Seismic Constraints on the Thickness and Structure of the Martian Crust from InSight* **[#1590]**<br>How thick is Mars' crust? / P to S and S to P / And noise show the way. |
| Manga M. Wright V. | *No Cryosphere-Confined Aquifer Below InSight on Mars* **[#1318]**<br>InSight probed crust / Fluids affect vs. / No thick cryosphere. |
| Xiao W. Wang Y. | *Polarization Characteristics of the Mars' InSight Seismic Data Based on the Horizontal to Vertical Spectral Ratio Curve* **[#1823]**<br>We performed polarization analysis to the Mars' InSight seismic data for the typical peak frequency bands based on the horizontal to vertical spectral ratio curves to investigate the possible sources of the ambient noise at the InSight landing site. |
| Menina S. Margerin L. Kawamura T. Lognonné P. H. Marti J. et al. | *Statistical and Energetic Characteristics of High Frequency (HF) and Very High Frequency (VF) Martian Events* **[#1657]**<br>Exploration of the properties and structure of the martian crust by using statistical and energetic characteristics of High Frequency (HF) and Very High Frequency (VF) events. |
| Mittelholz A. Johnson C. L. Thorne S. N. Yau V. Joy S. et al. | *Magnetic Variations of a Sol Observed Over a Year on Mars with InSight* **[#1941]**<br>Magnetic changes / On a sol over a day / Ionosphere's doing. |
| Grott M. Spohn T. Knollenberg J. Krause C. Nagihara S. et al. | *Thermal Conductivity of the Martian Regolith at the InSight Landing Site from HP3 Active Heating Experiments* **[#1237]**<br>HP3 measured the average thermal conductivity of the martian regolith. The low conductivity indicates that any cement present in the regolith cannot significantly increase grain to grain contacts. |
| Morgan P. Grott M. Schmelzbach C. Golombek M. P. Siegler M. et al. | *Relationships Among Regolith Thermal Conductivities and Seismic Velocities: Application to InSight Studies* **[#1587]**<br>Experimental data indicate that Mars InSight regolith seismic wave velocities and thermal conductivities increase with depth. Preliminary results from the InSight mission suggest an approximately linear relationship among these parameters. |
| Wood S. E. | *A New Model for the Thermal Conductivity of Planetary Regolith: The Effects of Particle Shape, Composition, Temperature, Porosity, Cohesion, and Compression at Depth* **[#2484]**<br>Any regolith / Thermal conductivity / This model computes. |
| Bates A. Karunatillake S. Lorenzo J. M. | *Validation of Cement Contact Theory to Estimate Martian Regolith Velocities* **[#1527]**<br>Understanding the seismic properties of the martian regolith is an ongoing challenge. In addition, the introduction of volatiles into the regolith presents an issue that has yet to be researched. We address this issue using cement contact theory. |
| Trussell A. Golombek M. Williams N. Abarca H. Warner N. H. et al. | *InSight Rock Size-Frequency Distributions on Mars* **[#1558]**<br>Rocks abundance around the InSight lander fall along <1% to 5% size-frequency distribution models that are continuous with rocks measured in HiRISE images. |
| Grima C. Putzig N. E. Campbell B. A. Perry M. R. Scanlan K. M. | *The Coherent Character of the Martian Surface at 20 MHz* **[#1221]**<br>A statistical study of the SHARAD surface echo provides (1) insights for proper |

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| | radiometric analysis at Mars, and (2) prospects to further hypothesis discrimination of the regional martian geology. |
| Marteau E. Golombek M. Vrettos C. Garvin J. B. Williams N. R. | *Soil Mechanical Properties at the InSight Landing Site on Mars* **[#2067]** This study provides cohesion estimates of the martian soil at the InSight landing site obtained by combining slope stability analysis with measurements of robotic arm forces at the scoop. |
| Stein T. C. Arvidson R. E. Zhou F. | *PDS Analyst's Notebook for InSight Mars Lander* **[#2336]** The PDS Analyst's Notebook for the InSight Mars Lander is a web application containing peer-reviewed, publicly available data, supported by documentation describing context for the observations, processing methodology, and data formats. |

## [P630]
## POSTER SESSION: MARTIAN VOLCANIC LANDFORMS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Wasilewski B. J. Gregg T. K. P. | *The Medusae Fossae Formation, Mars: Finding the Former Extent of an Enigmatic Deposit* **[#2374]** When considering / MFF extent we must / Search for clues. |
| Czechowski L. Zalewska N. Zambrowska A. Ciazela M. Witek P. et al. | *The Formation of Some Cone Chains in Chryse Planitia on Mars* **[#1380]** Small cones are common on Mars. Many cones form subparallel chains. We try to explain the processes responsible for the formation of cones in chosen region of Chryse Planitia. Moreover, we investigate energy required for cones formation. |
| Czechowski L. Zalewska N. Zambrowska A. Ciazela M. Witek P. et al. | *The Chain of Rootless Cones in Chryse Planitia on Mars* **[#2740]** We consider a small region in Chryse Planitia (~38°14′ N, ~319°25′ E). Generally, there are three mechanisms of these cones formation: (i) a grains' ejection, (ii) from mud or fluidized sand, and (iii) explosive formation. |
| Cowart J. C. Rogers A. D. | *Well-Preserved Volcanic Terrain in Mars' Terra Cimmeria Highlands* **[#1113]** Cimmerian lands / Well-preserved locations where / Lava and ice met? |
| Trisic Ponce J. Brendel C. Kohout T. Trigo-Rodríguez J. M. | *Martian Lava Tubes as Potential Water- and Life-Bearing Colonial Habitats* **[#1336]** Several lava tubes have been found on Mars. In this abstract we suggest a possible area of study where lava tubes could be found containing water-ice and which could provide shelter for life, both human and extraterrestrial. |
| Wiedeking S. Hiesinger H. Lentz A. Pasckert J. H. Raack J. et al. | *Rheology and Model Ages of Lava Flows on Alba Patera, Mars* **[#1612]** We studied 29 lava flows on the flank of Alba Patera (Mars). We derived rheological properties and absolute model ages. The results, which indicate a basaltic/basaltic-andesitic composition, were compared to studies on lava on other planetary bodies. |

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| Lahowetz D. Anderson S. W. Crown D. A. Berman D. C. | *Morphometric and Rheological Properties of Ridged Lava Flows in Daedalia Planum, Mars* **[#2547]** New yield strength and viscosity estimates are made by analyzing digital elevation models of the Daedalia Planum flow field. Flow thickness and surface slope are a few characteristics observed here. These results are comparable to terrestrial flows. |
| Conlon J. R. Gregg T. K. P. | *Small Volcanoes in Vastitas Borealis, Mars: A Morphological and Spatial Analysis* **[#2448]** Crowdsourcing methods are used to identify and map small volcanoes (<25km basal diameter) in the northern plains of Mars to test evidence of magma-water interaction. |
| Krishnan V. Kumar P. S. | *Evidence for Long-Lived Middle to Late Amazonian Volcanism, Tectonics, and Recent Boulder Fall Activities in the Northern Tharsis region, Mars* **[#1855]** This study presents new evidence for the long-lived, continuous to episodic volcanic activity spanning the entire middle to late Amazonian periods and recent mass wasting processes in the northern Tharsis region, Mars. |
| Zalewska N. Czechowski L. Ciazela J. Kuzaj M. | *Regional and Local Geological Characteristics of Isidis Planitia on Mars* **[#2710]** There are thousands of small cones on Isidis Planitia on Mars. Our analysis indicates that the cones can be grouped in larger systems. We divided Isidis Planitia into several characteristic regions. There may be several types of chains cones. |
| Shoemaker E. S. Carter L. M. Garry W. B. Morgan G. A. | *Investigating the Subsurface Northwest of Ascraeus Mons, Mars Using Radar* **[#1507]** We describe interpretations of subsurface interfaces identified northwest of Ascraeus Mons by the SHARAD and MARSIS radar sounders using forward modeling and recent mapping. |
| Luzzi E. Rossi A. P. Massironi M. Pozzobon R. Mestrelli D. et al. | *Piecemeal Caldera Collapse as the Trigger of Chaotic Terrains and Floor-Fractured Craters on the Moon and Mars* **[#1883]** We propose the piecemeal caldera collapse as a new formation mechanism to explain the collapse and disruption of chaotic terrains and floor-fractured craters on Mars and the Moon. The results of our analog experiments fit very well with study cases. |

## [P631]
## POSTER SESSION: ANALYZING CHONDRITES AND THEIR COMPONENTS: NOVEL METHODS

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| Donato T. P. Nascimento-Dias B. L. Zucolotto M. E. | *Analyzing the Allende Meteorite Through the Raman Spectral Peak Positions of (Fo-Fa): Fast Method to Characterize Range of Fe in Chondrites* **[#1381]** The Allende meteorite sample was analyzed using the Raman Spectroscopy technique, |

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| | with the purpose of looking for Fe contents in its composition. Presenting as result the effectiveness of this alternative technique for carbonaceous chondrites. |
| Moreau J. Jõeleht A. Plado J. Hietala S. Sharp T. et al. | *Injection of Molten Iron Sulfides and Metals into Rocks: Developing a Technique to Study Shock Melt Veins in Ordinary Chondrites* **[#1044]**<br>We propose to design an experimental method to study metal and iron sulfide shock melt veins in ordinary chondrites. A piston-like apparatus will inject molten metal/sulfide mixtures into fractured ultramafic rocks heated at high temperatures. |
| Righter K. Butterworth A. L. Gainsforth Z. Iacovino K. Erickson T. et al. | *Vanadium Valence in $MgAl_2O_4$ Spinels at Reducing Conditions (IW to IW-5)* **[#1111]**<br>Spinels grown under reducing conditions have low V content and lower valence vanadium than those grown at oxidized conditions. Oxybarometers for such reduced conditions must be calibrated with experiments at reducing conditions and not extrapolated from higher $fO_2$. |
| Northrup P. A. Wirick S. Flynn G. J. | *Tender Energy X-Ray Microspectroscopy Reveals Microscale Heterogeneity of P and S Chemistry in CM2 Chondrite* **[#2480]**<br>Tender energy X-ray absorption microspectroscopy at the TES beamline was used to directly measure microscale chemical speciation of P and S in a CM2 meteorite, revealing heterogeneity including phosphates, phosphides, sulfates, and sulfides. |
| Schultz C. D. Anzures B. A. Milliken R. E. Hiroi T. | *An Investigation of the Sub-mm-Scale Spectral Diversity of the ~3 μm OH/$H_2O$ Absorption Feature in CM2 Carbonaceous Chondrites* **[#1611]**<br>Leave the chondrite whole / Peering close and splitting light / Shows veiled variance. |
| Morgano M. Le Guillou C. Leroux H. Marinova M. Dohmen R. | *Experimental Study of the Interaction Between Amorphous Silicates and Water Vapor* **[#2608]**<br>We present the preliminary results of an experimental study involving the interaction between an amorphous silicate of pyroxene composition and water vapor. |
| Ogliore R. C. | *Acquisition and Online Display of High-Resolution Backscattered Electron and X-Ray Maps of Meteorite Sections* **[#1697]**<br>I describe a “Virtual SEM” technique for the acquisition and display of BSE and X-ray maps of meteorite sections. |
| Bonato E. Stangarone C. Maturilli A. Helbert J. | *A New Facility for the Planetary Science Community: The Planetary Sample Analysis Laboratory (SAL) at DLR* **[#2375]**<br>Extra-terrestrial / Materials to study / In a new lab at DLR. |

## [P632]
## POSTER SESSION: CARBONACEOUS CHONDRITES: PARENT BODY PROCESSING AND ORGANIC MATTER

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| Floyd C. J. Lee M. R. | *Rapid Calcite Dissolution in CM Carbonaceous Chondrites and Its Implications* **[#1335]** Rapid dissolution of calcite in CM chondrite Murchison. Dissolution quick / Calcite it soon vanishes / How has it survived? |
| Dobrică E. Ohtaki K. K. Nuth J. A. Brearley A. J. | *Insights into Fayalite Formation Through Secondary Processes: An Experimental and a Microstructural Investigation* **[#1659]** Fayalite crystals / Enhance our understanding / Of aqueous fluids. |
| Saikia B. J. Parthasarathy G. Borah R. R. | *Organic Compounds in Mahadevpur H4/5 and Natun Balijan L4 Ordinary Chondrites by Raman Spectroscopy* **[#1853]** Herein we identify organic trace in Mahadevpur H4/5 and Natun Balijan L4 ordinary chondrites by Raman Spectroscopy. |
| Phan V. T. H. Rebois R. Beck P. Quirico E. Noguchi T. et al. | *Nano-Infrared Spectroscopy of Functional Carbon Groups in Extraterrestrial Kerogens* **[#2029]** We will present the dataset of IR spectroscopy and IR imaging using NanoIR3s obtained from coals and meteorites as well as their IOMs. It includes a comparison of organic signatures of IOM and raw meteorites matrix. |
| Zolensky M. E. | *Xenoliths and Strange Cognate Lithologies — Or What the Heck is That?* **[#2511]** We describe three main groups of cognate and xenolithic clasts in meteorites. |
| Lee M. R. Cohen B. E. Boyce A. | *Carriers of Hydrogen in the CM Carbonaceous Chondrites* **[#1297]** The abundance and isotopic composition of H in CM falls and finds varies with degree of aqueous alteration and post-hydration heating. |
| Arribard Y. Baklouti D. Aléon-Toppani A. Borondics F. Della-Negra S. et al. | *Localization and Micro-Characterization of Organic Matter and Mineral Phases in Bulk Chondirtes by MIR Reflectance Hyperspectral Imaging* **[#1872]** We will show a MIR reflectance hyperspectral imaging associated with a data processing based on k-means clustering to study and map at a few µm resolution the mineral phases, hydration, and organic matter of millimeter-sized surfaces of chondrites. |
| Komatsu M. Fagan T. J. Yamaguchi A. Yasutake M. Kimura M. et al. | *The Comparative Study for Aqueous Alteration and Thermal Records in CR Chondrites by Raman Spectroscopy* **[#1962]** We examined the petrology and Raman characteristics of chondrules and matrices in CR chondrites from Japanese Antarctic meteorite collection in order to understand the secondary processing of the CR chondrite parent body(ies). |
| Gray M. L. Weisberg M. K. Ebel D. S. Alexander C. M. O'D. Foustoukos D. I. et al. | *Abundances and Isotopic Compositions of Volatile H, N, C in Unequilibrated Enstatite Chondrites and the Volatile Inventories of the Terrestrial Planets* **[#2116]** New H, N, and C data of five unequilibrated enstatite chondrites (ECs) supports previous conclusions that ECs may have contributed to the volatile abundances in the solid Earth. ECs remain the best match for the material that accreted to form Earth. |
| Grant H. Tartèse R. Jones R. H. Marrocchi Y. Piani L. | *Bulk Water Abundances and D/H Ratios of Unequilibrated Ordinary Chondrites* **[#2242]** Bulk D/H ratios of a set of unequilibrated ordinary chondrites confirm that the least metamorphosed samples have high D/H ratios. These are difficult to reconcile with models of the evolution of water H isotope composition in the protoplanetary disk. |
| Velbel M. A. Zolensjy M. E. | *Dehydroxylation and Peak Temperature of Matrix in CM and Related Carbonaceous Chondrites* **[#2373]** A geothermometer for CM matrix metamorphism is proposed. Tpeak values estimated using EPMA totals agree with previous estimates for most meteorites considered. |
| Le Guillou C. Zanetta P.-M. Leroux H. Guerin B. | *Light Element Quantification by TEM-EDS and Application to Organics Mapping in* |

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| Engrand C. et al. | *Ultra-Carbonaceous Antarctic Micrometeorites (UCAMMs)* **[#2572]**<br>We developed a method to quantify carbon, nitrogen, and oxygen by EDX spectroscopy in the TEM. Relative precision better than 5% is obtained. Applied to one UCAMM, we found a very nitrogen-rich area attached to GEMS-like particles. |
| Dutta A. Raychaudhuri D. Nevin C. G. Bhattacharya A. | *Extra-Terrestrial Carbon and Water Molecule in Mukundpura Carbonaceous Chondrite (CM2)* **[#1869]**<br>In the present study, LRS and FTIR spectroscopy has been carried out to determine qualitative and semi-quantitative features and parameters of organic and/or inorganic molecules in Mukundpura Carbonaceous Chondrite (CM2). |
| Davidson J. Schrader D. L. | *Identification of a Thermally Metamorphosed Clast in the Renazzo-Like (CR) Chondrite Pecora Escarpment (PCA) 91082* **[#1027]**<br>Primitive chondrites / Where are your impact melt clasts? / Found new candidate. |
| Dunn T. L. Robak K. N. Gross J. | *A CV Chondrite Clast in a CK Chondrite?* **[#1063]**<br>All the labs are closed / And I can't travel. This is all / The data I have. |
| Gyollai I. Kereszturi Á. Szabó M. Kereszty Zs. | *Signatures of Iron Enriching Metasomatism in Sidi Ali Ou Azza Meteorite* **[#1126]**<br>The aim of this work is to overview the iron content changes producing metasomatic processes in the Sidi Ali Ou Azza (L4, S3, W2) meteorite. Alteration occurs only in fractures and near to opaque grains resulting FeO infiltration. |
| Jenkins L. E. Lee M. R. Daly L. Li S. | *Fine-Grained Equant Troilite in the CM Chondrite Shidian: Potential Evidence for Low Temperature Post-Hydration Heating* **[#1204]**<br>Shidian, CM fall / Low temperature heating / Seen in troilite grains. |
| Schwarz W. H. Hopp J. Ludwig T. Bouvier A. Trieloff M. et al. | *Pb-Pb Ages of Chondritic Phosphates* **[#1981]**<br>We report Pb-Pb phosphate ages measured by secondary ion mass spectrometry for various H, A-L, R, CR6/7 chondrites and Tafassasset. |
| Dobrică E. Engrand C. Ohtaki K. K. | *Dolomites in Hydrated Fine-Grained Antarctic Micrometeorites: Effective Tools for Analyzing Alteration Condition* **[#1137]**<br>Carbonates are excellent candidates to study the secondary processes that modified the most primitive materials. Here, we expand on earlier efforts to investigate the alteration conditions of Antarctic micrometeorites, with a focus on carbonates. |
| Vacher L. G. Ogliore R. C. Liu N. | *Hydrogen Isotopic Composition of Water in the Ungrouped Carbonaceous Chondrite Tagish Lake* **[#2528]**<br>We evaluate the δD value of the water in Tagish Lake (TL) from in-situ Si/H and δD measurements of its hydrated fine-grained matrix by using NanoSIMS and suggest that its water composition may reflect only secondary processes on its parent-body. |

## [P633]
## POSTER SESSION: CHONDRITES — PHYSICAL PROPERTIES AND EXPERIMENTS

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|---|---|
| Szurgot M. A. Wach R. A. Altunayar-Unsalan C. Unsalan O. | *Mean Atomic Heat of Sariçiçek Howardite and Bursa L6 Chondrite* **[#1108]** Temperature dependence of mean atomic heat for interior, edge, and crust matter of Sariçiçek howardite and Bursa chondrite interior was studied, and was established that is expressed by the same, natural exponential function. |
| Moreau J. Schwinger S. | *Heat Diffusion in Shocked Chondrites: Towards a Better Understanding of Shock Melting Features* **[#1138]** We simulated post-shock heat diffusion in numerically shocked chondrites. Metals preferentially melt from heat diffusion rather than shock heating because strongly shock heated minerals surrounding colder metals act as heat sources for metals. |
| Willman H. B. Rolling A. R. Loftus C. L. Molesky M. J. Patmore E. B. et al. | *Comparison of Compression Strength of Ordinary and Carbonaceous Chondrite Stimulants* **[#1594]** Comparison of the compression strength of commercial, terrestrial, and hydrated meteorite simulants. |
| Rolling A. R. Willman H. B. Elmer W. C. Strait M. M. Flynn G. J. et al. | *Correlation of Particle Volume and Velocity of Fragments of Different Types of Meteorites During Disruption Events* **[#1595]** Investigation into the volume-velocity relationship of particles of different types of meteorites after disruption events. |
| Szurgot M. A. | *On the Mean Grain Density of Pułtusk, Chelyabinsk, Murray, and Murchison Chondrites, and Mean Density of Their Pores* **[#1029]** New form of relationship between bulk density and porosity of meteorites was derived and applied for Pułtusk, Chelyabinsk, Murray, and Murchison chondrites. Grain density and density of matter of pores were predicted, and weathering confirmed. |
| Floyd C. J. Lee M. R. | *Size Analysis of Chondrules and Their Rims in CM Carbonaceous Chondrites* **[#1337]** Chondrule and fine-grained rim size analysis in CM chondrites shows evidence of variation between different petrologic sub-types. |
| Pinto G. A. Marrocchi Y. Olivares F. Soto K. Varela M. E. et al. | *Size-Distribution of Nebular Components in $CO_3$ Chondrites: Hits at a Heterogeneous Accretion History* **[#1371]** We selected all nebular components (i.e. CAI, AOAs, FeO-rich and FeO-poor chondrules, and IOGs) larger than ~20 μm in 3 carbonaceous CO3 chondrites found in the Atacama Desert: El Médano 216, El Médano-397, and El Médano 463. |
| Hezel D. C. Metzler K. Hochstein M. L. | *Resolving the Contradictory Results for Chondrule Size Distributions When These are Empirically Determined and Theoretically Considered* **[#2264]** Chondrule size distributions are critical to understand chondrule formation, sorting, or fragmentation. We resolve a long-standing contradiction between theory and empirically determined size distributions when these are determined from 2D sections. |
| Ostrowski D. R. | *Acoustic Velocity and Mechanical Properties of Stony Meteorites* **[#2424]** Acoustic velocities are measured for nine previously unmeasured meteorites. Velocities within the range of ordinary and carbonaceous chondrites. Values are used to determine elastic moduli which is used to theorize about meteorites physical strength. |
| Harvey T. A. MacArthur J. L. Joy K. H. Jones R. H. | *Non-Destructive Determination of the Physical Properties of* |

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| | *Antarctic Meteorites* **[#1897]**<br>Investigating the physical properties of meteorites returned by the Lost Meteorites of Antarctica project via a non-destructive approach using photogrammetry to compute density and measurements of magnetic susceptibility and electrical conductivity. |

## [P634]
## POSTER SESSION: NEW CHONDRITES

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| Garvie L. A. J. Trif L. | *Bulk Mineralogy of the Tarda (C2-ung) 2020 Fall: Results from Powder XRD and Thermal (TG-DSC-MSEGA) Analysis* **[#2446]**<br>Tarda (C2-ung) is dominated by clays similar to those seen in the CI1 meteorites, such as Orgueil and Ivuna. However, in comparison with the CI1 meteorites, Tarda is comparatively dry, with a total TG loss up to 1000° C of 17%. |
| King A. J. Bates H. C. Schofield P. F. Russell S. S. | *The Bulk Mineralogy and Water Contents of the Carbonaceous Chondrite Falls Kolang and Tarda* **[#1909]**<br>We report the bulk mineralogy and water contents of the recent carbonaceous chondrite falls Kolang and Tarda. Kolang is the most altered CM chondrite fall recovered to date, and Tarda likely formed on a parent body beyond the orbit of Jupiter. |
| Tunney L. D. Hill P. J. A. Herd C. D. K. Hilts R. W. Holt M. C. | *Distribution of Terrestrial and Extraterrestrial Organic Compounds in the C2 Ungrouped Tarda Carbonaceous Chondrite* **[#1644]**<br>Using organic compound analyses of the Tarda C2 ungrouped carbonaceous chondrite, the development of best methods for distinguishing between terrestrial (contaminant) and extraterrestrial organic compounds are presented in this study. |
| Hoffmann V. H. Kaliwoda M. Schmahl W. Wimmer K. schmitt-Kopplin P. | *The Kolang (CM 1/2) and Tarda (C2 ungrouped) Meteorite Falls from 2020: First Systematic Mineralogical Investigations by LASER Raman Spectroscopy and SEM/EDX* **[#2458]**<br>Detailed and systematic investigations on the mineral phase composition and distribution of two new meteorite falls Kolang C 1/2 and Tarda C2-ungrouped are reported. Background are the asteroidal sample return missions Hayabusa 2 and Osiris Rex. |
| Hoffmann V. H. Wimmer K. Kaliwoda M. Schmahl W. Schmitt-Kopplin P. | *The Flensburg (C1-Ungrouped) 2019 Meteorite Fall: Raman Spectroscopy and Compilation of Magnetic Susceptibility Data on C — Ungrouped Falls/Finds* **[#2443]**<br>We will report new results on the Flensburg meteorite, a C1-ungrouped carbonaceous chondrite which fell in 2019. The Flensburg carbonaceous chondrite plays a prominent role in terms of the Hayabusa 2 and Osiris Rex asteroidal sample return missions. |
| Harries D. | *Occurrence of the Sodium Carbonate Shortite in the Flensburg C1 Chondrite* **[#1953]** |

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| | Water in chondrites / An alkaline brine / In brief, shortite. |
| Moggi Cecchi V. Pratesi G. Caporali S. Franchi I. A. Greenwood R. C. | *Northwest Africa 12727, 13596, and 13597: Three New Unequilibrated Ordinary Chondrites from Sahara* **[#2757]** The minerochemical and textural features of three new unequilibrated ordinary chondrites from Northwest Africa (NWA 12727, 13596, and 13597) are presented. |
| Silva G. G. França F. F. Martins L. Enrich Rojas G. E. Schuindt S. et al. | *Classification of the Tocache Meteorite, a Fall from Peru* **[#2693]** This work presents the petrographic and chemical characterization of the only fragment recovered of the Tocache meteorite, that fell on January 1, 1998, in the Tocache District, Peru, and was classified as an ordinary chondrite H5, S3, W1. |
| Herrero Pérez M. J. Reche Estrada J. Trigo-Rodríquez J. M. Ibáñez-Insa J. Llorca J. | *Studying the Thermal Metamorphism Experienced by the Parent Asteroid of Villalbeto de la Peña Ordinary Chondrite Using an Equilibrium Phase Diagram Model* **[#1993]** In this work, the theoretical equilibrium phase diagram for the homogeneous bulk composition of a single domain in a chondritic meteorite, the Villalbeto de la Peña L6 chondrite, is derived using new techniques calibrated for terrestrial mantle rocks. |
| Ibáñez-Insa J. Trigo-Rodriguez J. M. Peña-Asensio E. Rimola A. | *Studying the Main Mineralogy and Shock of the Bolivian H5 Chondrite Aiquile* **[#1385]** A XRD study of the main mineral phases of Aiquile H5 chondrite is presented. SEM-EDX results confirm the S3 shock stage of this meteorite, but the presence of glassy plagioclase and planar fracturing might point towards larger shock effects locally. |

## [P635]
## POSTER SESSION: CHARACTERIZATION, PARENT BODY ORIGINS, AND PETROGENESIS OF ACHONDRITES

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| Mikouchi T. Takenouchi A. Yasutake M. Hasegawa H. Yamaguchi A. et al. | *Olivine Petrofabric Analysis of Brachinites: Implications for Petrogenetic Diversities* **[#2334]** Petrofabric analysis of olivine in ten brachinites shows that both preferred shape and crystallographic orientations of olivine are commonly observed, suggesting high degree of differentiation involving cumulate formation in magma chambers. |
| Bell A. S. Shearer C. | *Thermodynamic and Phase Equilibria Constraints on the Late-Stage Magmatic $fO_2$ and Petrogenesis of the Angrite Sah99555* **[#2542]** This abstract uses new phase equilibria calculations that constrain the $fO_2$ of angrite magmas. |
| Litasov K. D. Ishikawa A. Reper K. E. | *Detailed Mineralogy and Trace Element Chemistry of Donino Iron Meteorite: A Pentlandite and Heazlewoodite Issue* **[#1445]** We present new mineralogical and trace element data on Dronino meteorite. Sulfide |

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| | inclusions with reticulate microstructure formed by Co-bearing pentlandite and Fe-bearing Ni3S2 are described. We also identified sarcopside and $SiO_2$ glass. |
| Li S. Hsu W. Nemchin A. Che X. Liu D. et al. | *In Situ U–Pb Dating of Phosphates in Weekeroo Station IIE Iron* **[#1186]**<br>We revisit the chronology of the most extensively studied IIE iron Weekeroo Station using the in situ secondary ion mass spectrometer (SIMS) technique. |
| Lavrentjeva Z. A. Lyul A. Yu. | *To Question About Formation of the Pallasite Parent Bodies: On the Peculiarities of Trace Element Composition of Mineral Components from the Omolon Pallasite* **[#1037]**<br>This work reports new data on the trace element composition of mineral fractions of the Omolon pallasite, which are considered from the viewpoint of cosmochemical history of pallasites. |
| Carpenter P. K. Irving A. J. Jolliff B. L. | *Amphibole Occurrences in Meteorites: Nakhlite Northwest Africa 13368 and Winonaite Northwest Africa 13432* **[#2329]**<br>We present first analytical results on potassic-chloro-hastingsite from augite melt inclusions in Nakhlite Northwest Africa 13368, and fluoro-edenite in Winonaite Northwest Africa 13432, and discuss aspects of the mineral chemistry. |
| Yamaguchi A. Barrat J. A. Chaussidon M. Beck P. Villeneuvee J. et al. | *Petrology and Geochemistry of Erg Chech 002, the Oldest Andesite in the Solar System* **[#1892]**<br>We present the petrology and geochemistry of Erg Chech 002, and discuss its crystallization and thermal history. |
| Nicklas R. W. Day J. M. D. Gardner-Vandy K. G. Udry A. | *Multi-Stage Differentiation History of Andesitic Achondrite Erg Chech 002* **[#1074]**<br>Erg Chech 002 is a new evolved achondrite dominated by pyroxene, plagioclase, and a Si-phase. Its very low siderophile element concentrations indicate it originated on a body that differentiated a core, and is not the result of chondrite melting. |
| Carpenter P. K. Irving A. J. Righter M. Lapen T. J. Tepper J. H. | *Mineralogy and Bulk Elemental Composition of Ungrouped Relatively Sodic Gabbroic Achondrite Erg Chech 002: An Ancient Planetary Crustal Sample?* **[#2205]**<br>A unique mafic gabbroic achondrite characterized by sodic plagioclase may represent a crustal sample from a previously unrecognized differentiated planet. |
| Takenouchi A. Sumino H. Mikouchi T. Ono H. Yamaguchi A. | *Argon-Argon Chronology of Two Shocked Eucrites, Northwest Africa 1000 and Yamato 980433* **[#1742]**<br>We measured the Ar-Ar ages of two shocked eucrites, NWA 1000 and Y 980433. Both eucrites record the common older thermal events 3.4-3.9 Ga and younger shock-induced thermal events <650-900 Ma. |
| Cartwright J. A. Kouvatsis I. | *Further HED Analysis to Investigate the Bombardment History of Vesta* **[#2739]**<br>Look at vestan rocks / Seeking melt clasts with secrets / Revealing impacts. |
| Jaiswal S. Mahajan R. R. Ngangom M. | *Heavy Noble Gas in Eucrites and Diogenites: An Attempt to Understand the Trapped Components* **[#1183]**<br>We present a heavy noble gas signature in eucrites and diogenites. |
| Roque C. Nascimento-Dias B. L. | *Characterization of the Serra Pelada Meteorite by Raman: Implications for Planetary Formation and Hypotheses of Water Origin* **[#1312]**<br>This work performed the chemical and mineralogical characterization of the Serra Pelada meteorite, analyzing the implications of this meteorite for astrobiology, relating to planetary formation and the hypothesis of water origin. |
| Garvie L. A. J. Ma C. Wittmann A. | *Location and Speciation of Germanium in the Butler and Northwest Africa 859 Ungrouped Iron Meteorites* **[#2398]** |

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| | Germanium, in the Butler and NWA 859 ungrouped iron meteorites, partitions with tetrataenite (to 0.6 wt%) and to 10 wt% in a new and common Ni-Ge-P sub-micron-sized precipitate. |
| Ross A. J. Stephen N. R. Downes H. | *Identification of Coexisting Ortho- and Clinopyroxene by Electron Backscatter Diffraction in Chemically Homogenous "Enstatite" Grains in Almahata Sitta Ureilites* **[#2384]** We studied pyroxenes in two Almahata Sitta ureilites with a nominal chemical makeup of olivine + orthopyroxene + pigeonite. Structurally we found the "enstatite" composition to be both ortho- and clinopyroxene, whereas pigeonite is solely pigeonite. |
| Sawicki J. A. Ebrahimi C. | *Unusual Achondrite-Like Find in Sooke Basin: Results of First Analyses* **[#2775]** The stone discovered during diving in Sooke Basin with pulse metal detector weighs ~13 kg, attracts a magnet, and is up to 70% covered by black fusion crust. Analyses show that it is carbonaceous basaltic achondrite including nanodiamonds. |
| Irving A. J. Carpenter P. K. Ziegler K. | *Petrology and Oxygen Isotopic Composition of Two Different Ungrouped Highly Magnesian, Reduced Ultramafic Achondrites (Northwest Africa 11562/12969 and Northwest Africa 13307): More Samples from Unknown Parent Bodies* **[#2244]** We describe unusual highly magnesian, reduced harzburgitic, and websteritic achondrites which differ significantly from the more well-known aubrites, and probably derive from previously unrecognized parent bodies. |
| Layak P. Rai N. | *Geochemical and Mineralogical Constraints on the Composition of the Parent Planetesimal for the Acapulcoite and Lodranite Suite of Meteorites* **[#1983]** Constraining the composition for Acapulcoite-Lodranite (AL) parent body using criteria such as mineral compositions, densities, bulk composition of the modeled ALs from thermodynamic and experimental petrology data, trace elements, and O-isotopes. |

## [P636]
## POSTER SESSION: CHONDRITIC METEORITE MELANGE: E, O, AND C

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| Zenie L. C. Almeida N. V. King A. J. Franchi I. A. Schofield P. F. et al. | *Relict Forsterite in Unequilibrated Enstatite Chondrites* **[#1434]** Relict forsterite grains have been identified in 24 chondrules in the Kota Kota EH3 chondrite. CL imaging shows trace element variations likely related to the origin and evolution of the grains. |
| Sukhanova K. G. Skublov S. G. Galankina O. L. Kotova E. L. | *Trace Elements Mobility in Silicate Minerals of EOC Under Thermal Metamorphism* **[#1831]** We report of major (EPMA) and trace (SIMS) element analysis of silicate minerals |

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| | (olivine, low-Ca pyroxene, and plagioclase) of porphyritic and nonporphyritic chondrules from equilibrated ordinary chondrites (EOC) Elenovka and Knyahinya. |
| Storz J. Ludwig T. Bischoff A. Schwarz W. H. Trieloff M. | *Carbon Isotope Analyses of Graphite in Enstatite Chondrites and Ureilites* **[#1995]** We report SIMS measurements of carbon isotopic composition of graphite. In enstatite chondrites, metal-associated graphites display higher variability than silicate-associated. In fine-grained ureilites isotopic variability could be due to smelting. |
| Hopp J. Böhm M. Ludwig T. Varychev A. Trieloff M. | *In Situ Measurements of Sulfur Isotopic Composition of Sulfides in Enstatite Chondrites* **[#2002]** We report SIMS measurements of sulfur isotopic composition in enstatite chondrite sulfides. Oldhamite and niningerite display larger variations than troilite. |
| Manzari P. Mele D. Tempesta G. Agrosì G. | *Possible Clues of Sulfide Volatilization in Al Haggounia 001* **[#1615]** In this abstract, we show some data from the study of Al Haggounia 001, using the combination of 3D techniques supported by chemical characterization. We found some features that could provide clues on the origin of porosity in this meteorite. |
| Ustinova G. K. | *Analysis of the Solar Proton Effects in the Stubenberg and Jesenice Chondrites* **[#1310]** The solar cosmic ray contributions to production of cosmogenic radionuclides in the near-surface layers of the chondrites of low ablation are estimated. The effects are analyzed for some radionuclides in the Stubenberg and Jesenice chondrites. |
| Gemma M. E. Ebel D. S. | *Mineral Abundance, Variation, and Coarsening Across Petrologic Types of H Chondrite Meteorites* **[#2768]** Mineral percent / Across petrologic type / Of group H chondrites. |
| Kumar A. Mahajan R. R. Sarbadhikari A. B. | *Neon Isotopic Study of Ordinary Chondrites* **[#1421]** We are presenting Neon Isotopic systematic in the Ordinary chondrites. |
| Rubin A. E. | *IIE Irons: Early Accreted, Metal-Rich Ordinary Chondrites from a Partially Differentiated Asteroid* **[#1021]** IIE-iron mineral and bulk compositions lie along LL-L-H trends. They accreted early, acquired many Type-I chondrules (formed in part from CAI precursors), and more $^{26}$Al. IIE irons are metal-rich restites formed adjacent to reduced type-6 OC clasts. |
| Baziotis I. Ferrière L. Asimow P. D. Anand M. Xydous S. et al. | *A Unique Mineral Assemblage Recording Shock Conditions in Kakowa (L6) Ordinary Chondrite* **[#1524]** The Kakowa is a highly shocked L6 ordinary chondrite. It contains a unique assemblage of high-pressure polymorphs, including the first chondritic occurrence of donwilhelmsite, a mineral recently discovered in the lunar meteorite Oued Awlitis 001. |
| Welten K. C. Nishiizumi K. Caffee M. W. | *Cosmogenic Radionuclides in Four Paired Antarctic L/LL Chondrites Indicate Similar Cosmic-Ray Exposure Age as Chelyabinsk LL Chondrite* **[#1821]** Cosmogenic radionuclides in 4 L/LL chondrites from Wisconsin Range, Antarctica indicate they are paired fragments. Their CRE age of ~1.7 Ma overlaps with the age of the large Chelyabinsk LL chondrite, suggesting a common ejection event. |
| Dodds K. H. Bryson J. F. J. Neufeld J. A. Harrison R. J. | *The Structure and Accretionary History of the CVox Parent Body Constrained from the Magnetization of Kaba* **[#2133]** The magnetization of some CVox meteorites suggests their parent body was partially differentiated. We use the magnetization of Kaba and thermal modelling of planetesimals to constrain the structure of the CVox parent body and its accretional history. |
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| Scott E. R. D. Herzog G. F. | *Short Cosmic-Ray Exposure Ages of CI and CM Chondrites May Reflect Disintegration of Volatile-Rich Asteroids at Perihelion* **[#1833]**<br>Dark, volatile-rich asteroids seem to disintegrate near the Sun. This may explain why CM and CI chondrites have short cosmic ray exposure ages of a few million years or less. |
| Young J. M. Glotch T. D. Bechtel H. Gilbert-Corder S. N. Hamilton V. E. | *Nano-Infrared Investigation of the CM2 Chondrite ALH 83100* **[#1998]**<br>Laser shines brightly / Cantilever is tapping / Tell your tale space rock. |
| Bonato E. King A. J. Bates H. C. Schofield P. F. Stangarone C. et al. | *Spectroscopic Characterisation of Primitive $CO_3$ Carbonaceous Chondrites* **[#2364]**<br>Reflectance spectra / Of COs for understanding / Asteroid surface. |

## [P637]
## POSTER SESSION: MARTIAN METEORITES: IGNEOUS AND SURFACE PROCESSES

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| Guo Z. Li Y. Wen Y. Y. Zeng X. J. | *Unique Zoned Pyroxenes in Basaltic Shergottites Meteorite: Implications for Some Open System Process* **[#1802]**<br>A detailed TEM anlysis was carried out for the zoned pyroxene in a shergottites. Nano-sized Fe-rich particles and pigeonite were confirmed to be the reason for the Fe enrichment in pyroxene rims, indicating an impact origin of zoned pyroxene. |
| Ostwald A. M. Udry A. Gross J. Day J. M. D. | *Parental Melts of Nakhlites and Chassignites Determined from Analysis of Melt Inclusions* **[#1079]**<br>Complex magmatic / History in melt droplets / From one place on Mars. |
| Udry A. Howarth G. H. Herd C. D. K. Day J. M. D. Lapen T. K. et al. | *What Have We Learned About the Interior and Surface of Mars from Martian Meteorites* **[#1046]**<br>Martian meteorites are the only samples that we possess from Mars and are necessary to better constrain the geology of Mars. The Mars 2020 mission will return samples in 2031 allowing Earth-based laboratory analyses on samples with field context. |
| Niihara T. Misawa K. | *Pyroxene Compositions in EETA79001 Lithologies: Comparison with Zagami* **[#1783]**<br>We conducted detailed comparison of EETA 79001 lithologies and Zagami. Both shergottite contain several different lithology in a single rock and may constrain complex magmatism on Mars. |
| Stephen N. R. Irving A. J. | *Petrological Examination of Coarse-Grained Shergottites Northwest Africa 10761, Northwest Africa 11300, and Northwest Africa 12323; Combined Analytical Microscopy Using SEM-EDS and XFM* **[#1911]**<br>Three gabbros from Mars / Revealed using XFM / More phases than thought! |
| Staddon L. G. Darling J. R. Schwarz W. H. | *Microstructurally Constrained Geochronology of Baddeleyite Within Shergottites* |

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| Stephen N. R. Schuindt S. et al. | *Northwest Africa (NWA) 7257, NWA 8679, and Zagami* **[#1875]**<br>We explore the effects of shock metamorphism on baddeleyite microstructure and U-Pb isotope systematics within three, moderately shocked shergottites. |
| O'Neal E. W. Udry A. Howarth G. H. Gross J. Ostwald A. M. | *Characterization of Poikilitic Shergottite Parental Melts and What They Can Tell Us About Martian Magmatism* **[#1065]**<br>Based on melt inclusion analyses conducted, parental melt compositions of poikilitic shergottites exhibit similar compositions to that of olivine-phyric shergottites, possibly linking them. |
| Irving A. J. Carpenter P. K. Righter M. Lapen T. J. Tepper J. H. | *Martian Meteorite Rain 2021: Petrology and Bulk Elemental Composition of More Shergottites and Nakhlites* **[#2229]**<br>The deluge of meteorite specimens ejected from Mars continues unabated with 20 new diverse examples described during 2020. |
| Li Y. McCausland P. J. A. Flemming R. L. | *Shock Effects on Olivine Structure and Slip Systems in Martian Dunite Northwest Africa 2737* **[#2428]**<br>Investigation on microstructures formed/modified by martian igneous process and shock effects. |
| Cao F. Flemming R. L. Izawa M. R. M. Agee C. B. | *Mineralogy and Shock Effects in Martian Breccia Northwest Africa 7034 by In Situ Micro X-Ray Diffraction* **[#2472]**<br>We used micro-XRD to study the mineralogy and shock effects of major minerals in martian breccias (plagioclase, pyroxene). Shock pressure of these minerals is quantitatively estimated for the first time. Some pyroxene grains show high-level pressure. |
| Griffin S. Daly L. Lee M. R. Forman L. V. Piazolo S. et al. | *Crystallographic Deformation Within the Nakhlites: Implications for Emplacement and Ejection* **[#2083]**<br>Conditions on Mars / Pyroxene and olivine / Slip systems reveal. |
| Payre V. Dasgupta R. | *Effects of Phosphorus on Martian Magma Genesis: An Experimental Study* **[#1705]**<br>We show that concentration of P2O5 as low as 0.2 wt.% in the martian mantle is sufficient to significantly affect both the composition of martian, mantle-derived melts, and the residual mineralogy. |
| Mahajan R. R. Basu Sarbadhikari A. | *Nitrogen and Noble Gases in Martian Meteorite Tissint* **[#1041]**<br>Presented nitrogen and noble gas isotopic composition in the martian meteorite Tissint. The aim to understand the trapped components in Tissint. |
| Franz H. B. Dottin J. III Wu N. Farquhar J. Irving A. J. | *Large Sulfur Isotopic Anomalies in Shergottites Gadamis 001 and Northeast Africa 011* **[#2018]**<br>We will present sulfur isotope ratios for sulfides of martian meteorites Gadamis 001 and Northeast Africa 011 acquired through chemical extraction from bulk rock samples, which show isotopic anomalies among the largest yet detected in shergottites. |
| Davidson J. Wadhwa M. Sutton S. Hervig R. L. | *Water on Mars: Insights from Correlated Microscale Investigations of Hydrogen Isotopes, Water Abundances, and Iron Valence of Nominally Anhydrous Pyroxene in Nakhlites* **[#2103]**<br>We report the combined $H_2O$–δD–$Fe^{3+}/\Sigma Fe$ systematics of nakhlite pyroxenes to understand the variability in hydrogen isotope compositions and redox within martian nakhlites. |

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| Shi E. Wang A. Li H. Ling Z. | *A γ-$CaSO_4$ with Abnormal Stability from Atacama Desert and in a Martian Meteorite* **[#2151]**<br>γ-$CaSO_4$ from Atacama desert and in MIL03346 were studied using the multiple micro-analysis techniques. The infilling of Si, P, and methyl into their tunnel structure was found to be the reason causing their abnormal stability. |
| Nascimento-Dias B. L. do Anjos V. C. Zucolotto M. E. da Silva T. V. F. Barreto J. et al. | *Possible Interpretations and Implications of the Carbons Detection in Martian Meteorite Zagami* **[#1333]**<br>Martian meteorites are considered important pieces of geological material from Mars. Based on analysis, carbon results detected in the Zagami; suggested here, some possible interpretation about the origin of this carbon and implications. |
| Nascimento-Dias B. L. do Anjos V. C. Zucolotto M. E. | *Calcium Carbonates Detected in Martian Meteorites May Be Indicative of the Existence of Paleolakes on Mars* **[#1308]**<br>Using raman was detected a Raman shift between 1080–1090 $cm^{-1}$ in NWA 6963 an ALH 84001. This peak is called “internal modes” due they originate from vibrations between the C and O of carbonate ($CO_3$) and suggest the presence of Calcite ($CaCO_3$). |
| Siljeström S. Steele A. | *Organic Phases in Nakhla Martian Meteorite as Mapped by Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS)* **[#1468]**<br>We identified organic phases in Nakhla martian meteorite, which were associated with minerals such as iron oxides and iron carbonates. The carbon phases included a rich set of oxygen-and nitrogen-containing organic molecules. |
| O’Brien A. C. Hallis L. J. Regnault C. Morrison D. J. Tait A. et al. | *Determining Origin of Organic Matter in Martian Samples Using Metabolomics* **[#2069]**<br>Lafayette fell when? / Surprise crop disease remnant / Might give us a clue! |

## [P638]
## POSTER SESSION: PRESOLAR GRAINS, IDPS, GENESIS, STARDUST, HAYABUSA

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Stephan T. Bose M. Boujibar A. Davis A. M. Gyngard F. et al. | *The Presolar Grain Database for Silicon Carbide — Grain Type Assignments* **[#2358]**<br>The updated Presolar Grain Database now contains data for 19,976 SiC grains. We review current classification schemes to unify various definitions of grain types used previously. |
| Westphal A. J. Gainsforth Z. Tomsick J. Butterworth A. L. | *High-Statistics Measurement of Oxidation State of Fe in the ISM Using XMM Observations of Cyg X-1* **[#1643]**<br>We use a high-statistics XMM Fe L-edge spectrum of the ISM in the direction of Cyg X-1 with a library of standard spectra acquired by synchrotron microprobe to conclude that ISM Fe is highly reduced, either in metal or carbide. |

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| Gainsforth Z. Butterworth A. L. Tomsick J. Westphal A. J. | *Simulated Fe-L Edge XAS of Molecular Species in the ISM* **[#1669]**<br>We simulated X-ray absorption spectra of molecular species in vacuum for comparison against space-based X-ray telescope observations of the absorption spectrum of the interstellar medium. |
| Fisenko A. V. Semjonova L. F. | *Nanodiamonds of Meteorites: Extreme Isotopic Composition of Xenon Components* **[#1016]**<br>The first results of modeling the measured Xe isotope compositions for Orgueil and Indarch diamonds by Xe-P3, Xe-S and two extreme Xe components are discussed. |
| Whittington A. G. Sehlke A. Speck A. K. | *Recalescence in Silicate Melts: Applications to Circumstellar Dust Grains, Lava Fountains, and Lava Flows* **[#1776]**<br>Rapidly crystallizing silicate melts can release latent heat so rapidly that they spontaneously heat up — we have documented local heating exceeding 160°C in experiments. We apply the result to dust grains and chondrules, lava fountains, and flows. |
| Pabari J. P. Singh R. Acharyya K. Nambiar S. Jitarwal S. et al. | *Detachment of Interplanetary Dust Particles from Asteroid Belt* **[#1430]**<br>Trajectory of Interplanetary Dust Particle evolves after its origination from asteroid belt. Results show that particle is detached from the belt, when it achieves eccentricity greater than 0.25. Also, it is expected to reach Mars in about 264 My. |
| Boyd M. R. Cartwright J. A. Singh J. Bagot P. A. J. Moody M. P. | *Nanoscale Compositional Analysis of an Antarctic Micrometeorite Using Atom Probe Tomography* **[#2449]**<br>Cosmic dust may show / Atmospheric processing / Now we look closely. |
| Lucas J. Resendiz B. U. Dominguez G. | *Isotopic Signatures Associated with Quantum Tunneling of Atomic Oxygen on Cold Dust GrainSurfaces* **[#2493]**<br>Investigations of low-temperature diffusion of oxygen isotopes on dust grain surfaces due to quantum mechanical tunneling using computational simulations to solve the Schrödinger equation numerically. |
| Fernandes D. Rudraswami N. G. Pandey M. | *Composite Micrometeorites Recovered from Antarctica* **[#1053]**<br>Two individual composite micrometeorites recovered from Antarctica accommodate preserved micro-chondrule and chondrule fragments, textural investigation, and chemical compositions suggest the most probable provenance from known chondrites. |
| Zhang M. Kitajima K. Kita N. T. | *Development of Submicron Oxygen-Three Isotopes Analytical Protocol for ~ 1 μm Wild 2 Particles* **[#1690]**<br>We developed an analytical protocol for determining the oxygen isotope ratios of 1–2 μm Wild 2 particles with an uncertainty of < 10‰ in $\Delta^{17}O$. |
| Nguyen A. N. Mane P. Ross D. K. Simon J. I. | *Identification of an $^{16}O$-Poor Solar System Condensate in the Miller Range 090019 $CO_3$.1 Chondrite* **[#2769]**<br>We identified a $^{16}O$-poor grain with an oxide core and C-rich rim, a $^{16}O$-poor whisker-shaped silicate, and a $^{16}O$-rich silicate. The silicate grains likely condensed from a gas while the C, O aggregate grain was altered by $^{16}O$-poor reservoir. |
| Jaeger L. Butterworth A. L. Gainsforth Z. Lettieri R. Ardizzone A. et al. | *Automatic Detection of Interstellar Dust Impact Craters on Stardust Aluminum Foils by Convolutional Neural Networks* **[#1716]**<br>We describe a convolutional neural network that achieves high specificity and sensitivity in locating impact craters in the Stardust interstellar collector aluminum foils. |

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| Jurewicz A. J. G. Laming J. M. Christoffersen R. | *The Genesis Mission: A Unique Opportunity for Scientific Collaboration* **[#1295]** The Genesis mission exposed many materials to different types of solar wind. The mission goal is cosmochemical (a baseline of nebular composition based on solar matter); important solar physics and space weathering goals can be achieved concurrently. |
| Schmeling M. Jurewicz A. J. G. Allton J. Burnett D. S. | *Removing Contamination from Genesis Sapphire Collectors by Polishing* **[#1262]** Different abrasive material were tested for suitability of Genesis Sapphire Collector cleaning. The results were evaluated by optical microscopy, total reflection X-ray, and secondary ion mass spectrometries. |
| Rieck K. D. Jurewicz A. J. G. Ogliore R. C. | *Comparing SIMS Data for Solar Wind Na in Two Collectors Using Multiple Approaches* **[#2638]** We report results of reprocessing bulk solar wind 23Na data measured in Genesis DLC collectors with SIMS, and compare our results with measurements in Si. We also report new measurements made with an $O_3$- primary beam (vs. $O_2$+) with low impact energy. |
| Veryovkin I. V. Tripa C. E. | *RIMS with Laser Ablation Probes for Trace Elemental Analysis of Genesis Samples: Lessons Learned for Rb and Sr* **[#2692]** We summarize our development of RIMS instrumentation for trace elemental analysis of Rb and Sr in Genesis solar wind collectors. We demonstrate ps UV laser probe having no visible mass interferences on Genesis sapphire collectors. |
| Mijjum M. Welten K. C. Bixler A. J. Nishiizumi K. Burnett D. S. | *Investigating Micrometeorite Material Retention on Genesis Mo-Pt Foils* **[#2376]** By removing/analyzing micrometeorite (MM) impacts from Genesis Mo-Pt foils and measuring their size-frequency distribution, we find the negligible MM material deposited does not pose a threat to the planned solar wind derived radionuclide analysis. |
| Burgess K. D. Stroud R. M. | *Exogenous Copper Sulfide in a Returned Grain from Asteroid Itokawa* **[#1175]** The particle came from Itokawa, / But this sulfide doesn't look like the others. / The grain must have formed / Where it wasn't as warm. / This chalcopyrite needed water. |

## [P639]
## POSTER SESSION: SOLAR NEBULAR PROCESSES

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Li M. Huang S. Zhu Z. Petaev M. I. Steffen J. H. | *Maximum Temperatures in Evolving Protoplanetary Disks and Composition of Planetary Building Blocks* **[#2473]** We calculate the maximum temperatures in the disks which form from collapse of molecular cloud cores with different initial conditions. We also calculate the compositions of planetary building blocks. |

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| Lichtenberg T. Drazkowska J. Schönächler M. Golabek G. J. Hands T. O. | *Bifurcation of Planetary Building Blocks During Solar System Formation* **[#1870]** A new framework for protoplanet formation explains chronology and dichotomy in isotopes and volatiles between inner and outer solar system. The moving snowline yields two reservoirs of bodies diverging in volatiles, core formation, and accretion mode. |
| Arakawa S. Krijt S. | *The Stickiness of $CO_2$ and $H_2O$ Ice Particles: Effects of "Viscoelastic" Energy Dissipation on the Threshold Velocity for Sticking* **[#1216]** Laboratory experiments revealed that $CO_2$ ice particles are less sticky compared to $H_2O$ ice particles. We found that this difference in stickiness would originate from the large difference in the strength of viscoelastic dissipation. |
| Garani J. Lyons J. R. | *Modeling Nitrogen Isotope Chemistry in the Solar Nebula* **[#2571]** This abstract presents results on the hypothesis that the process of self-shielding can be used to explain the 400‰ difference in nitrogen isotope ratios between the bulk Earth and the Sun. |
| Fukai R. Arakawa S. | *The Evolutional Model of Chromium Isotopic Heterogeneities in the Protoplanetary Disk* **[#1049]** We tried to estimate the relative formation region of volatile-rich asteroids by utilizing the nucleosynthetic Cr isotopic variation ($^{54}$Cr/52Cr) in bulk-scale CCs. |
| Umurhan O. M. Estrada P. E. Sengupta D. | *Are the First Planetesimals Born in Turbulence?* **[#2243]** Turbulence generated by sheared settled particle layers (alpha < 1e-5) sap energy from the gas on scales larger than Kolmogorov's. Given particle growth models, we conjecture that most of the first planetesimals (<0.5 Ma) were formed in turbulence. |
| Sridhar N. Bryson J. F. J. King A. J. Harrison R. J. | *Constraints on the Ice Composition of Carbonaceous Chondrites* **[#1095]** Compared to the CO and CM chondrites, magnetic measurements indicate that the CI chondrites, WIS 91600, and Tagish Lake accreted water ice with a different composition, which impacted the aqueous alteration pathways experienced by these meteorites. |
| Koch T. E. Spahr D. Merges D. Christ O. Genzel P.-T. et al. | *Forsterite Dust Aggregation Aboard the International Space Station (ISS)* **[#1950]** We studied the behaviour of dust particles under microgravity conditions aboard the ISS. |
| Sandtorf-McDonald J. R. Ahrens C. J. Chevrier V. F. | *Nitrogen and Water Ice Mixtures: Spectral Analysis of Homogeneous and Heterogeneous Condensation with Possible Clathration* **[#2623]** Mixtures of water and nitrogen ice were made under low temperature, low pressure conditions. Two condensation protocols were used: a one-step direct condensation method, and a two-step condensation method. Both mixtures were analyzed with FTIR. |
| Kadlag Y. Hirtz J. Becker H. Leya I. Mezger K. | *Early Solar Irradiation as a Source of the Inner Solar System Isotopic Heterogeneity* **[#1185]** The effect of irradiation on the mm to cm sized dust is explored as an another alternative for the variations in neutron-rich isotopes of elements (such as $^{54}$Cr) in inner solar system objects using new data on the components of enstatite chondrites. |
| Sharma S. Mei Q.-F. Leya I. Humayun M. | *Palladium Isotopic Heterogeneity in the Solar System* **[#1655]** We report the nucleosynthetic isotope anomalies in Pd isotopes for five different groups of iron meteorites (IAB, IIAB, IID, IVA, and IVB), combined with the ungrouped meteorites Chinga and Gebel Kamil. |
| Leitner J. Vollmer C. Harries D. Kodolányi J. Ott U. et al. | *A Study of Chromium and Silicon Nitrides in Carbonaceous Chondrites* **[#1878]** We identified Si3N4 and CrN in metal-sulfide grains in a set of carbonaceous chondrites. |

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| | N-isotopic compositions show variations between chondrite groups that could be related to different heliocentric distances of the respective formation regions. |
| Zhu K. Moynier F. Schiller M. Alexander C. M. O'D. Davidson J. et al. | *Mass-Independent Chromium Isotopic Panorama in Chondrites: Implications for Origin of Chondrite Parent Bodies and Early Terrestrial Depletion* **[#2131]** MIF Cr isotope data show intra-group $\varepsilon^{54}$Cr heterogeneities. The $\varepsilon^{53}$Cr difference between chondrites and Earth indicates an early terrestrial volatile depletion. |
| Liu N. Ogliore R. C. Tissot F. L. H. Dauphas N. | *Is There Presolar Dust in the Allende Curious Marie Calcium-Aluminum-Rich Inclusion?* **[#2382]** Our detection of no C-anomalous grain and two O-anomalous candidates by in situ NanoSIMS survey of a fine-grained Allende CAI suggests that presolar oxides could be the carrier of the s-process noble gas signatures recently reported for the same CAI. |
| Marquez R. T. C. Charlier B. L. A. Tissot F. L. H. | *Search for the Carriers of Anomalous Nucleosynthetic Signatures in Early Solar System Condensates* **[#2635]** Tissot et al. (see accompanying abstract) show that highly anomalous carriers were preserved in Allende fine-grained CAIs. We present our recent progress in identifying the carriers of these anomalies through SEM/EDS analysis of leaching residues. |
| Kodolányi J. Hoppe P. Vollmer C. | *In Situ Constraints on the $^{60}$Fe Abundance in the Early Solar System* **[#1291]** New NanoSIMS analyses of old chondrules (Al-Mg age: 1-2 million years after canonical CAIs) do not find significant in situ growth of $^{60}$Ni from $^{60}$Fe dacay, unlike many previous in situ studies. Why the different result? |
| Shollenberger Q. R. Tang H. Young E. D. | *$^{54}$Fe Heterogeneity in Sequential Acid Leachates of Refractory Inclusions* **[#1733]** We report $\varepsilon^{54}$Fe variations in sequential acid leachates obtained from three CAIs. CAIs mostly contain Fe that condensed from the gas phase, but a small amount of Fe is derived from refractory dust incorporated into CAIs during their formation. |
| Rietmeijer F. J. M. Brearley A. J. Nuth J. A. | *Experimental Confirmation of Deep Metastable Eutectic Vapor Condensation in Astronomical Environments and the Solar Nebula* **[#1620]** Condensation experiments using combinations of Mg, Al, Fe, and O show that amorphous, metastable nanophase condensates could form from a gas phase due to rapid quenching in the solar nebular, according to deep metastable eutectic behavior. |
| Han J. Keller L. P. | *Hibonite and Its Associated Ultrarefractory Phases from the Paris CM Chondrite* **[#2587]** TEM studies of hibonite and its inclusions of Zr-bearing perovskite, lakargiite, tazheranite, and Os-Ir-W-Mo alloy to determine their microstructure, chemistry, and crystallography. |
| Konovalova K. A. Plechov P. Yu. Litasov K. D. Shcherbakov V. D. Vasiliev S. P. | *Evolution of Pyroxene Composition During CAI Formation in CV3-Chondrite Northwest Africa 12590* **[#1517]** We report results on the mineralogical study of Ti-Cpx from the B1-type CAIs in new CV3 chondrite Northwest Africa 12590. We have identified several generations of Cpx with different textural features and Ti3+/Ti4+ ratios. |
| Mishra R. K. | *Petrography and Mineralogy of a Large Calcium, Aluminum-Rich Inclusion in Chainpur (LL3.4) Ordinary Chondrite* **[#1837]** Calcium, Aluminium-rich inclusions (CAIs) in ordinary chondrites are very rare and |

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| | small. Petrography and mineralogy of the largest (1500 x1200 microns) CAI in Ordinary chondrites found in Chainpur (LL3.4) is described. |
| Konovalova K. A. Plechov P. Yu. Litasov K. D. Shcherbakov V. D. Vasiliev S. P. | *Mineralogy of the Complex Refractory Metal Nuggets in B1 Type CAI from CV3-Chondrite Northwest Africa 12590* **[#1961]** We report the results on the mineralogical study complex refractory metal nuggets with nonmetal phases from the B1-type CAIs in new CV3 chondrite Northwest Africa 12590. |
| Hyde T. W. Schmidt J. Matthews L. S. Carballido A. | *Experimental Study of Chondrule Rim Formation* **[#1128]** Chondrules found within chondritic meteorites contain fundamental information about the origin of the solar system. This paper examines the development of fine-grained dust rims and the data they provide concerning this question. |
| Patzer A. Bullock E. S. Alexander C. M. O'D. | *Evidence Against Chondrule-Matrix Complementarity as Seen in CO, CM, and CR Chondrites* **[#1866]** We have investigated 12 CO, CM, and CR chondrites to test models for the compositions and origins of chondrules and matrix. Our results are inconsistent with complementarity and invoke separate evolutionary paths for chondrules and matrix. |
| Frizzell K. R. Bermingham K. R. Meyer B. S. | *Utilizing Nucleosynthetic Models and Jupyter Notebooks to Constrain the Building Blocks of the Solar System* **[#2650]** Here, we show how we make results from nucleosynthesis calculations using NucNet Tools more accessible to cosmochemists investigating the building blocks and evolution of the solar system using Python's Jupyter notebook user interface. |
| Trappitsch R. | *Working with Solar System Elemental and Isotopic Abundances in Python* **[#2485]** Solar system abundances in Python 3.6+: $ pip install iniabu; $ python; >>> from iniabu import ini. |

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## POSTER SESSION: IMPACTS: CHANGING PLANETARY BODIES BEYOND EARTH

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| Ciocco M. Roskosz M. Doisneau B. Mostefaoui S. Gounelle M. | *NanoSIMS-TEM Coupled Study of Three Highly Shocked L Chondrites to Constrain the Collisional History of the Solar System* **[#2020]** TEM and NanoSIMS observations are combined to precisely quantify major and trace element redistribution across high-pressure polymorphic assemblages in three L chondrites. This dual approach allows us to accurately estimate impact shock pulses. |
| Gupta S. Arya A. S. Solanki P. M. Amitabh Suresh K. et al. | *Morphodynamic Study of Oblique Impact Crater on Lunar Surface Using Terrain Mapping Camera Onboard Chandrayaan-2* **[#2140]** Lunar impact cratering has an important role for planetary evolution and shaping of the |

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| | planetary bodies. Correlation of impact cratering with impact experimental results helps for better understanding of impact crater formation. |
| Wren P. F. Fevig R. A. | *Lunar Doublet Craters: Constraining Binary Asteroids in the Near-Earth Population* **[#1671]**<br>Surveyed areas in lunar maria and highlands for doublet impact craters. Estimating impactor sizes, and applying statistics to constrain near-Earth binary asteroids. |
| Boyce J. M. Schaber G. G. Giguere T. | *Luna 24: A Case Study for the Value of Accurate Calibrated Impact Flux Curves for Predicting Absolute Age* **[#1035]**<br>Luna 24 samples and our crater density based prediction from 1977 of their age provide a blind test for the accuracy of current impact flux calibration models (i.e., Neukum et al., 2001) where our 1977 prediction was 3.5 Ga, and now 3.26 Ga. |
| Hill D. Fox O. Hager A. Ukiwo O. Duffy A. et al. | *An Attempt to Determine Minimum Areas for Useful Model Ages* **[#2463]**<br>Dated different size ranges of craters. Craters >1200 km areas are assumed to give reliable isochron model ages. We tested for being drawn from the same population for smaller ranges of areas using Kolmogorov-Smirnov test. |
| Neidhart T. Miljković K. Daubar I. J. Sansom E. K. Gao A. et al. | *Update on the Crater Cluster Mapping and Statistics on Mars* **[#2033]**<br>The properties of impact craters on Mars that formed in the last 15 years were studied to update a crater catalogue. About 58% of these impact sites are clusters. We will present characteristics of these clusters. |
| Shaffer S. J. Hoffman M. E. Newsom H. E. | *Initial Small Crater Survey of the MER Spirit Rover Traverse* **[#2760]**<br>An initial survey of the smallest craters across the first 500 sols of the Spirit rover traverse that supplements past observational studies of these smallest craters at other rover locations. |
| Boatwright B. D. Head J. W. Kreslavsky M. A. | *Improved Crater Wall Slope Detection Using a Hough Circle Transform with Applications to Mars Crater Morphometry and Climate History* **[#1651]**<br>Crater walls on Mars: / Improved algorithm means / Better detections. |
| Herrick R. R. Dorn L. M. | *The Mechanics of Crater Cavity Formation and Modification at the Simple-to-Complex Transition on Mars* **[#2414]**<br>Using stereo-derived topography and photogeologic analysis of type examples, we assess the mechanics of crater excavation and modification for 7-9 km martian craters with different types of wall failure. |
| Burt D. M. | *Distinctive Features of Impactoclastic Layered Rocks on Mars* **[#1210]**<br>Layered rocks studied at the three rover landing sites on Mars appear to have no features diagnostic of primary liquid water deposition, and abundant features suggestive of sedimentation by impactoclastic density currents, as well as evidence of later diagenetic alteration. |
| Miljkovic K. Daubar I. J. Rajsic A. Neidhart T. Sansom E. K. et al. | *New Impact Craters on Mars Since the Landing of the InSight Mission* **[#1758]**<br>Impacts batter Mars / Too far from InSight's ears / Wishful thinking. |
| Froment M. Lognonné P. Larmat C. Rougier E. Lei Z. et al. | *Numerical Simulation of an Impact-Generated Stress-Glut Field and Corresponding Seismic Source* **[#1847]**<br>We present a numerical method to compute the stress-glut field of an impact based on 3D simulations. A description of the impact as a time-varying seismic point-source is obtained, combining a 6-component seismic moment tensor and a vector force. |
| Yasui M. Arakawa M. Okawa H. Hasegawa S. | *Impact Cratering Experiments on Granular Targets Simulating Surface Layer on* |

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| | *Asteroid 162173 Ryugu: Crater Scaling Law and Impact-Induced Seismic Shaking* **[#1158]**<br>We conducted impact cratering experiments on glass beads having the size frequency distribution simulating the surface layer on asteroid Ryugu to examine the crater size scaling law and the propagation process of impact-induced seismic wave. |
| Yamamoto Y. Arakawa M. Yasui M. Hasegawa S. Yokota Y. et al. | *Crater Size Scaling Law and Impact-Induced Seismic Shaking on Rubble-Pile Asteroids* **[#1979]**<br>We conducted impact experiments on granular targets composed of low strength and coarse-grains to study the effects of size distribution on the crater size scaling laws and the impact-induced seismic shaking processes on asteroids. |
| Wlodarczyk I. | *Possible Impacts of the Asteroid (101955) Bennu* **[#1509]**<br>We present computations of possible collisions of the asteroid (101955) Bennu with the Earth, based on all published observations. |

## [P641]
## POSTER SESSION: IMPACTS: FINDING AND ANALYZING EARTH'S CRATERS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Osinski G. R. Grieve R. A. F. Hill P. J. A. Newman J. | *Impact Earth — A 2021 Update on the Terrestrial Impact Record* **[#1970]**<br>We provide an update on the number of confirmed meteorite impact structures on Earth as listed in the Impact Earth crater database. Omissions and recent additions are discussed. |
| Shumilova T. G. | *Giant Kara Astrobleme: Present State and Future Frontiers* **[#1608]**<br>Here we briefly describe the present state of our knowledge about the Kara Crater and impactites, and propose some future frontiers of the astrobleme. |
| Kenny G. G. Öhman T. Whitehouse M. J. Raitala J. | *Zircon U–Pb Dating of the Kara Impact Structure, Russia, Indicates No Role in Late Cretaceous Mass Extinctions* **[#1413]**<br>A ca. 75 Ma U–Pb age for impact-recrystallized zircon indicates that the Kara impact event occurred in the Campanian and was not related to the K–Pg boundary, the Campanian–Maastrichtian boundary, or a supposed marine extinction event at ca. 80 Ma. |
| Srivastava P. K. Ghosh S. Das A. K. De S. K. Misra S. et al. | *An Evaluation of the Size of Ramgarh Crater, India: Clues from Satellite Gravity Data* **[#1096]**<br>Satellite Bouguer gravity map suggests that the visible rim of the Ramgarh Crater, India, represents the maximum extension of the crater. Hence, previously established rim-to-rim diameter of ~2.4 km represents the maximum size of the crater. |
| Master S. Cooper G. R. J. | *New Topographic Modelling of the >45 km Diameter Simlipal Ring Structure,* |

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| | *Singhbhum Craton, Odisha, India — World's Oldest Impact Structure* **[#1610]**<br>The c.3.08 Ga Simlipal structure is made of quartzites and basalts with shatter cones. Processed DEMs show concentric topographic rings surrounded by troughs. A central layered intrusion with gravity high is regarded as a differentiated melt sheet. |
| King D. T. Jr. Ormö J. Petruny L. W. De Marchi L. Agrawal A. | *Field, Drill-Core, and Geophysical Analysis, Wetumpka Impact Structure, Alabama* **[#2467]**<br>Wetumpka impact structure, Alabama, a 7.5 km diameter, Late Cretaceous feature of the inner coastal plain of Alabama, has been examined by field studies, drill-cores, and geophysical methods, which are reported here. |
| Quintero R. R. Cavosie A. J. Meyers J. Workman-Davies C. | *Ora Banda: Evidence for a Newly Discovered Impact Structure in Western Australia* **[#1921]**<br>We present photographic evidence of shatter cones and initial micro-analytical work conducted on breccia from drill core samples from Ora Banda. Planar microstructures in quartz were identified in BSE. Further petrographic analysis is in progress. |
| Quintero R. R. Cavosie A. J. | *Deformed Quartz from the First Drill Cores at the Ilkurlka Circular Geophysical Anomaly in Western Australia: A Possible Impact Structure* **[#1946]**<br>Results from a survey of minerals from samples spanning two boreholes through the Ilkurlka anomaly are presented. We describe concussion and sub-planar fractures in quartz, and kink bands in biotite, observed by BSE imaging. |
| Harris R. S. Jaret S. J. Albin E. F. | *The Woodbury-Manchester Impact Structure: Confirmation of a Large Low-Angle Oblique Impact on Earth in the Early Neoproterozoic* **[#2365]**<br>It's a new crater! / Look at all these shocked quartz grains / And it's really large. |
| Alwmark C. Monson C. C. | *Confirmation of Shocked Quartz Grains in the Crater In-Fill of the Glasford Impact Structure* **[#1228]**<br>Here, we confirm, for the first time, that multiple sets of PFs and PDFs in quartz grains are present in a sample from the crater in-fill of the 4 km-in-diameter Glasford impact structure in Illinois (USA). |
| Herr A. A. Karunatillake S. Hood D. R. Heinrich P. Horn M. et al. | *Investigating the Brushy Creek Suspected Impact Crater, St. Helena Parish, Louisiana* **[#2737]**<br>An investigation of the suspected Brushy Creek impact crater, Louisiana using a combination of petrographic and geomorphological analysis. |
| Ucar H. Kletetschka G. | *Identification of Possible Impact Glass in Ocean Sediment from South Atlantic* **[#1648]**<br>Published studies showed microtektite level before the Matuyama-Brunhes reversal as a glassy object formed by a meteorite impact. In South Atlantic ocean sediment, we found glass particles that may extend the borders of the Australasian strewnfield. |
| Che X. C. Xie H. Q. Ma M. Z. Zhou L. Q. Long T. et al. | *In-Situ Cathodoluminescence Feature of Zircons in Thin-Sections of Impact Layer, Barberton Belt, South Africa* **[#1797]**<br>Comprehensive the grain size, BSE, EDS, and CL images of zircon grains from the impact layer, the origins of zircons are complex and variety, needs to redate all types of zircon to broaden the understanding of the oldest impact events on the Earth. |
| Minde P. Ernstson K. | *The Enigmatic Holmajärvi (Northern Sweden) Diamictite: Evidence of a Meteorite Impact Deposit* **[#1345]**<br>We report a diamictite occurrence in northern Sweden that contains typical impactite |

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| | components such as polymictic breccias with melt particles and shocked minerals. The impact origin is unknown. |
| Plado J. Jõeleht A. Losiak A. Szyszka M. Ormö J. et al. | *Small Impact Crater-Like Features: The Tor Crater, Sweden, as a Reference Structure in Evaluating Alternative Causes of Formation in Non-Volcanic Settings on Earth and Mars* **[#2725]** A multi-technique analysis to evaluate a potential impact origin against other plausible causes of formation of the Tor structure in central Sweden is presented. |
| Yakymchuk C. Kirkland C. L. Cavosie A. J. Szilas K. Hollis J. et al. | *Endogenic Origin of the Archean Maniitsoq Structure, West Greenland* **[#1167]** The Maniitsoq region of West Greenland allegedly hosts the oldest impact crater on Earth. We present the results of a comprehensive investigation of zircon from across the region. No evidence of shock deformation of zircon was found. |
| Garde A. A. Keulen N. Waight T. | *Hydration of Melt Grains from the Hiawatha Crater, North-West Greenland: Evidence for Impact Through the Greenland Ice Sheet?* **[#1288]** Mordenite microspherulites in felsic perlitic melt grains document high-T hydration during post-impact cooling, prior to low-T hydrothermal alteration. Meltwater from an ice sheet surrounding the hot crater would constitute a perfect source for this. |
| Hyde W. R. Garde A. A. Kenny G. Beck P. Johansson L. et al. | *Shock Metamorphism and Organic Matter in New Impactite Samples from the Hiawatha Crater, NW Greenland* **[#1287]** New impactite samples from the Hiawatha Crater contain highly shocked quartz and FRIGN zircon, as well as preserving fragments of organic matter displaying cell structures. |
| Seo J.-H. Han C. Bharadwaj S. Wörner G. Svensson A. et al. | *Was There a Meteorite Impact or Volcanic Eruption at the Onset of the Younger Dryas?* **[#2680]** We report that the glacio-chemical and isotopic signals at the Younger Dryas onset in GRIP ice core show no evidence of the Laacher See eruption in Eifel, Germany, or a meteorite impact. |

## [[642]
## POSTER SESSION: IMPACTS: CRATER FORMATION AND PROCESSES ON EARTH AND BEYOND

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| Allen N. H. Nakajima M. Helhoski S. Wünnemann K. Trail D. | *Simulating the Formation of Earth's Largest Impact Crater* **[#1731]** We simulate the impact that formed the Vredefort Crater, Earth's largest verified impact crater, using the iSALE2D modeling program. We find that a more energetic impact is required to fit the observed geologic evidence than previous results suggest. |
| Ivanov B. A. | *Searching for Numerical Models to Reproduce Terrases in Impact Craters* **[#1931]** |

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| | We start a small project to learn how to model the rock strain localization around impact craters combining the approach by Senft and Stewart (2009) and the acoustic fluidization. Having modeled faults, we still do not see model terrasses. |
| DeStefano A. M. | *An Updated Secondary Lunar Meteoroid Ejecta Model for Engineering Design* **[#2549]** An updated secondary meteoroid ejecta model has been developed for the use in engineering design. The secondary ejecta flux environment depends on direction and speed for a given location on the lunar surface. |
| Sasai H. S. Yasui M. Y. Arakawa M. A. Shirai K. S. | *High Velocity Impact Experiments on Porous Ice Aggregates Simulating Cometary Nuclei Surface: Measurements of Post Shock Temperature around Impact Crater* **[#1773]** We conducted high-velocity impact experiments on porous ice and measured post-shock temperatures directly beneath the crater to investigate whether residual heat around the crater might form a temporal water pond to promote chemical reactions. |
| Christoph J. M. Sharp T. Marchi S. Elkins-Tanton L. T. | *Characterizing Ejecta Fragments from Impact Experiments into Meteoric Iron Using Scanning Electron Microscopy (SEM)* **[#2730]** We use SEM to image and characterize ejecta fragments from previous impact gun experiments into samples of the Santiago Papasquiero iron meteorite, to identify fracture and deformation mechanics. |
| Hamann C. Hecht L. Schäffer S. Born K. Luther R. et al. | *Rapid, Impact-Induced Dehydration, Melting, and Recrystallization of $CaSO_4$-n$H_2O$ (Gypsum, Bassanite, Anhydrite) Inferred from Laser-Irradiation Experiments* **[#2380]** Laser-irradiation experiments with Ca sulfates shed light on dehydration of gypsum, transformation of gypsum to anhydrite via bassanite, and melting and recrystallization of calcium sulfates in the context of hypervelocity impacts on Earth and Mars. |
| Svetsov V. V. Shuvalov V. V. | *Causes of Formation of Charcoal Particles Found Under Ejecta from Small Impact Craters* **[#1007]** Numerical modeling of the impacts of iron asteroids about 1 meter in size at 10 km/s on trees show that a shock wave in wood can produce charcoal particles that are scattered in the air and on the ground and are buried under ejecta from a crater. |
| Kuzmicheva M. Yu. Ivanov B. A. | *Modeling of the Magnetic Anomaly of a Complex Crater, Taking into Account the Drilling Data of the Bosumtwi Crater* **[#1327]** An analysis of the magnetic anomaly over the well-studied Bosumtwi Crater (Ghana, 10 km in diameter), including crater formation numerical modeling and developing a magnetic anomaly model, based on simulated parameters and drilling data is done. |
| Röhlen R. Wünnemann K. Maas C. Allibert L. Manske L. et al. | *The Fate of Iron Cores Upon Impact of Differentiated Bodies into Magma Oceans* **[#1854]** Our numerical simulations study the fate of iron cores of differentiated impactors after impacting in a magma ocean with an improved material tracking method. |
| Allibert L. Güldemeister N. Manske L. Nakajima M. Wünnemann K. | *Numerical Modeling of the Thermal State of Earth After the Moon-Forming Impact Event* **[#2215]** Numerical simulations of Moon-forming impact scenarios allow for quantifying the melt production as a function of impact angle, velocity, and initial thermal state. In all our simulations, the Moon-forming impact scenarios produce a global magma ocean. |
| Manske L. Plesa A.-C. Ruedas T. Wünnemann K. | *The Influence of Interior Structure and Thermal State on Impact Melt Generation in Terrestrial Planets* **[#2030]** |

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| | We revisit melt generation in impacts on generic terrestrial planets, where we coupled thermal evolution models of the target planets with impact simulations accounting for shock heating, heating due to plastic work and decompression melting. |
| Hietala S. Plado J. Höglund K. Andersen M. Holmlund J. et al. | *In Situ Sedimentary Rock and Pseudotachylitic Breccia Veins in the Rim of the Söderfjärden Impact Crater Structure, Finland* **[#1222]**<br>The research team found in situ sedimentary and pseudotachylitic cataclastic rock veins from the rim area. Rocks include PDFs in quartz grains and thus represent the ejecta layer. No sedimentary rock outcrops have been earlier seen in the crater area. |
| Spencer C. J. Cavosie A. J. Evans N. J. Rankenburg K. Thomas R. J. et al. | *Granulate Titanite in Granitoid from the Rotes Kamm Crater — A Product of Regional Metamorphism, NOT Meteorite Impact* **[#1235]**<br>EBSD and U-Pb geochronology of titanite from the Roter Kamm Crater rim highlight the potential for misinterpreting inherited microstructures as impact-related phenomenon in target rocks with a complex geological history. |
| Huber M. S. Gulick S. P. S. Tisato N. Kovaleva E. Clark M. et al. | *Preliminary Results of Geophysical Properties of Granitoids Taken from a Transect Through the Vredefort Impact Structure* **[#1188]**<br>Impact! Peak ring rise. / Rock properties transmuted. / Uplift boundary? |
| Feignon J.-G. de Graaff S. J. Ferrière L. Kaskes P. Déhais T. et al. | *Petrological and Geochemical Investigations of the Granite Basement in the Chicxulub Peak Ring: Implications for the Yucatán Target Rock* **[#1557]**<br>A large shocked granite unit was recovered in the Chicxulub impact structure peak ring, and is a major component of the impactites found. Detailed investigations gave information on granite sources and the composition of Yucatán target rock. |
| Gulick S. P. S. Christeson G. L. McCall N. Jõeleht A. Morgan J. V. et al. | *Impactite Stratigraphy and Depositional Processes in the Chicxulub and Ries Impact Structures: Insights into Crater Floors* **[#2320]**<br>Comparison of impactite stratigraphy using geophysics and drilling data from the Chicxulub and Ries impact structures. Results highlight final crater morphology is affected by infilling processes during crater modification. |
| Verhagen C. M. Tikoo S. M. Gattacceca J. Schmieder M. Rochette P. et al. | *Unraveling the Magnetic History of Peak Ring Granitoid Rocks from the Chicxulub Impact Structure* **[#2350]**<br>Peak ring granitoids / Hydrothermal overprint / Contacts are the key. |
| Burney D. Neal C. R. | *PGE Content of Impact Melts and Sulfides in the Chicxulub Crater; Evidence for PGE Mobilization/Fractionation and the Impactor Signature* **[#2409]**<br>The platinum group elements can show the signature of the impactor that delivered them. The Chicxulub impact was large enough to fractionate this suite of elements, but the impact lithologies hint at a chondritic origin. |
| Navarro K. F. Urrutia-Fucugauchi J. Villagran-Muniz M. Sanchez-Ake C. Perez- Cruz L. et al. | *Physical Characterization of an Impact Vapor Plume from a Chicxulub Carbonate Layer Using Laser Ablation in a Simulated Late Cretaceous Atmosphere* **[#1354]**<br>The impact vapor plume was produced using Yax-1 borehole sediments and was characterized as a function of electron number density, plasma temperature, and pressure. Its emission spectrum was dominated by Ca, Ca+, O, and N lines. |
| Ernstson K. Portz D. Müller W. | *Zhamanshinite-Like Black-Glass Melt Rocks from the Saarland (Germany) Meteorite Impact Site* **[#1350]**<br>The Saarland (Germany) impact with craters and strongly shocked and melt rocks, has yielded abundant new finds of impactites with large black glass components similar to the Zhamanshinites in Kazakhstan. Paleolithic black glass artifacts occur. |

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| Esau A. Hamann C. Kaufmann F. E. D. Sergienko E. Yanson S. et al. | *Heterogeneities of Impact Melts from the Zhamanshin Crater: A Two-Stage Mixing Scenario?* **[#2613]** Detailed microchemical investigations of zhamanshinites, irghizites, and microirghizites from Zhamanshin impact crater, Kazakhstan, reveal a complex, multistep genesis of heterogeneous impact melts and interactions between target and projectile. |
| Ernstson K. | *The East Bavarian Meteorite Crater Assemblage Revitalized — Probably Linked to the Ries Crater (Germany) Impact Event* **[#1851]** The 50 years old hypothesis about the much larger extension of the Ries Crater impact event up to more than 100 km to the east gets here a further new confirmation with a rejection of the ignorance at that time and continuing until today. |
| Poßekel J. Ernstson K. | *Ries Impact Structure (Germany) Long-Distance Cratering Effects: The Mandlberg Phenomenon Seen in Ground Penetrating Radar (GPR)* **[#1347]** The rejected hypothesis of the renowned geologist E. Rutte that the Ries impact event had far greater effects has recently experienced a revival. We report on GPR measurements, which support the existence of further craters in eastern Bavaria. |
| Svensson M. J. O. Osinski G. R. Longstaffe F. J. | *Revisiting the Origin of the Ries Graded Suevite: Implications for Plume Fallback Preservation* **[#2478]** Petrography of the Ries graded suevite and a comparison to the Bosumtwi fallback deposits supports a subaqueous origin of the Ries graded suevite; however, there are other factors that could influence fallback preservation requiring further study. |

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## POSTER SESSION: IMPACTS ON THE MOON

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| De Hon R. A. | *Crater Wall Failure and Original Excavated Diameter* **[#1296]** Wall failure by slumping and regolith flow increases the apparent diameters of complex craters. Plotting depth/corrected diameter yields a best fit trend of d = 0.945D0.328 with R2 = 0.459. |
| Jodhpurkar M. J. Ostrach L. R. Zellner N. E. B. | *Mapping and Interpreting Moulton Crater and Its Surroundings* **[#1767]** We used WAC and NAC imagery to conduct crater counts on Moulton Crater and its surrounding area, along with creating a geologic map. This brings us closer to constraining the crater's age and understanding the interaction of geologic processes here. |
| Williams J.-P. Gallinger C. L. Hayne P. O. Paige D. A. Pathare A. V. et al. | *The Diversity of Lunar Ejecta Materials at Giordano Bruno Crater Derived from LRO Diviner Observations* **[#1791]** |

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| | The ejecta of Giordano Bruno Crater has a diverse mixture of thermophysical properties consistent with the materials having experienced little modification since emplacement. We develop a thermal model to quantify the variations in properties. |
| Iqbal W. Hiesinger H. van der Bogert C. H. | *Investigating a Potential Source of Young Ages at Apollo 15 Landing Site* **[#1917]** New detailed geological maps along with CSFD measurements were used to investigate the relatively young ages found in the Apollo 15 samples. |
| Gebbing T. Hiesinger H. Iqbal W. van der Bogert C. H. | *New Geologic Map of the Apollo 16 Landing Site: Implications for Crater Size-Frequenzies of the Lunar Chronology* **[#1986]** The Apollo 16 landing site was mapped with the recent lunar data to measure CSFDs and compare the data with different sample studies for the calibration of the lunar chronology. |
| Oetting A. Schmedemann N. Hiesinger H. | *Refinement of the Lunar Production Function — Preliminary Normalization of Data* **[#2088]** This abstract deals with the preliminary normalization of data for a further refinement of the lunar production function. |
| Bondarenko N. V. Dulova I. A. | *High-Resolution Topography Reconstruction with the Improved Photoclinometry Method: A Look at Small Lunar Craters* **[#2673]** Improved photoclinometry method is used to derive high-resolution high-quality topographic data from triplets of LROC NAC images taken under different illumination directions. Such topographic data enable quantitative analysis of craters down to 5 m. |
| Jackson A. P. Perera V. Gabriel T. S. J. | *A Moth-Eaten Blanket: Re-Impacting Debris Punctured Holes in the Early Lunar Crust* **[#2294]** The Moon was hot / But now is not / How long did it take? / Much is at stake / The crust kept the heat in / Until it was beat in / Shot full of holes / By a hail of stones / Leftover Earth / From its own birth. |
| Jappji M. Thesniya P. M. Rajesh V. J. | *Morphology of the Copernican Das Crater on the Farside of the Moon* **[#2260]** The study attempts to carry out the detailed morphological mapping of the Das Crater on the farside of the Moon using orbital remote sensing data from various lunar exploratory missions. |
| Giuri B. Hiesinger H. Schmedemann N. van der Bogert C. H. | *Lunar Light Plains in the Orientale Region, Moon* **[#2774]** A preliminary map of light plains in the lunar Orientale region. Our results show consistency with previous maps, however present at least two slightly different morphologies of plain surfaces. Further study may give us new insights in the origins of LP material. |
| Liu J. W. Liu J. ZH. Guo D. J. Zhang J. Y. Zhu K. et al. | *The Structures and Impact Direction of the South Pole-Aitken Basin* **[#1990]** Examining the inner structure of lunar basins reveals that oblique impact can enough explain the anomaly ellipse structures of SPA without other conditions. Alternatively, the annular structures and impact direction of SPA are prosed. |
| Ruesch O. Wöhler C. | *Composition and Size Dependent Abrasion of a Rock on the Moon Derived from Topographic Diffusion Modeling and Optical Observations* **[#1052]** Composition and size dependent abrasion of a rock on the Moon derived from topographic diffusion modeling and optical observations. |
| Krasilnikov A. S. Krasilnikov S. S. Ivanov M. A. | *The Model Estimates of the Craters Ejecta Thickness in the Southern Polar Region of the Moon* **[#1459]** |

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| | One of the major tasks during photogeological analysis of areas selected for the landing missions is the determination of the sources of materials. In our work, we estimated thickness of the basin and crater ejecta blankets. |
| Halim S. H. Crawford I. A. Collins G. S. Joy K. H. Davison T. M. | *Modelling the Survival of Carbonaceous Chondrites Impacting the Lunar Surface, as a Potential Resource* **[#1409]**<br>Carb-chon Moon landing. / Surviving carbon might be / ISR-Useful. |

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## POSTER SESSION: IMPACTS: STUDYING EJECTA ON EARTH

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| Okawa H. Arakawa M. Yasui M. Hasegawa S. Yokota Y. et al. | *Three-Dimensional Tracking of Various Sized Glass Beads Ejected from Impact Crater* **[#1780]**<br>We conducted impact cratering experiments on various sized glass beads target and investigated the effect of ejecta particle size on the n-scaling law for ejection velocity distribution applicable for the crater formation processes on asteroid Ryugu. |
| Cavosie A. J. Biren M. B. Hodges K. V. Wartho J.-A. Horton Jr. J. W. et al. | *Dendritic Reidite from Chesapeake Bay Ejecta at ODP Site 1073, Offshore New Jersey, USA: A Hallmark of Distal Impact Ejecta?* **[#1068]**<br>We report the first occurrence of a dendritic habit for reidite, a high-pressure $ZrSiO_4$ polymorph, found in distal ejecta from the Chesapeake Bay impact structure. We speculate that it may be a unique indicator of distal ejecta. |
| Kawohl A. Whymark W. E. VanderWal J. Whymark W. A. Hall M. et al. | *Impactites East of the Sudbury Igneous Complex — A Reconnaissance Study* **[#1001]**<br>Geological mapping and sampling over ca. 350 km2 in the eastern, underexplored periphery of the Sudbury Igneous Complex, ON, Canada, has revealed the widespread occurrence of impactites, including impact melt-derived dikes and voluminous breccias. |
| Dutta A. Sinha K. K. Raychaudhuri D. Roy M. Bhattacharya A. et al. | *Petrographic Characterization of Impactites from Dhala Crater, India* **[#1865]**<br>In the present study, based on the surface and sub-surface samples aided by petrographic and high resolution SEM–BSE imaging, three types of impact breccia (Type I, II, and III) were identified from Dhala Crater, India. |
| Arif Md. Patil S. K. Pati J. K. Misra S. | *Anisotropy of Magnetic Susceptibility (AMS) of Target Rrocks and Impactites from Dhala Impact Structure, India* **[#1932]**<br>We present here the effects of shock pressure and temperature on the AMS fabric of granitoid target rocks and impact melt breccias from the complex Dhala Structure (India). |
| Losiak A. Plado J. Jõeleht A. Szyszko M. Ormö J. et al. | *Interaction of Ejecta During Multiple Crater Formation on Earth: Kaali 2/8 Case and Laboratory Experiments* **[#2100]** |

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| | We found a double layer of ejecta within a Kaali 2/8 double crater (Estonia). This may suggest there was a time lag between formation of those two impacts. |
| Molnár M. Šlang S. Ventura K. Ernstson K. | *Lechatelierite in Moldavite Tektites: New Analyses of Composition* **[#1580]** Experimental studies with SEM-EDS analyses on moldavite tektites and their lechatelierite inclusions show a complex composition with the formation participation of $SiO_2$, SiO, and Si, which explains the acid resistance and the reduced softening point. |
| Whymark A. | *The Role of Beryllium-10 in Determining the Australasian Tektite Source Crater Location* **[#1050]** Beryllium-10 content, poor mixing considerations, and the presence of uprange ejecta in the Australasian tektite strewn field indicate deep excavation of proximal tektites indicating an abnormally thick sequence of recent sediments at the impact location. |
| Whymark A. | *Comparison of Strontium and Neodymium Isotopes in Australasian Tektites with Potential Source Materials* **[#1051]** Sr-Nd isotopes indicate that Australasian tektites are compatible with a Red River source of sediments, which account for 80% of the sediments fed into the Song Hong, Yinggehai Basin, and with sinks in the East Vietnam Sea, South China Sea. |
| Harris T. H. S. | *Reframing the Australasian Tektite Source Mystery* **[#1008]** NASA hall of fame researcher Dean R. Chapman successfully calibrated the Apollo lunar mission heat shield design using Australasian tektite testing, then failed to apply the requisite rotating frame transform to solve for terrestrial origin location. |
| Harris T. H. S. | *Electromagnetic Indications of Australasian Tektite Morphology* **[#1009]** Fragment-form Indochinite Australasian tektites show clear indications of electromagnetic involvement in their formative process. High-voltage, high-current arcing can cause effects not previously discussed in the literature, over rapid timescales. |
| Trnka M. Tilsar V. | *Tektites Occurring In Situ and Impact Clastic Sediments on the Indochina Peninsula* **[#1195]** In Indochina, the extensive relicts of allochthonous unmelted ejecta occur, which formed during the same event as the Australasian tektites and preserved them in situ. |
| Krauss A. Whymark A. | *The Influence of Crack Propagation on Tektite Glass Corrosion Sculpture* **[#1489]** Corrosion of tektite glass follows lines of weakness. V-grooves are indicative of active crack propagation driven by internal tensile stresses. U-grooves indicate no crack propagation, or corrosion proceeding faster than crack propagation. |

## [P645]
## POSTER SESSION: IMPACTS: THINGS GET SHOCKED (SHOCKED MINERALS)

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|---|---|
| Raychaudhuri D. Basu D. Murmu S. Dutta A. | *Response of Shock-Deformed Zircons and Their Transformation to Reidite and Baddeleyite in Impactites from Dhala Impact Structure, Madhya Pradesh, India* **[#1282]** Zircon grains from Dhala Structure are observed to respond differently with gradation of shock effects and transform to reidite and baddeleyite. Shock stage variation from F-S2 to F-S6/7 is assigned from various shock metamorphic evidences. |
| Zhao J. W. Xiao L. He Q. Xiao Z. Y. | *Element Distribution of Shock-Deformed Regions in Zircon and Implications for Zircon Chronology During the Impact* **[#1804]** Here we systematically analyzed the correlations between shock deformations (from low to high degree: PFs, reidite, and granular zircon) and element distribution in zircon by high-resolution Nano-SIMS mapping data. |
| Kenny G. G. Pasek M. A. Bellucci J. J. | *The Response of Zircon to Extreme Pressures and Temperatures — Insights from a Lightning Strike and a Nuclear Explosion* **[#1420]** Imaging and microstructural analysis of zircon and baddeleyite in a fulgurite and in trinitite highlight features that form in response to extreme pressure–temperature excursions but are not unique to hypervelocity impacts. |
| Cavosie A. J. Rickard W. D. A. Evans N. J. Rankenburg K. Roberts M. P. et al. | *Fingerprint of β-Cristobalite in Libyan Desert Glass — The Hottest Naturally Occuring Silica Polymorph?* **[#1219]** ß-cristobalite is rarely preserved due to transformation to α-cristobalite at low temperature. We report evidence for the former presence of ß-cristobalite in Libyan Desert Glass, and suggest it may be the hottest silica polymorph ever reported. |
| Kaliwoda M. Trepmann C. A. Dellefant F. Hess K. U. Schmahl W. W. et al. | *Quartz and Cristobalite Ballen Aggregates Formed by Dehydraton of Shock-Generated Amorphous Phases in Impact Melt Rocks from the Ries Impact Structure (Germany)* **[#2445]** “Bales” of quartz aggregates have been detected in impactites from a range of terrestrial impact structures. In our work, we focused on quartz aggregates from the Ries impact structure in Germany to provide new information on these features. |
| Sato M. Kurosawa K. Kato S. Ushioda M. Hasegawa S. | *Shock Remanence Intensity and Stability Structures of Single-Domain Titanomagnetite Bearing Basalt Sample* **[#1816]** This study reports systematic changes in shock remanence properties with respect to shock induced pressure for single-domain titanomagnetite bearing basalt based on shock experiments, remanence measuremets, and impact simulations. |
| Gucsik A. Futó P. Vitéz L. Viczián-Dombai R. Nyíri Zs. et al. | *Shock Stage Clarification of Plagioclase Samples from Asteroid Itokawa Using Raman and Cathodoluminescence Microscopy and Spectroscopy* **[#2781]** In this abstract, the recent results of Raman and Cathodoluminescence properties of a plagioclase sample from asteroid Itokawa are summarized, which may apply for the mineralogical studies of the fine-grained astromaterials. |
| Barbaro A. Nestola F. Pittarello L. Ferrière L. Murri M. et al. | *Impact Shock Origin of Carbon Phases in Yamato 74123 Ureilite* **[#1123]** We studied Y-74123 providing evidence of shock origin for diamond in ureilites, importance of heterogeneous propagation, local scattering of the shock wave, and role of Ni-Fe bearing alloys in diamond crystal growth during impact event. |
| Gucsik A. Futó P. Szarvas R. Nagy A. Nagy D. et al. | *Micro-Raman Sprectroscopy of the Barberton Impact Spherules from South Africa: An Application to the Identification of Shock Metamorphism* **[#2780]** The purpose of this study is to provide structural data of the spherules by means of |

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| | Raman spectroscopy, which can aid to understand more about the formation mechanism of the Barberton Impact Spherules. |
| Dellefant F. Trepmann C. A. Gilder S. A. Sleptsova I. Kaliwoda M. et al. | *Distinguishing Shock-Related Microstructures in Gneisses from the Vredefort Impact Structure, South Africa* **[#1985]** To understand the differences between impact-related and lightning shock effects, we investigated samples from two, 10 m-deep drill cores of the Vredefort impact structure by comparing microfabric observations with the magnetic properties. |
| Amodeo K. M. Davies E. J. Stewart S. T. Spaulding D. K. | *Improving the $SiO_2$ Equation of State with Shock and Post-Shock Temperatures* **[#2714]** Shocking silica / Improving the EOS / Measured temperature . |
| Ma C. Tschauner O. Beckett J. R. Prakapenka V. | *Discovery of Feiite ($Fe_2$+2($Fe_2$+Ti4+)O5) and Liuite ($GdFeO_3$-Type $FeTiO_3$), Two New Shock-Induced, High-Pressure Minerals in the Martian Meteorite Shergotty* **[#1681]** New high-pressure minerals feiite (simply Fe3TiO5) and liuite ($FeTiO_3$-perovskite) may provide new insights into shock conditions and impact processes on Mars, and also inform the study of Earth systems at high pressures and temperatures. |
| Ma C. Beckett J. R. Prakapenka V. | *Discovery of New High-Pressure Mineral Tschaunerite, ($Fe_2$+)($Fe_2$+Ti4+)$O_4$, a Shock-Induced, Post-Spinel Phase in the Martian Meteorite Shergotty* **[#1720]** Tschaunerite is $Fe_2TiO_4$ with the $CaTi_2O_4$-type (CT) post-spinel structure, formed by a solid-state transformation from ulvöspinel during the impact event(s) on Mars that led to the excavation and ejection of Shergotty off the planet. |
| Kurosawa K. Ono H. Niihara T. Mikouchi T. Tomioka N. et al. | *Shock Metamorphism in a Quasi-Open System I: Undulatory Extinction in Calcite ($CaCO_3$)* **[#1817]** We developed a new procedure for shock recovery with expanding shock waves. We could collect samples experiencing a variety of pressures and keeping with the initial stratigraphy. Calcite exhibits a distinguishable feature at >3 GPa compression. |
| Ono H. Kurosawa K. Niihara T. Mikouchi T. Genda H. et al. | *Shock Metamorphism in a Quasi-Open System II: Melt Veins in Basalt at Shock Stage 2* **[#1810]** We performed a recovery experiment with expanding shock waves using terrestrial basalt samples. The thin section of the recovered sample was investigated by electron microscopy. Shock melt veins were identified even at < 20 GPa (Shock stage 2). |
| Spathis V. Price M. C. Tandy J. D. New J. S. Wozniakiewicz P. J. | *Shock Synthesis of Prebiotic Molecules: Preliminary Results* **[#1623]** Doped ice mixtures impacted using a two-stage light gas gun to investigate shock synthesis and/or modification of prebiotic molecules. |
| Spathis V. Price M. C. Tandy J. D. Wozniakiewicz P. J. Campbell-White J. et al. | *Shock Synthesis of Prebiotic Molecules II: Probing the Temperature of Creation Using Impact Flash Spectra* **[#1625]** Impact flashes from doped ice mixtures are investigated to determine the peak temperatures achieved during impact, providing a temperature range within which organic synthesis can occur. |
| Price M. C. Spathis V. Tandy J. D. Wozniakiewicz P. J. New J. et al. | *Shock Synthesis of Pre-Biotic Molecules III: Probing the Pressure* **[#1328]** We report on the development of a novel, high-speed, low cost, pressure sensing system that can be used to directly measure the pressures produced during hypervelocity impacts on water ice. Opening a new dimension in shock synthesis experiments. |

# [P646]
# POSTER SESSION: SPECIAL SESSION: EXPLORING THE MYRIAD OF OCEAN WORLDS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Waller S. E. Miller M. E. Hofmann A. E. Hodyss R. P. Cable M. L. et al. | *Hypervelocity Plume Sampling: Experimental Efforts and Astrobiology Implications* **[#1129]**<br>Twinkle, twinkle little plume / We want to know how fast to zoom. / To ionize, but not fragment / Organics coming from your vent. |
| Burke S. E. Miller M. E. C. Continetti R. E. Hanold K. Waller S. E. et al. | *The Chemical Effects of Hypervelocity Impact: Implications for Ocean Worlds Plume Sampling Schemes* **[#2063]**<br>The Aerosol Impact Spectrometer will be used to study impact behavior and post-impact character of submicron ice grains impacting a target at hypervelocity. The results will have implications for a plume sampling mission to the Ocean World Enceladus. |
| Ulibarri Z. E. Munsat T. Abel B. Dee R. James D. et al. | *Measurement of Organic Molecules and D-H Ratios in Laboratory Mass-Spectra of Hypervelocity Dust Impacts into Ice* **[#2732]**<br>Experiments at CU Boulder allow for hypervelocity dust impact into ice. Analysis of the impact eject with TOF instruments indicate that complex organics survive and can be measured directly, as can deuterium-hydrogen ratios. |
| Martellato E. Marchi S. Galluzzi V. Palumbo P. Rotundi A. | *Ganymede's Cratering Record* **[#2175]**<br>The study of crater populations represents a powerful tool to derive planetary surface ages. In this work, we make new crater counts on Ganymede, in order to refine the datation of the geological processes that have shaped its surface. |
| Trainer M. G. Brinckerhoff W. B. Grubisic A. Danell R. M. Kaplan D. et al. | *Development of the Dragonfly Mass Spectrometer (DraMS) for Titan* **[#1532]**<br>Dragonfly Mass Spec / In early days of life looks / Ahead to Titan. |
| Espley J. R. DiBraccio G. A. Gruesbeck J. R. | *Measuring Magnetic Fields at Ocean Worlds* **[#1746]**<br>Measuring magnetic fields at ocean worlds will yield important science results. Magnetometers are very low resource instruments (even with magnetic cleanliness). We welcome interest in collaborations for future missions. |
| Naz N. Kounaves S. P. | *Analysis of Synthetic Terrestrial and Modeled Enceladian Seawater Using the Microfluidic Wet Chemistry Laboratory (mWCL)* **[#2233]**<br>To assess icy world habitability, the flight-proven Phoenix-WCL has been redesigned to analyze melted ice ejected from Enceladus' subsurface ocean. We have characterized the microfluidic-WCL ion sensor array using terrestrial and enceladian samples. |
| Burnett D. C. Burnett J. | *Enabling Tethered Ocean World Vehicles by Sharing Power and Communication Conductors* **[#2407]**<br>Establishing long-distance, high-performance communication over power conductors will allow us to create custom robot tethers with minimum diameter, thereby enabling deployment of more capable through-ice underwater vehicles on ocean worlds. |

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| Watson H. C. Liebow E. Boyle M. Shaw G. H. | *Freezing Point Experiments of NaCl Solutions Up to 70MPa: Implications for Icy Moons and Ocean Worlds* **[#2599]**<br>We have done preliminary, high precision experiments aimed at measuring the phase relations of NaCl solutions at pressures directly relevant to the crustal conditions of Europa and Enceladus. |
| Spiers E. M. Weber J. M. Venigalla C. Annex A. M. Berdis J. et al. | *TIGER: JPL PSSS Architecture and Feasibility Study for a New Frontiers 5 Mission Concept to Enceladus* **[#1598]**<br>We suggest a mission called TIGER / That's designed as a Saturn fly-byer / To observe the small moon / Named Enceladus soon / To assess its habitability drivers. |
| Elder C. M. Nordheim T. A. Patthoff D. A. Leonard E. Cartwright R. J. et al. | *Uranus Magnetosphere and Moons Investigator (UMaMI)* **[#2289]**<br>New Frontiers mission / To the Uranus system / For the next decade. |
| Marusiak A. G. Panning M. P. Vance S. D. Carnahan E. Hesse M. A. et al. | *Effects of Methane Clathrates on Thermal and Seismic Profiles* **[#1151]**<br>Thermal profiles / Methane clathrates in Titan / Through seismology? |
| Hay H. C. F. C. Matsuyama I. Pappalardo R. T. | *Can High-Frequency Tidal Deformation Help Constrain the Ocean Thickness of Europa and Ganymede?* **[#1582]**<br>Love numbers beat quick / When the ocean is quite thick. / Measure this, we say! |
| Singh V. McCarthy C. Silvia M. Jakuba M. German C. et al. | *Communication Tethers May Survive Shearing Across Ice Faults on Europa* **[#2403]**<br>Hostile icy faults / Robust tethers will survive / Cryobots, roll out. |
| Senske D. A. Leonard E. J. Patthoff D. A. | *Mapping Europa at the Regional Scale: Insights from Conamara Chaos and Surrounding Regions* **[#1266]**<br>Regional-scale geologic mapping of Europa provides greater insight into the characteristics of global-scale units. The Conamara Chaos region is mapped and it is shown that these units can be linked, using the global units, to other parts of Europa. |
| Sobron P. Barge L. M. Invader Team | *Exploring Deep Sea Hydrothermal Vents on Earth and Ocean Worlds* **[#2505]**<br>InVADER is NASA's most advanced subsea sensing payload, an integrated imaging and laser Raman spectroscopy/LIBS/laser induced native fluorescence instrument for in-situ, rapid, long-term underwater analyses of vent fluid and precipitates. |
| Spring J. Corrigan P. Rideout H. Castle C. King I. et al. | *KRAKENS Underwater Drill System for the InVADER Project: Tech Demo for Ocean Worlds* **[#1131]**<br>The Kinetic Rotary Acquisition Kit for the Excavation of Nautical Substrate (KRAKENS) is a subsea coring drill system designed as part of the NASA PSTAR-funded InVADER project, which will deploy and operate a deep sea astrobiology sensor payload. |

## [P647]
## POSTER SESSION: GEOLOGY AND GEOPHYSICS OF SATELLITES AND OCEAN WORLDS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Berdis J. Murphy J. Chanover N. | *Identifying Europa's Surface Features Using Water Ice Crystallinity and the Abundances of Non-Ice Materials* **[#1570]**<br>Europa's surface: / Composition can reveal / Unseen ridge structure. |
| Dhingra R. D. Buratti B. J. Seignovert B. S. | *Europa Clipper Preparatory Photometry to Constrain Surface Properties* **[#2257]**<br>We analyze 21 full-disk image data of Europa acquired by Voyager 2, Galileo, and New Horizons using two simple photometry functions. This work will enable quick data products and analysis from the planned missions to Europa like Europa Clipper and JUICE. |
| Tomlinson T. C. Hayne P. O. | *Possible Origins of Dark Crater Ejecta on Europa* **[#1654]**<br>Approximately half of the craters on Europa feature darkened ejecta, the origin of which are unknown. This study examines several exogenic and endogenic processes that could be responsible for darkening ejecta around these craters. |
| Mondro C. A. Emery J. Moersch J. E. | *Modeling Fracture Populations in Europa's Brittle Ice Shell and Implications of Fracture-Added Porosity* **[#2357]**<br>Self-organizing fracture distributions can be used to calculate fracture populations which occur below the limit of resolution of image data in Europa's ice shell and which likely affect porosity and permeability of the outer brittle layer. |
| Krier J. D. Roberts J. H. | *Evolution of the Ice Shell of Enceladus Including Expansion Due to Freezing* **[#2118]**<br>Enceladus' shell / Pressure builds as it thickens / Causing cracks and jets. |
| Olsen K. G. Schmerr N. C. Huang MH. Hurford T. A. Brunt K. M. | *Investigating Icequakes on Enceladus Using an Antarctic Analog: Application of Seismic and Machine-Learning Techniques to Characterize Tidally Induced Seismicity Along Icy Rifts* **[#2048]**<br>Antarctic ice quakes / Can this then tell us how does / Enceladus shake? |
| Lucchetti A. Rossi C. Mazzarini F. Pajola M. Pozzobon R. et al. | *Length and Self-Similar Clustering Analysis of Ganymede's Equatorial Grooves* **[#1061]**<br>In this work, we analyze the grooves' length and spatial distribution to estimate the potential thickness of the icy crust above the deep ocean required to develop densely populated structures at the surface of Ganymede. |
| Leonard E. J. Beddingfield C. Elder C. M. Nordheim T. A. Cartwright R. J. et al. | *Investigating the Formation of Miranda's Inverness Corona* **[#2296]**<br>Miranda's south pole / At Inverness Corona: / Let's investigate! |
| Beddingfield C. B. Leonard E. J. Elder C. M. Nordheim T. A. Cartwright R. J. et al. | *A Digital Elevation Model of Miranda's Youngest Corona, Inverness* **[#2543]**<br>We present a new digital elevation model of Inverness Corona, which we will use to further analyze Miranda's geologic history. Morphometric analysis of Inverness Corona could reveal key insight into Miranda's most recent geologic history. |
| Crósta A. P. Silber E. A. Lopes R. M. C. Malaska M. J. Solomonidou A. et al. | *Exploring Habitability Conditions in Titan's Impact Record: The Formation of Menrva Crater* **[#2309]**<br>We modeled the formation of Titan's Menrva Crater (d=425km), concluding that the impact resulted in exchange of materials among Titan's crustal layers (organics, ice, and water ocean), plus enough heat to potentially create a habitable niche. |
| Huffman M. R. Ward E. M. Kay J. P. Rhoden A. R. Stickle A. M. | *5-Phase Ice Simulations to Test the Effects of Embedded Low Viscosity Layers on Crater Formation* **[#1663]**<br>Europan impacts / Betray her hidden structure / What's under the hood? |
| Schmedemann N. Wagner R. J. Roatsch T. | *Crater Distributions of the Galilean Satellites* **[#2250]** |

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| Hiesinger H. | We investigate the possibility to scale the lunar crater size-frequency distribution to Ganymede and Callisto. |
| Hirabayashi M. Fassett C. I. Montalvo P. Cheng H. C. J. Klimczak C. | *Efficient Topographic Degradation on Ceres as Revealed by the Equilibrium Population of Small Craters* **[#1585]** Crater equilibrium conditions suggest that crater degradation on Ceres is more efficient than on the Moon and Mercury, but less than on Vesta, given statistical evidence of sub-kilometer-sized craters' efficient removal. |
| Williams D. A. Nelson D. M. Milazzo M. P. | *The Io GIS Database, V. 1.0* **[#1504]** This presentation discusses a new GIS database of higher-order data products of Jupiter's moon Io, which is intended as a tool for future research and to plan observations for future missions. It is an Io planetary spatial data infrastructure. |
| Friend P. Kyriacou A. | *Dielectric Profiling of Enceladus' Surface in the Tiger Stripe Region* **[#2586]** Enceladus' active geysers deposit a layer of unconsolidated ice grains, estimated to be of order 100 m thick. The permittivity of this layer must be accounted for in radar searches for a near-surface aquifer in future astro-biology missions. |
| Chen H. Z. Yin A. | *Geomorphologic Evidence for Ice-Sheet Glaciation on Pluto's Largest Moon Charon* **[#1460]** The surface morphology of the Charon's encountered hemisphere indicates a post-tectonic regional glaciation event. The related landforms are analogous to those of the Antarctic ice sheet. |
| Qualizza-McDonald B. R. O'Hara S. T. | *The Role of Basal Sliding in the Migration of Angular Block Terrain on Pluto* **[#1630]** This work uses mapping, statistical analysis, and topographic profiles to test if the criteria for basal sliding in the mobilization of angular block terrain suggested by O'Hara and Dombard (2020) is observable within Sputnik Planitia, Pluto. |
| Miller D. V. Kay J. P. Schenk P. | *Distribution of Normal Faults Not Evenly Distributed Across Dione* **[#2391]** Identifying the visible tectonic features on Dione and exploring their distribution and characteristics. We intend to infer the elastic thickness of Dione's ice shell and gain insight into the formation of the Moon's Wispy Terrain. |

## [P648]
## POSTER SESSION: CRACK, BOOM! ACTIVE AND ERUPTIVE SATELLITES AND OCEAN WORLDS

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| Morrison A. A. Whittington A. G. Zhong F. Mitchell K. L. Carey E. M. | *Rheological Evolution of Brine Liquids and Suspensions: Chloride and Sulfate Brine as Analogs to Cryoflows on Europa* **[#2137]** Rheology links material properties to morphology. Chlorides and sulfates have been |

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| | implicated as major constituents of Europa surface ice and ocean. NaCl and $MgSO_4$ have a stronger effect on liquid viscosity than other solutes. |
| Nathan E. M. Huber C. Head J. W. | *Understanding Icy Moons as a Population of Solar System Bodies* **[#1751]**<br>Many icy moons: / Stresses and timescales tell us, / How they all evolved. |
| Cerubini R. Pommerol A. Poch O. Kipfer K. Thomas N. | *Linear Polarisation of Salty Flash-Frozen Ice Particles* **[#1469]**<br>The polarised reflectance of flash-frozen salty ice particles changes as they warm up, reflecting changes in the crystallinity of both salts and ice. It also provides additionnal constrains on the fine structure of flash-frozen salty particles. |
| Pankine A. | *Reconciling Estimates of Endogenic Power Emitted from the Southern Polar Region of Enceladus* **[#2574]**<br>The endogenic heat flux from the southern polar region of Enceladus is ~16 GW with ~2.7 GW from vapor condensing inside ice fractures, ~1.5 GW from heat conducted from water-filled portion of fractures, and ~11.6 GW conducted from shallow ocean. |
| Robertson K. M. Li S. | *Laboratory Derived Mineral-Ice Mixtures with Applications to Chaos Terrain Formation on Europa* **[#1972]**<br>Here we discuss the methodology for the preparation and measurement of laboratory derived ice-mineral mixtures as a means of validating the radiative transfer modeling of Galileo NIMS reflectance data of Chaos terrain on Europa. |
| Li S. Robertson K. Sun V. Z. | *Unveiling Chaos Terrain Formation on Europa Through Synthesizing Ice Mixtures and Modeling of the Galileo NIMS Reflectance Data* **[#2452]**<br>We conducted nonlinear spectral unmixing modeling of the Galileo NIMS data to understand the chaos terrain formation on Europa. |
| Korycansky D. G. | *Towards Modeling Crater Collapse and Relaxation with a Stokes-Flow Code* **[#1267]**<br>We describe preliminary work on a multi-material code for modeling impact crater modification and relaxation on medium to long timescales. |
| Chivers C. J. Buffo J. J. Schmidt B. E. | *Thermal and Chemical Evolution of Small, Shallow Water Bodies on Europa* **[#2761]**<br>Lakes in the ice shell / Short lived and salty ices / Clipper detects signs? |
| McEwen A. S. Keszthelyi L. P. Mandt K. E. Team I. V. O. | *The Io Volcano Observer (IVO)* **[#1352]**<br>IVO will “follow the heat” to understand the tidal heating and evolution of Io. |
| Keszthelyi L. P. McEwen A. S. | *Measuring Ionian Lava Temperatures via VNIR Color Imaging* **[#2009]**<br>We demonstrate that an imaging system derived from the Europa Clipper EIS camera can robustly distinguish between mafic and ultramafic lava temperatures if included on a mission to Io. |
| Wurz P. Vorburger A. McEwen A. S. Mandt K. Davies A. G. et al. | *Measurement of Io’s Atmosphere During the IVO Mission* **[#1407]**<br>As part of the Io Volcano Observer mission, mass spectrometric measurements of Io’s atmosphere are foreseen during ten flybys of Io, where the regular thermal atmosphere, the outgassing of lava lakes, and a volcanic plume will be investigated. |
| Buczkowski D. L. Schmidt B. E. Landis M. E. Scully J. E. C. Hughson K. H. G. et al. | *Fractures and Furrows on Lobate Flows in Occator Crater, Ceres: Morphologic Evidence of Ice Content* **[#1765]**<br>Fracture and furrow morphologies of the lobate flows within Occator Crater on Ceres are consistent with that of ice-rich flows on Earth, such as either rock glaciers with interstitial ice or ice-cored, debris-covered glaciers. |
| Lalich D. E. Poggiali V. Hayes A. G. | *Invisible Mounds: Observing the Earliest Stages of Labyrinth Evolution on Titan with* |

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| Schurmeier L. R. Malaska M. J. | *the Cassini RADAR* **[#2406]**<br>Invisible mounds / Volume scattering hides them / Labyrinth precursors. |

## [P649]
## POSTER SESSION: SURFACE-ATMOSPHERE INTERACTIONS ON ICY WORLDS: A VOLATILE SESSION

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| Horvath D. G. Andrews-Hanna J. C. Newman C. E. Lian Y. | *Comparative Hydrology of the North and South Polar Regions of Titan* **[#2609]**<br>The influence of topography, climate, and hydrological conditions on the lake distribution at the north and south polar regions are investigated. |
| Lake B. D. Radebaugh J. Christiansen E. H. Rose D. Barnes J. W. et al. | *Sand Distribution, Ice-Rich Regions, and Sources of the Sand Seas of Titan* **[#2722]**<br>Using Cassini imagery, we mapped distributions of sand and water ice on Titan that support previous findings that suggest exposures rich in water ice deposits are located between sediment sources and sand seas. |
| Light S. L. Gurwell M. A. Nixon C. A. Thelen A. E. | *Seasonal Variability of Titan's Global Wind Field* **[#2165]**<br>The gales of Titan / Oh, how they blow! What fury! / And how they do change! |
| Rose D. Radebaugh J. Christiansen E. H. Lake B. | *Length, Orientation, and Spacing of Linear Dunes in the Shangri La Sand Sea, Titan* **[#2568]**<br>Linear dunes on Titan have the potential to reveal much about the planet's wind and atmosphere. This study focuses on creating a dataset for statistical analysis of dune length, orientation, and spacing in Titan's Shangri La sand sea. |
| Moore J. M. Howard A. D. White O. L. Umurhan O. M. Singer K. N. et al. | *Are the Surface Textures of Pluto's Wright Mons and Its Surroundings Exogenic?* **[#1693]**<br>An alternative hypothesis for the development of the hummocky terrain on Pluto's Wright Mons is that it represents accretion of gaseous volatiles, resembling textures that are similar to the convex outward crystalline deposits seen on cave walls. |
| Dhingra R. D. Jennings D. E. Barnes J. W. Cottini V. | *Surface Temperature Decrease at Bright Ephemeral Feature Site on Titan's North Pole* **[#2276]**<br>VIMS saw it bright and transient / CIRS sees it cooler too / Titan's north pole is / Filled with lakes and seas / Now we see it wet too (?) |
| Heslar M. F. Barnes J. W. | *Physical Oceanography in the Coastal Zones of Titan's Punga Mare* **[#2128]**<br>We present evidence for liquid-filled labyrinthi channels, active shorelines, wind-roughened seas, roughness at river debouches possibly indicative of streamflow/tidal race/bubble outbursts in a VIMS specular glint observation of Punga coastal zones. |
| McKinnon W. B. Mao X. Singer K. N. Keane J T. Schenk P. M. et al. | *Are Maryland and Other Craters on CCKBO Arrokoth Compaction Craters, and Does it Matter?* **[#2719]**<br>Compaction craters / Explains Arrokoth's surface / Saves its neck from harm. |

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| Cartwright R. J. Nordheim T. A. Grundy W. M. DeColibus D. Sori M. M. et al. | *Latitudinal Distribution of $CO_2$ Ice on Ariel Consistent with Seasonal Migration* **[#1298]** We present new ground-based, near-infrared reflectance spectra that indicate the abundance of $CO_2$ ice is likely decreasing at high latitudes on the Uranian moon Ariel, supporting volatile transport model predictions. |
| Keeney B. A. Parker J. Wm. Cunningham N. Stern S. A. Verbiscer A. J. | *The First Measurements of Charon's Far-Ultraviolet Surface Reflectance* **[#2366]** Water ice seen in / Charon's FUV spectrum / From New Horizons. |
| Solomonidou A. Neish C. Coustenis A. Malaska M. Le Gall A. et al. | *The Chemical Composition of Impact Craters on Titan* **[#2633]** We investigate the spectral behavior of nine Titan impact craters in order to constrain their composition. It appears that active processes are working to shape the surface of Titan, and it remains a dynamic world in the present day. |
| Steckloff J. K. Soderblom J. M. Soto A. | *Titan's Bistable, Cyclical Climate: A Song of Slush and Photodestruction* **[#1036]** Stable yet changing / Titan's climate must cycle / Between warm and cold. |
| Engle A. E. Hanley J. Tan S. P. Tegler S. C. Grundy W. M. et al. | *Mapping Changes in the Methane-Ethane System When Adding Nitrogen at Titan Surface Conditions* **[#1722]** Recent work in the Astrophysical Materials Lab mapped the liquidus and solidus transitions at low pressures in the methane-ethane system. We now introduce nitrogen at 1.45 bar to determine how it affects the temperature at which ice first forms. |
| Nuevo M. Sciamma-O'Brien E. Sandford S. A. Salama F. Materese C. K. et al. | *Preliminary XANES Analysis of Laboratory Analogs of Titan Tholins* **[#2160]** We analyzed laboratory Titan tholins produced from $N_2$:$CH_4$ and $N_2$:$CH_4$:$C2H_2$ gas mixtures with different relative abundances, using XANES spectroscopy to obtain information on their chemical structures and their elemental C/N ratios. |

## [P650]
## POSTER SESSION: SHAKEN AND STIRRED: PHYSICAL AND COMPOSITIONAL STATE OF SATELLITES AND OCEAN WORLDS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Di Paolo F. Ruggieri A. Cosciotti B. Lauro S. E. Mattei E. et al. | *Radar Sounding of Ganymede and Callisto: Two-Way Attenuation and SNR Evaluation in Diverse Dielectric Scenarios* **[#1242]** RIME onboard JUICE mission will explore the icy crusts of Ganymede and Callisto. The dielectric properties of the subsoil will govern its performance. Estimations of two-way attenuation and signal-to-noise ratio suggest a deep radar penetration. |
| Kiefer W. S. | *Tidal Dissipation and the Interior Structure of Io: Magma Mush or Magma Ocean?* **[#2539]** Comparison of models of tidally heated mantle convection with observations of heat flux from the Galileo mission suggest that about 50% of Io's tidal dissipation occurs in the deep mantle. Ongoing work compares the magma mush and magma ocean models. |

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| Kronrod E. V. Kronrod V. A. Kuskov O. L. | *Dehydration Processes in the Hydrated Cores of Large Icy Satellites* **[#1730]** This paper presents the calculation results of unsteady temperature regimes in the cores of ice satellites, taking into account the composition, convective heat transfer, and possible processes of dehydration in the interior of the satellites cores. |
| Zandanel A. E. Hellmann R. Truche L. | *Olivine Dissolution in Partially Frozen Ammonia-Water Solutions* **[#2274]** We present results of an experiment set showing olivine dissolution over one year from -20°C to 22°C in ammonia-rich alkaline solutions that mimic fluid compositions on icy moons. We show olivine dissolution continues in partially frozen solutions. |
| Trinh K. T. Bierson C. J. O'Rourke J. G. | *Delayed Timing of Metal-Silicate Differentiation in Europa* **[#2394]** Europa's full thermal and magnetic history is crucial for assessing its potential habitability. However, core formation and its subsequent existence strongly affect Europa's evolution, so we constrain the timing of Europa's metallic core formation. |
| Wang A. Yan Y. C. McKinnon W. B. | *Phase Transformations in Salts Caused by the Impact of Energetic Electrons and the Relevance to Europa* **[#2112]** We found a reasonable path to extrapolate our ESD simulation experiment results to Europa reality based on an evaluation of electron flux and kinetic energy of the electrons in two cases, then developed a quantification procedure for color comparison. |
| Runcevski T. McConville C. | *Phase Diagrams of Planetary Ices Relevant to Titan: Acetonitrile and Benzene* **[#1121]** Acetonitrile and benzene have been detected on Titan. Here, we report the binary phase diagram and provide information on the structure and composition of the solid-phases under modeled titanean environment. |
| Stephan K. Ciarniello M. Poch O. Schmitt B. Haack D. et al. | *Spectral Properties of $H_2O$ Ice Depending on Particle Sizes and Temperatures Expected on Ganymede and Callisto* **[#1341]** We present the results of laboratory measurements, which were performed in order to evaluate in detail how variations in particle size and surface temperature together influence the spectral $H_2O$-ice signature. |
| Fauguerolles C. Morizet Y. Le Menn E. Gaillot A.-C. Tobie G. | *Experimental Constraints on N Cycle on Titan: From $NH_3$-Rich Hydrothermal Fluids to Atmospheric $N_2$ and Possible Deep Rock Storage* **[#2023]** To better constrain the N cycle on Titan, we performed experiments involving $NH_3$-rich fluids and olivine + orthopyroxene. $N_2$ is produced for T above 500-600°C and could explain the $N_2$-rich atmosphere. Serpentine, talc, and NH4-phlogopite are formed. |
| Li J. Yu X. Sciamma-O'Brien E. He C. Sebree J. et al. | *Comparison Study of Surface Energies for Titan Haze Analogs "Tholin"* **[#2675]** A cross-laboratory comparison study reveals that Titan's aerosol may possess the commonalities shared by laboratory produced tholin. |

## [P651]
## POSTER SESSION: GIANT PLANETS, RINGS AND DYNAMICS — OH MY!

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| Shim S.-H. Nisr C. Kim T. Lee Y. J. Chizmeshya A. et al. | *Mineral-Water Reaction at High Pressures — Implications for Uranus and Neptune* **[#1208]** We found unexpectedly large solubility of MgO in $H_2O$ at high pressure. The results suggest possible compositional gradients and heavy element presence in the $H_2O$-rich layer of Uranus and Neptune. |
| Tchernyi V. V. Kapranov S. V. Pospelov A. Yu. Chensky E. V. Milovanov U. B. | *The Role of Diamagnetism of Ice Particles of Saturn's Protoplanetary Cloud to the Rings Origin* **[#1355]** Interaction of Saturn's magnetic field with diamagnetic ice particles of protoplanetary cloud created rings system at a three-dimensional magnetic well. |
| Doyle A. E. Desch S. J. Young E. D. | *Icy Exomoons Evidenced by Spallogenic Nuclides in Polluted White Dwarfs* **[#2178]** We present evidence that excesses in Be in two polluted white dwarfs are the result of accretion of icy exomoons that formed from rings in the radiation belts of giant exoplanets. |
| Lissauer J. J. Stevenson D. J. Bodenheimer P. D'Angelo G. | *Mixing of Condensable Constituents with H and He During the Formation and Evolution of Jupiter* **[#2272]** We present simulations of the growth of Jupiter incorporating mixing of light gases with water and silicates entering the planet as solids. We find that the current radial distribution of elements depends on the order in which constituents accreted. |
| Benmahi B. Cavalié T. Dobrijevic M. Biver N. Bermudez-Diaz K. et al. | *Monitoring of the Temporal Evolution of Water Vapor in the Stratosphere of Jupiter with the Odin Space Telescope Between 2002 and 2019* **[#1472]** In this paper, we present two decades of monitoring of the water emission in Jupiter's stratosphere with the Odin space telescope. We discuss the implications of the observed line to continuum ratio decrease in terms of vertical mixing and atmospheric chemistry. |
| Cohen I. J. Clark G. B. Kollmann P. Turner D. L. | *Investigating Unusual Inbound/Outbound Asymmetries in Energetic Particles in the Voyager 2 Observations of Uranus' Magnetosphere* **[#2072]** We investigate several alternate explanations for the inbound/outbound asymmetry in the energetic particles observed by Voyager 2, which was previously interpreted as evidence for substorm-like injections similar to those observed at Earth. |
| Toyoda Y. T. Arakawa M. A. Yasui M. Y. | *Experimental Study on Restitution Coefficients of Porous Ice Ball Simulating Saturn's Ring Particles* **[#1903]** We conducted low-velocity impact experiments for porous ice balls simulating Saturn's ring particles in order to study the effect of porosity on the relationship between the impact velocity and the restitution coefficient. |
| Vidmachenko A. P. | *The Difference in the Visible Characteristics of Saturn's Disk at the 2010 Equinox from Previous Three* **[#1100]** At all previous equinoxes (1966, 1980, 1995) asymmetries were observed in absorption in methane bands and in ultraviolet between N and S hemispheres, and at equinox of 2010 there were no differences in absorption between hemispheres at mid-latitudes. |
| Kuznetsov E. D. Al-Shiblawi O. M. Gusev V. D. Ustinov D. S. | *Pairs of Trans-Neptunian Objects with Close Orbits* **[#1859]** We performed a search for pairs of dynamically correlated TNO. We found several tens |

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| | pairs of TNOs among cold classical Kuiper Belt Objects and shown that the pair 2004 VA131 – 2004 VU131 may be the youngest pair of KBOs known today. |
| Rosaev A. E. | *Some Interesting Cases of Close Asteroid Pairs Perturbed by Resonance* **[#1554]** The main goal of this presentation is to search for the resonances, nearest to the known very young asteroid pairs. We present the list of the asteroid pairs close to resonance and try to classify it by degree of perturbation. |
| Jayam V. J. Thaman K. T. Jain S. J. Kim J. K. Xue Q. et al. | *An Analytic Model of Stable and Unstable Orbital Resonance* **[#2764]** This paper applies elementary techniques from Newtonian mechanics to predict the relative strengths of Kirkwood gaps in the main asteroid belt and approximates the liberation period in stable resonant system such as Saturn's moons Titan and Hyperion. |

## [P652]
## POSTER SESSION: CERES AND VESTA

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| Izawa M. R. M. Koutoula E. Stancu M.-N. Yamashita S. Okuchi T. et al. | *Hydrothermal Ammoniation of Chondrites: Implications for Ceres* **[#2247]** Hydrothermal reactions between carbonaceous chondrites and ammonia-water solutions do not produce ammoniated clays such as those proposed for the Cerean surface — not even saponite-rich Tagish Lake. R chondrites, however, do produce such clays. |
| Distel A. G. Palin R. M. Chin E. J. | *Magmatic Processes on the Asteroid 4-Vesta: Implications for Differentiation of Small Rocky Bodies* **[#2246]** The research outlined within this abstract builds upon previous studies' thermodynamic modeling results, and will provide new insight into the validity of competing models for Vesta's magmatic evolution using the thermodynamic software MELTS. |
| Cheng H. C. J. Klimczak C. | *Systematic Fracture Pattern on Vesta Revealed by Polygonal Impact Craters* **[#1015]** Our mapping of polygonal impact craters revealed a systematic fracture pattern on Vesta. The straight crater rim segments show a dominant E-W orientated fracture pattern at both polar regions and no preferred fracture orientations at the equator. |
| Zeilnhofer M. F. | *Preliminary Regional Analysis of Central Peaks on Ceres Using the Near-Global Crater Database and Implications for Crustal Strength* **[#1062]** Craters displaying central peaks were investigated in 30° x 30° blocks. The median peak-to-crater diameter ratio for each block were compared to one another to understand how crustal strength affects these values. |
| Kouvatsis I. Cartwright J. A. | *Petrography of Eucrite Northwest Africa 11548: Searching for Melt Clasts* **[#2683]** Melt clasts in eucrites / Reveal info of Vesta's / Impact history. |
| Rousseau B. De Sanctis M. C. Raponi A. | *DAWN-VIR at Vesta and Ceres: Wrap-Up of the Corrections for the Data of the* |

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| Ciarniello M. Ammannito E. et al. | *Visible Channel* **[#1440]**<br>The Dawn-VIR spectrometer acquired an important amount of data at Vesta and Ceres. We present the correction of the visible dataset which is affected by instrumental artefacts linked to the detector temperature. |
| Zitnik A. W. Hurtado J. M. Jr. | *Exploring Spatial Relationship Between Domes and Impacts on Ceres* **[#2647]**<br>GIS software and crater detection algorithms are used to explore potential spatial connections between impact events and the formation of surface domes. |
| Mest S. C. Neesemann A. Crown D. A. Berman D. C. Pasckert J. H. et al. | *The Chronostratigraphy of Ceres* **[#2055]**<br>From HAMO-based global geologic mapping of Ceres, we present the first Cerean chronostratigraphic time scale. Using prominent geologic features and AMAs estimated from CSFD statistics, we propose a time scale subdivided into three geologic time periods. |
| Ferrari M. Raponi A. De Sanctis M. C. Ammannito E. Ciarniello M. et al. | *Investigating the 1-μm Feature in the Refined Average Spectrum of Ceres* **[#2095]**<br>The VIR data collected on Ceres surface have shown a clear absorption at 1 μm. The interpretation of this band provides new constraints on its mineralogy. The presence of iron-bearing minerals and low-crystallinity phases can explain this feature. |
| Krohn K. Jaumann R. Wickhusen K. Otto K. A. Kersten K. et al. | *Asymmetric Craters on Ceres* **[#2527]**<br>High resolution images of Ceres reveal a special type of crater. Asymmetric craters are characterized by a sharp rim on the uphill side and a smooth rim downhill side. All craters are formed slopes. |
| Brown A. J. King S. J. Bishop J. L. | *Distinguishing Anhydrous Carbonates Using Spectral Centroid and Asymmetry Near 2.5 and 4 Microns* **[#2708]**<br>We report on an ongoing study using an asymmetric band fitting approach to distinguish carbonates. This is of interest to spectroscopy and mapping of differentiated bodies, small and large. |
| Fuentes-Quiñones M. Arvelo X. Ayala A. A. Rivera-Muñiz B. Colón J. et al. | *Exploring the Spectral Clustering Analysis of the Surface Composition of a Known Asteroid* **[#1375]**<br>The main goal for this project was to explore the spectral clustering analysis of the surface of an asteroid. This work was completed as part of a high school level project developed at The Arecibo Observatory's STAR Academy. |
| Potin S. M. Douté S. Kugler B. Forbes F. | *Simulated Observations of Small Bodies: The Effect of Shape and Topography* **[#1542]**<br>We used laboratory bidirectional reflectance spectroscopy of terrestrial analogues applied on 3D models of the planetary bodies (1)Ceres and (4)Vesta. We compare the unresolved observation of these bodies with the laboratory spectra. |

## [P653]
## POSTER SESSION: SMALL BODY OBSERVATIONS: NEAR AND FAR

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| Granados M. Madiedo J. M. | *A Meteorite Fall Observed in the Framework of the Southwestern Europe Meteor Network (SWEMN)* **[#1332]**<br>In this work, we present a preliminary analysis of a meteorite-dropping bolide that overflew the south of Spain on 28 January 2020. |
| Ogliore R. C. Daulton T. L. Vacher L. Liu N. Korotev R. et al. | *Candidate Cosmic Spherule from the November 2019 Saint Louis Bolide* **[#1919]**<br>We recovered an iron oxide spherule from the November 2019 fireball near St. Louis, Missouri. We compare the microstructure and composition of this spherule to coal fly ash spherules to determine if it is extraterrestrial or industrial in origin. |
| Zhilyaev B. E. Vidmachenko A. P. Steklov A. F. | *Meteor with Interesting Characteristics from the 2001 Leonids Meteor Shower* **[#1067]**<br>Using our program of "tuning technique" and invasion model, we estimated initial meteoroid velocity 28 km/s and its mass 60 kg. Brightness variations in wake showed that meteor burned on altitude 32 km on speed 10 km/s at "one-side" observations. |
| Madiedo J. M. Ortiz J. L. Aceituno J. De Guindos E. | *Orbit and Emission Spectrum of a Mag. -12 Meteor Event Recorded on 2019 February 6* **[#1274]**<br>In this work, we present a preliminary analysis of a very bright fireball that was spotted over the south of Spain on 2019 February 6. |
| Peña-Asensio E. Trigo-Rodríguez J. M. Rimola A. Izquierdo J. Robles A. J. et al. | *The Jerez De La Frontera (Spmn020121) Bolide: A -13 Magnitude Event with a Long Endurance Persistent Trail from the Comae Berenicids Meteor Shower* **[#1692]**<br>Really bright bolide studied with a long endurance persistent trail associated with the Comae Berenecids meteor shower. |
| Peña-Asensio E. Trigo-Rodríguez J. M. Rimola A. Izquierdo J. Chioare M. et al. | *2020 Ursid Meteor Shower Activity from Video Recordings and Forward-Scatter Echo Detections* **[#1174]**<br>We reconstructed the trajectory from double station observation and analysed the orbit of the event SPMN$_2$21220C associated to 8P/Tuttle comet. Also, from forward-scatter detection we did not register an Ursids meteoroid stream outbreak as predicted. |
| Madiedo J. M. Ortiz J. L. Aceituno J. De Guindos E. | *The Ursid Meteor Outburst in 2020: Preliminary Results* **[#1275]**<br>In this work, we present a preliminary analysis of the Ursid outburst observed in December 2020. Several Ursid emission spectra were also recorded. |
| Martinez C. Madiedo J. M. | *Systematic Monitoring of Large Meteoroids in the Earth-Moon Environment* **[#1300]**<br>We present a preliminary analysis of a superbolide generated in the atmosphere by a large meteoroid on 16 November 2020. The event was spotted by the SMART survey, which is being conducted in the framework of the Southwestern Europe Meteor Network. |
| Markwardt L. Gowman G. Gerdes D. W. Malhotra R. Adams F. C. | *Latest Results from DECam Search for L5 Earth Trojans* **[#2538]**<br>We will present the latest results of a DECam search for Earth Trojans. This new search utilizes the Shift-and-Stack technique and eight hours of data across eight nights to detect objects down to ~200 m and reliably classify candidates as Earth co-orbitals. |
| Aponte-Hernández B. Taylor P. A. Rivera-Valentín E. G. O'Dell M. | *A Publicly Accessible Repository for Arecibo Planetary Radar Observations of Near-Earth Asteroids* **[#2174]**<br>All of the data! / Radar of many space rocks. / Arecibo love. |
| Hickson D. C. Virkki A. K. Rivera-Valentín E. G. | *Polarimetric Analyses of Archival Arecibo Near-Earth Asteroid Radar Observations* **[#2593]** |

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| | Here, we present preliminary results from a comprehensive polarimetric analysis of archival radar observations of near-Earth asteroids from Arecibo Observatory, aiming at characterizing both individual objects as well as population statistics. |
| Dotto E. Banaszkiewicz M. Banchi S. Barucci M. A. Bernardi F. et al. | *The EU Project NEOROCKS — The NEO Rapid Observation, Characterization, and Key Simulations Project* **[#1971]**<br>NEOROCKS is an EU-funded project approuved in the framework of the call SU-SPACE-23-SEC-2019 from the Horizon 2020 — Work Programme 2018-2020 Leadership in Enabling and Industrial Technologies — Space. |
| Lazzarin M. La Forgia F. Siviero A. Frattin E. Ochner P. et al. | *Spectroscopic Investigation of the Large Potentially Hazardous Asteroid (52768) 1998OR2 within NEOROCKS EU Project* **[#2056]**<br>We are going to present a spectroscopic investigation of the potentially hazardous asteroid 1998 OR2 with observations performed at Asiago observatory on 15 April 2020 and spectra covering almost the entire rotational period of the object (4.11 h). |
| Takir D. Matsuoka M. Waiters A. Kaluna H. Usui T. | *Three-Micron Spectroscopy of Phobos and Deimos* **[#1386]**<br>We present spectra of Phobos and Deimos that included a comprehensive spectral range (~0.7-4 μm) to search for signatures of hydrated minerals, organics, and carbonates. |
| Maeda N. Terai T. Ohtsuki K. Yoshida F. Ishihara K. et al. | *Size Distributions of Bluish and Reddish Small Main Belt Asteroids* **[#1388]**<br>Using our data obtained with the Hyper Suprime-Cam on the Subaru Telescope, we derived size distributions of small main-belt asteroids for two color populations, i.e., S-like and C-like asteroids, and found that their shapes are very similar. |
| Fieber-Beyer S. K. | *Interesting Objects Near (6) Hebe* **[#1233]**<br>While focusing on the intersection of the 3:1 Kirkwood Gap and the ν6 secular resonance, a number of objects were observed to determine whether (6) Hebe has a family or not. Eight of the nearby asteroids observed exhibit rare spectral features. |
| Germann J. T. Fieber-Beyer S. K. Gaffey M. J. Strom C. A. | *NIR Reflectance Spectroscopy of Massalia Family Asteroids 8452 Clay, 2316 Jo-Ann, 7760, 52442, 27120Isabelhawkins.* **[#1320]**<br>Our group is investigating the Massalia Family to determine if it is a probable source for L-chondrites. We are studying the spectral parameters to infer the mineralogic composition; this abstract details five asteroids as a part of a larger study. |
| Tanbakouei S. Trigo-Rodríguez J. M. Rivkin A. S. Moyano-Cambero C. E. Llorca J. et al. | *A Reflectance Spectra Link Between the CV-CK Chondrites Clan and the EOS Asteroid Family: Different Degrees of Space Weathering Experienced by Carbonaceous Chondrites Asteroids* **[#1456]**<br>In this abstract, we will present CV and CK chondrite groups reflectance spectra compared with these obtained for Eos family members. The spectral comparison demonstrates a good match between the Eos family and the CV-CK clan. |
| Kyrylenko I. I. Krugly Y. M. Golubov O. A. | *New Asteroid Pair Candidates in the Main Belt* **[#2741]**<br>Our survey of the inner part of the main asteroid belt resulted in 12 new asteroid pairs candidates, with formation ages between 13 and 300 kyr, and 17 known pairs for which age estimates agree with literature in most of the cases. |
| Kokhirova G. I. Ivanova O. V. Rakhmatullaeva F. Dzh. | *Identification of the Nature of Asteroid Don Quixote from Observations in the Sanglokh Observatory* **[#1451]**<br>The physical and dynamic properties of the near-Earth asteroid (3552) Don Quixote were investigated on the basis of multicolor optical observations carried out at the Sanglokh observatory. |

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| Kokhirova G. I. Ivanova O. V. Rakhmatullaeva F. Dzh. Baransky A. | *Results of Observations of the Dual Status Object 2008GO98 (3962) in 2017* **[#1453]** The paper presents the results of optical observations of the dual status object 2008 GO98 (362P) which were observed in July-September 2017. |
| Salas I. Madiedo J. M. | *Properties of Large Fragments from Comet 2P/Encke: Spectroscopic Analysis* **[#1286]** We present here a preliminary analysis of a very bright meteor event produced in the atmosphere by a large fragment from Comet 2P/Encke. |
| Sánchez A. Trigo-Rodríguez J. M. Rodríguez D. | *Photometric Monitoring of a 29P/Schwassmann-Wachmann 1 Outburst in November 2020* **[#1115]** We report a 2.7 magnitudes outburst experienced by comet 29P on November 20, 2020. Multiband photometric monitoring is able to decipher the processes triggering outbursts. The pristine nature of 29P suggests that it might be a great space mission target. |
| Lilly E. L. Hsieh H. H. Bauer J. B. Steckloff J. S. Jevcak P. J. et al. | *No Activity on 13 Centaurs Discovered in the Pan-STARRS Detection Database* **[#2499]** We present an observational and thermo-dynamical study aimed at searching for and characterizing possible activity on 13 Centaurs with perihelia across the proposed amorphous ice crystallization zone. We rule out present activity on all our targets. |
| Trigo-Rodriguez J. M. Sánchez A. Manteca P. | *Photometric Follow-Up of the Two Components of Comet 2018 F4 PANSTARRS After Breakup* **[#1107]** A three-month photometric monitoring of the two nuclei of fragmented C/2018 F4 is presented. We noticed that the two nuclei exhibited similar brightness, but experienced fluctuations of 0.1 magnitudes, alternating the dominance in brightness by shielding. |
| Luk'yanyk I. Safonova M. Ivanova O. Mohan R. Sutaria F. et al. | *Spectroscopy and Photometry of Interstellar Comet 2I/Borisov on 2-m HTC Telescope* **[#1565]** In an exciting, yet an extremely fortuitous event, nature offered us an unprecedented opportunity to observe an interstellar comet. We observed it before and at perihelion photometrically and spectroscopically to compare with the solar system comets. |

## [P654]
## POSTER SESSION: SMALL BODY SURFACES: BOULDERS, CRATERS, AND REGOLITH

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| Barrington M. N. Birch S. Jindal A. Corlies P. Hayes A. et al. | *Geomorphologic Evolution of the Imhotep Region of Comet 67P Churyumov-Gerasimenko* **[#2197]** We investigate the temporal and spatial evolution of the smooth terrain Imhotep on Comet 67P/ Churyumov-Gerasimenko with the goal of characterizing and quantifying the scales of the geomorphologic processes acting on the comet's surface. |
| Yokota Y. Honda R. Tatsumi E. Domingue D. | *East-West Comparison of the Photometric Properties on Asteroid Ryugu* **[#2105]** |

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| Schröder S. E. et al. | We performed a regional photometric analysis using the image data of the asteroid Ryugu. It was found that the photometric property of the western bulge is different from that of the eastern hemisphere. |
| Golish D. R. Li J.-Y. Clark B. E. Zou X.-D. Rizos J. L. et al. | *Regional Photometric Mapping of Asteroid (101955) Bennu* **[#1677]** Our regional photometric analysis of Bennu, using OCAMS images, reveals correlations between albedo, macroscopic roughness, and photometric response, as modeled by empirical and Hapke formulations. |
| Banik D. Gaurav K. | *Spin Change of Rubble Piles Due to Mass Shedding Culminating from Surface Motion* **[#1122]** Mass shedding caused due to surface motion on rubble-pile asteroids has a negligible effect on its spin rate. The reason is investigated analytically using the conservation of angular momentum and the equilibrium of regolith is discussed. |
| Durda D. D. Parker A. H. Whizin A. D. Shoffner M. Pyke B. | *The Box-of-Rocks Experiment (BORE): A Suborbital Experiment Package for Microgravity Regolith Science and Technology Demonstration* **[#2265]** The Box-of-Rock Experiment (BORE) is a suborbital microgravity experiment package enabling small body regolith science and technology demonstration. |
| Ebihara T. Yumoto K. Sugita S. Honda R. Kameda S. et al. | *Investigation of Distribution and Orientations of Boulders on Asteroid Ryugu: Implications for Surface Evolution* **[#1902]** To understand direction and mode of mass movement on the surface of asteroid Ryugu, we create the catalog of boulders near the equator and investigated the relationship between their orientations and direction of gravitational slopes. |
| Ogsugi A. Sakatani N. Shimaki Y. Arai T. Senshu H. et al. | *Thermal Properties of Boulders on C-Type Asteroid 162173 Ryugu Observed by Hayabusa2TIR During Low Altitude Operations* **[#2184]** Close-up thermal images taken by TIR on Hayabusa2 below the altitude of 500 m from C-type asteroid Ryugu during the Minerva-II and MASCOT release operations were analyzed to investigate temperature variations of boulders and their physical state. |
| Sasaki S. Kanda S. Kikuchi H. Michikami T. Morota T. et al. | *Crack Orientations of Boulders on Ryugu: N-S Preference and Exfoliation Feature* **[#2010]** Cracks of Ryugu boulders have preferred N-S orientation and exfoliation feature, probably caused by thermal stress due to the diurnal/annual variation of solar heating. |
| Joshi V. Ramesh K. T. | *Updated Calculations of Thermal Breakdown of Rocks on the Asteroids Bennu and Ryugu* **[#2551]** We have developed updated estimates of the time to breakdown of rocks on Bennu and Ryugu as a result of thermal fatigue. |
| Morota T. Sugita S. Cho Y. Tatsumi E. Sakatani N. et al. | *Impact Strength of Ryugu's Boulder Inferred from Meter-Sized Crater Statistics* **[#1755]** In order to obtain constraints on the impact strength of Ryugu's boulders, we investigated the size distributions of small boulders and meter-sized craters, and quantified the armoring effect on Ryugu. |
| Popescu M. Tatsumi E. Campins H. de León J. García J. L. et al. | *Widely Distributed Exogenic Materials of Varying Compositions on Asteroid (101955) Bennu* **[#2026]** We report additional possibly exogenic boulders on Bennu's surface using the spectro-photometric images obtained by the OSIRIS-REx mission. We classified them by spectrophotometry and morphology and we discuss their origin. |
| Aoki M. Sugimoto C. Yumoto K. Tatsumi E. | *Spectroscopic Analysis of Bright Boulders Inside the SCI Crater on* |

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| Morota T. et al. | *Anteroid Ryugu* **[#1989]**<br>We analyzed the bright boulders (BBs) newly excavated by the artificial impact based on optical images of Ryugu. Results show that the spectra of fresh BBs are not drastically different from other BBs, which are space weathered or solar heated. |
| Bottke W. F. Moorhead A. Hergenrother C. W. Michel P. Schwartz S. R. et al. | *Meteoroid Impacts as a Source of Bennu's Particle Ejection Events* **[#1362]**<br>Meteoroid impacts deliver 7000 J to Bennu every two weeks near perihelion in the late afternoon, enough to explain Bennu's largest particle ejection events. |
| Takai Y. Morota T. Yumoto K. Honda R. Kameda S. et al. | *Statistics of Small Craters Observed on Boulder Surface of Asteroid Ryugu* **[#2044]**<br>This study investigates small craters on boulder surfaces on asteroid Ryugu. Based on the statistics of small craters on boulder surfaces and comparison with Bennu, we estimate the lifetime of boulders and infer the surface processes of Ryugu. |
| Ramsley K. R. Head J. W. | *The Motion of Ejecta Boulders Entering Phobos Craters* **[#1575]**<br>Mobilization of ejecta from Stickney Crater on Phobos, the inner moon of Mars, is interpreted as a mechanism for the near-global emplacement of grooves. To test this hypothesis, our model studies the motion of boulders that roll into Phobos craters. |
| Pajola M. Lucchetti A. Ivanovski S. Poggiali G. Ieva S. et al. | *Boulders on Asteroids Didymos and Dimorphos: Future DART-LICIACube Observations* **[#1116]**<br>The future DART and LICIACube observations of asteroids Didymos and Dimorphos will be presented together with the expected boulders SFDs derivable from such datasets. |
| Yokota Y. Y. Arakawa M. A. Yasui M. Y. Yamamoto Y. Y. Okawa H. O. et al. | *Experimental Study on Impact Craters Formed on Mountain-Like Surface Topography of Asteroids* **[#1815]**<br>We conducted the impact cratering experiments on granular targets simulating the mountain-like surface topography of asteroids, and we investigated the effects of the surface topography on the crater size scaling law and the ejecta growth process. |

## [P655]
## POSTER SESSION: SMALL BODY LABORATORY STUDIES AND MODELING

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Tinker C. R. Glotch T. D. | *A Dust Deposition Chamber for Thermal Infrared Spectral Analysis of Coated Rocks in a Simulated Airless Body Environment* **[#1756]**<br>Apparent disconnects between the spectral and thermophysical properties of Bennu present the need to study the effects of thin and/or discontinuous dust coatings in an airless body environment. |
| Passoni L. Imhof G. Sunday C. Bassas M. Sournac A. et al. | *A Single-Wheel Testbed for Regolith Science Studies* **[#1982]**<br>We present the design of a tesbed aimed at studying rover wheel-regolith dynamics. We |

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| | demonstrate how the testbed can help validate image analysis techniques and understand sinkage and slippage on small-body surfaces covered with regolith. |
| Snead C. J. Funk R. C. Righter K. | *Small Particle Glovebox Experiments — Preliminary Results* **[#2495]** We performed small particle manipulation experiments in a small nitrogen sample cabinet in order to inform design parameters of HAYABUSA2 and OSIRIS-REx gloveboxes. |
| Potin S. M. Cloutis E. A. Izawa M. R. M. | *Laboratory Spectroscopy to Assess the Origin of the Martian Moons* **[#1544]** We analyse the spectral reflectance properties and associated compositions of several samples available for analysis that may provide insights into the origin of Phobos, and several processes modifying the reflectance spectrum of a surface. |
| Dibb S. D. Bell J. F. III Garvie L. A. J. | *Reflectance Spectra of Metal-Troilite Mixtures: Implications for M-/X-Type Asteroid Exploration* **[#1543]** We present 0.35–2.5 μm reflectance spectra of mixtures of metal and troilite powder (d<75 μm). The spectra are relatively featureless. Changes in slope may be used to assess surface composition in data from future missions to X-type asteroids. |
| Burbine T. H. Buchanan P. C. Jercinovic M. J. Greenwood R. C. | *Determining Vestoid Mineralogies Using HEDs as a Guide* **[#1351]** We will test formulas to see how well these equations determine the bulk pyroxene mineralogies of HEDs. Our aim is to derive better uncertainties for the calculated pyroxene compositions and to assess how well we can link Vestoids back to Vesta. |
| Anzures B. A. Schultz C. D. Milliken R. E. Hiroi T. | *Assessing Effects of Particle Size on Water Content Estimates of Carbonaceous Chondrites and Their Parent Bodies* **[#2255]** Boulders not powders? / Asteroid water obscured. / Need grain size effect. |
| Tanbakouei S. Trigo-Rodríguez J. M. Blum J. Williams I. Llorca J. | *Comparing the Reflectivity of Ungrouped Carbonaceous Chondrites with the Reflectivity of Ungrouped Carbonaceous Chondrites with Those of Short Period Comets Like 2P/Encke* **[#1581]** The main goal of our work is to identify samples in our meteorite collections with reflectance characteristics similar to those of comet 2P/Encke. |
| Murtazov A. K. Efimov A. V. | *Visual Spectra of Some Chondrites and Terrestrial Basalts* **[#1172]** The work presents the results of measuring the lava spectra samples, and also the spectra of terrestrial basalt samples, and two samples of ordinary chondrites fallen on the Earth' surface. |
| Tkalcec B. J. Tack P. De Pauw E. Vekemans B. Nakamura T. et al. | *SXRF Analysis of an Orgueil Fragment as Analog Material for Ryugu Samples Returned in the Hayabusa2 Mission* **[#1662]** Fe and Sr distributions at depth within an Orgueil fragment shown by SXRF results. |
| Hallatt D. Leroux H. Roussel P. | *Preliminary Results of Exploring the Behaviour of Phyllosilicates When Subject to Thermal Conditions Relevant to Asteroid Ryugu* **[#2518]** We present early XRD and STA of serpentine under elevated temperatures and controlled atmospheres. |
| Royle S. H. Watson J. S. Sephton M. A. | *UV Photolysis of Humic Acids: Fractionation Between the Coma and Surface Composition of Comets* **[#1454]** We expose astrobiologically relevant organic polymers to UV irradiation and liquid water to simulate surface processes during the perihelion of comets and active meteoroids. Fractionation of phases between volatiles and refractory solids is studied. |
| Van Ginneken M. Wozniakiewicz P. J. | *Chondrule-Like Material in Wild 2: A New Insight from Impact Experiments of* |

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| | *Chondrule Fragments on Stardust Analogue Al Foil* **[#1925]**<br>We will present preliminary results of a study of craters and residues resulting from the impact of fragments of different types of chondrules on Stardust analogue foils. |
| Russell S. R. Fieber-Beyer S. K. | *An Evaluation of CI Carbonaceous Asteroid Regolith as a Plant Growth Medium for Space Crop Production* **[#1406]**<br>Due to the composition of C-type meteorites, it has been speculated that plants could grow in the regolith of the larger bodies. This study investigates the growth of three types of edible crops in a CI carbonaceous regolith simulant. |
| Perov N. I. | *Forecasting for the Hazardous Asteroids Appearance* **[#1043]**<br>In the frame of the pairwise two body problem (the Sun and a particle and the Sun and the Earth), with taking into account the motion of the line of apsides and the line of nodes, the minimal distance between the Earth and a small body is determined. |
| Landis G. A. | *Eccentricity and Inclination Reduction Following Capture of Martian Moons* **[#1019]**<br>A hypothesis for the low inclination of the orbits of the martian moons following capture is presented, in which the inclination is reduced by the cumulative effect of ejection and re-accretion of material from the surfaces. |
| Ipatov S. I. | *Migration of Bodies from the Zone of the Outer Asteroid Belt to the Earth* **[#1618]**<br>The zone of the outer asteroid belt, especially from 3 to 4 AU, could make a valuable contribution to the delivery of water to the Earth. |
| Larson J. N. Venditti F. C. F. Sarid G. Fernandez Y. | *Put Your Mascon: Implementing the Mascon-Layer Model into the N-Body Integrator Rebound* **[#2743]**<br>Put your mascon! Don't you understand the gravity of this simulation? |
| Golubov O. Unukovych V. Scheeres D. J. Kopatko A. V. Strelchenko A. | *Thermal Models of YORP and Yarkovsky Effects: Typical Evolution and YORP Equilibria* **[#2670]**<br>An approximate analytic theory of the YORP and Yarkovsky effects lets us to boil down the information about an asteroid to a few shape coefficients, consistently describing general evolutionary trends, and predicting a special kind of YORP equilibrium. |
| Nakano R. Hirabayashi M. | *Finite Element Modeling Approach to Characterize Temperature Variations of Irregularly Shaped Bodies* **[#1292]**<br>We introduce a new thermophysical model which solves 3D heat diffusion equation by using a FEM approach. This model will be a powerful tool for the Yarkovsky and YORP investigations. |
| Neumann W. Grott M. Trieloff M. | *Do Water-Rich Carbonaceous Chondrites and the NEA Ryugu Share a Common Parent Body?* **[#1852]**<br>Properties of CI and CM parent bodies are investigated by fitting the carbonate formation temperature and age data with thermal evolution models and compared with our best-fit Ryugu parent body. A common source suggested by the spectra is unlikely. |
| Cordiner M. A. Charnley S. B. | *Investigating the Synthesis of Organic Molecules in Cometary Comae via Neutral-Neutral Reactions* **[#2297]**<br>We present results from our latest models for cometary coma chemistry, which show that some organic molecules detected previously using radio spectroscopy could originate from neutral-neutral reactions in the coma, instead of from ice in the nucleus. |
| Wooden D. H. Woodward C. E. Harker D. E. Kelley M. S. P. | *Cometary Particles with Amorphous Carbon: A Large Carbon Reservoir and Aggregate Particles' Optical Properties Computed with DDSCAT* **[#2694]** |

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| | Analyses show cometary C/Si atomic ratios are near ISM values so cometary particles sequestered carbon from the outer disk that highlights the inner disk "carbon deficit" and motivates DDSCAT-computations of cometary aggregates with amorphous carbon. |
| Mertens C. A. K. Riebe M. E. I. Busemann H. | *Probability of Cosmogenic Nuclide Production Rates* **[#2098]**<br>Using geometric probability considerations, the range of likely production rates of cosmogenic noble gases in a meteoroid, as predicted in the model of Leya and Masarik (2009), can be narrowed down and thus also the ranges of likely CRE ages. |

## [P656]
## POSTER SESSION: SMALL BODY MISSION SUPPORT: PAST, PRESENT, AND FUTURE

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| Becker K. J. DellaGiustina D. N. Bennett C. A. Golish D. R. | *Initial Ground Registration of NEAR MSI Images to Asteroid (433) Eros* **[#1511]**<br>Images acquired by the NEAR/MSI camera were used to construct a digital terrain model. The image pointing attitude and spacecraft positions were updated using byproducts of the stereophotoclinometry control process to construct map products in ISIS. |
| Golish D. R. DellaGiustina D. N. Bennett C. A. Becker K. J. Shultz N. K. | *Improved Remediation of NEAR MSI Images of Asteroid (433) Eros* **[#1682]**<br>We present a new blur remediation method for NEAR MSI images of asteroid Eros. The new method utilizes an asymmetric model of MSI's PSF to improve the remediation and recovers portions of the images previously lost to artifacts. |
| Heather D. J. Taylor M. | *The Rosetta Science Archive: Preparing for Legacy Science* **[#2142]**<br>This presentation summarises the final scientific content of the Rosetta mission archive and the work completed to enhance the content and ensure that the full scientific potential of the mission can be realized. |
| Clark C. S. Clark P. E. | *Progress 2021: Constant-Scale Natural Boundary Mapping to Depict Material Transport on Comet 67P/c-g* **[#2695]**<br>We iron out the cartographic wrinkles in our constant-scale natural bonudary maps of comet 67P/Churyumov-Gerasimenko. |
| Moruzzi S. A. Hayes A. G. Soderblom J. M. Corlies P. Birch S. P. D. et al. | *Investigating Sub-Resolution Surface Properties of Comet 67P/Churyumov-Gerasimenko from Optical Photometry and Hapke Modeling* **[#2125]**<br>We quantitatively distinguish the surface properties of different morphologies on Comet 67P from each other and discuss them in the context of the evolution of 67P. |
| Coles K. S. Bennett C. A. Lauretta D. S. Wolner C. W. V. | *A Comprehensive Atlas of Asteroid (101955) Bennu* **[#1110]**<br>The Atlas of Bennu will use maps, images, and other media to illustrate the results from |

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| | the OSIRIS-REx mission's encounter with near-Earth asteroid Bennu, including the survey of Bennu, sample site selection, and sampling. |
| Seabrook J. S. Daly M. G. Barnouin O. S. Philpott L. Gaskell R. W. et al. | *Building a High-Resolution Shape Model of Bennu from OSIRIS-REx Lidar Data* **[#1248]** OSIRIS-REx laser altimeter data has been corrected for spacecraft uncertainties in position and pointing and an in-flight mirror calibration has been applied to the data. From this, a high resolution global shape model has been created. |
| Palmer E. E. Weirich J. R. Lopez K. Barnouin O. S. Daly M. G. et al. | *Stereophotoclinometry Terrain Generation Supporting Autonomous OSIRIS-REx Touch-And-Go Sample Collection* **[#2263]** SPC generated 225 navigation maps for the OSIRIS-REx mission with a ground sample distance (resolution) as small as 5mm. 30 NavCam images resulted in outstanding results of 123 high-correlation feature matches and unprecedented accuracy. |
| Yumoto K. Tatsumi E. Kouyama T. Golish D. R. Kameda S. et al. | *Cross Calibration Between Hayabusa2 ONC-T and OSIRIS-REx MapCam for Comparative Analyses of Asteroids Ryugu and Bennu* **[#1370]** Cross calibration between ONC-T and MapCam reduced the uncertainties in the relative reflectance between Ryugu and Bennu to <1/3. The reflectance is significantly different between the two asteroids, but likely fresh craters have a similar spectra. |
| Yamada M. Kouyama T. Yumoto K. Tatsumi E. Morota T. et al. | *Moon Imaging by Optical Navigation Camera (ONC) During HAYABUSA2 Earth Return* **[#1942]** Hayabusa2 successfully delivered the sample of Ryugyu to the Earth and performed the Earth swing-by on December 6, 2020. We will report the calibration results using the lunar images taken by the Optical Navigation Camera (ONC) during the swing-by. |
| Ito M. Tanaka S. Sakatani N. Senshu H. | *Detailed Shape Modeling of a Local Topography Using Thermal Infrared Imager Data and Evaluation of Thermal Inertia of Asteroid 162173 Ryugu* **[#1822]** In this study, we analyzed the surface temperature distribution in the detailed topography of asteroid Ryugu using high-resolution (27 cm/pix or less) TIR images taken at altitudes lower than 300 m. |
| Mazzotta Epifani E. Dotto E. Ieva S. Perna D. Della Corte V. et al. | *Rotational Properties of Binary Asteroid System (65803) Didymos, Target of the DART/LICIACube and HERA Missions* **[#1190]** We will present the results of the TNG observing campaign of Didymos system, part of the international campaign during the 2021 apparition to investigate the still open questions on the unperturbed rotational properties of the target. |
| Ieva S. Mazzotta Epifani E. Dotto E. Perna D. Brucato J. R. et al. | *Rotational Resolved Spectroscopy of the Didymos System, Target of the DART/LICIACube Mission* **[#1239]** We will present new results about the spectroscopic characterization of the Didymos system, target of the next DART/LICIACube mission, obtained at different rotational phases during the last observable window prior to the DART impact in 2022. |
| Thomas C. A. Rivkin A. S. Moskovitz N. A. Pravec P. Scheirich P. et al. | *Constraining the Orbital Parameters of the Didymos-Dimorphos System: Lightcurve Observations in Preparation for AIDA/DART* **[#2753]** Didymos is the target of the DART and Hera missions. DART will impact Dimorphos, the secondary of the system, and we will use telescopes to measure the orbit change. To understand the change, we must understand the system before impact. |
| Dotto E. Della Corte V. Amoroso M. Bertini I. Brucato J. R. et al. | *LICIACube at (65803) Didymos: The Italian Cubesat in Support to the NASA DART Mission* **[#2051]** |

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| | "LICIACube — the Light Italian Cubesat for Imaging of Asteroids"[2] is an Italian CubeSat, managed by the Italian Space Agency (ASI), that will be part of the DART mission. |
| Cheng A. F. Chabot N. L. Rivkin A. S. Dotto E. Della Corte V. et al. | *DART and LICIACUBE: Momentum Transfer from Kinetic Impact* **[#2531]** Images of DART impact ejecta plume evolution from the LICIACube flyby of Didymos can discriminate strength versus gravity cratering and constrain target properties, aiding determination of momentum transfer. |
| Raducan S. D. Luther R. Jutzi M. Wünnemann K. Michel P. et al. | *Benchmark and Validation Studies with SPH and iSALE, in the Context of the DART and Hera Missions* **[#1908]** DART slams Dimorphos, / Validation tests can tell / Are our models right? |
| Lolachi R. Glenar D. A. Stubbs T. J. | *Optical Characterization Model of the DART Impact Ejecta Plume* **[#2630]** We present a radiative transfer model for LICIACube observations of the DART impact ejecta plume. Combining realistic phase functions (Lommel-Seeliger) and multiple-scattering it can be used for characterizing ejecta material. |
| Hirata K. Usui T. Hyodo R. Genda H. Fukai R. et al. | *Constraints on the Origin of Phobos Using Major Element Data Obtained by MMX MEGANE* **[#1467]** Using the multivariate mixing model of Phobos' bulk elemental composition, we evalutate the model's performance to discriminate the Phobos' origin hypotheses as a function of planned measurement capabilities of MEGANE/MMX. |
| Scheeres D. J. McMahon J. W. Bierhaus E. B. Wood J. Benner L. A. M. et al. | *Janus: A NASA SIMPLEx Mission to Explore Two NEO Binary Asteroids* **[#1706]** The Janus mission will be launched with the NASA Psyche mission in August/September of 2022 and will send two spacecraft to fly by two NEO binary asteroids in 2026. |
| Lilly E. Spahr T. Grav T. G. Masiero J. Sonnett S. S. et al. | *Building the Reference Small Body Population Model* **[#2584]** The Reference Small Body Population Model (RSBPM) is under development by the Near-Earth Object Surveyor team. The RSBPM will contain information on the orbital-, size-, and albedo distributions of most small solar system objects, including comets. |
| Sonnett S. Mainzer A. Grav T. Spahr T. Masiero J. et al. | *NEO Surveyor Cadence and Simulations* **[#2705]** The Near-Earth Object (NEO) Surveyor is a planned infrared space-based survey to detect, catalog, and characterize NEOs. We simulate the survey performance and convey expected discovery statistics. |
| Arai T. Yoshida F. Kobayashi M. Ishibashi K. Kimura H. et al. | *Current Status of DESTINY+ and Updated Understanding of Its Target Asteroid (3200) Phaethon* **[#1896]** We present the current status Of DESTINY+ mission, review the results of extensive astronomical observation of the target asteroid (3200) Phaethon. |
| Bierson C. J. Elkins-Tanton L. T. O'Rourke J. G. | *Modeling the Surface Temperatures of Asteroid 16 Psyche* **[#1603]** The asteroid 16 Psyche is thought to have a metal rich bulk composition from its relatively high bulk density and surface properties. In this work, we present a new model for understanding Psyche's surface temperatures. |
| Kim Y. Hirabayashi M. | *(16) Psyche's Internal Structure May Have Low and High Dense Silicate Layers on Top of a Metallic Core* **[#1546]** We use our FEM approach to investigate Psyche's possible internal structure. We introduce three hypothetical layer conditions (metallic core, dense silicate mantle, and less dense silicate surface layer) and constrain these layers' sizes. |

# [P657]
# POSTER SESSION: MERCURY: BIG SCIENCE IN A SMALL PLANET

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| Bu C. Bostick B. C. Chillrud S. N. Domingue D. L. Ebel D. S. et al. | *Laboratory Simulations of Solar Wind Ion Irradiation on the Surface of Mercury* **[#2093]** We are building a novel apparatus to simulate solar-wind ion irradiation on Mercury using powders, with a system to measure sputter yields and in-situ reflectance. Results will provide inputs for models of Mercury's exosphere and spectrophotometry. |
| Deutsch A. N. Heldmann J. L. Colaprete A. Elphic R. C. Cannon K. M. | *Measuring the Surface Ruggedness of Ice-Bearing Craters on Mercury* **[#2024]** We analyze the surface texture of ice-bearing craters on Mercury, and compare surface ruggedness to crater temperature and ice stability depths. |
| Rodionova Zh. F. Feoktistova E. A. Zharkova A. Yu. Kokhanov A. A. | *Comparative Analysis of Morphological Features of Mercury Craters in Two Independent Catalogues* **[#1410]** The Morphological Catalog of the craters of Mercury is the first part of the Global Mercury Crater Catalog, created by the Sternberg Astronomical Institute (SAI) and MIIGAiK. It includes > 27,000 craters, diameters ~ 12,000 of which ≥ 10 km. |
| Fevig R. A. Wren P. F. | *Pilot Study of Doublet Craters on Mercury* **[#2750]** A systematic survey of doublet craters on Mercury was initiated. One possible doublet out of twenty-one crater pairs was found. Likely doublets outside of the survey regions were noted. We will report on an expanded survey by conference time. |
| Munaretto G. Lucchetti A. Cremonese G. Pajola M. Massironi M. et al. | *Analysis of Multiangular MESSENGER Color Observations of Hollows at Canova Crater, Mercury* **[#1943]** We focus on the analysis of multiangular, multiband MESSENGER/MDIS-WAC color images of hollows at Canova Crater, Mercury. We extracted and compared spectra for the hollows and the smooth material in the crater floor. |
| Yazici I. S. Klimczak C. | *Global Fracture Pattern on Mercury Revealed by Polygonal Impact Craters* **[#1395]** We have mapped 7,146 impact craters across Mercury and then analyzed the straight rim segments of these impact craters to reveal a fracture pattern to contribute additional information about Mercury's tectonics. |
| Keebler A. M. Watters T. R. | *Displacement Profiles of Wrinkle Ridge Thrust Faults on Mercury* **[#2704]** Displacement profiles of Mercury's wrinkle ridge thrust faults show evidence of restricted and unrestricted fault growth, indicating complex interactions between developing faults. |
| Rodriguez J. A. P. Domingue D. Abramov O. Travis B. Weirich J. et al. | *The Devolatilized Landscapes of Mercury: New Insights and Major Uncertainties* **[#2270]** We present some new insights into the landscapes resulting from volatile cyclicity on |

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| | Mercury, including the origin of chaotic terrains, the development of permanently shadowed crater clusters, and the long-term stability of hollow-bearing plains. |
| Zambon F. Carli C. Wright J. Rothery D. A. Altieri F. et al. | *Spectral Units Identification in the H05-Hokusai Quadrangle on Mercury* **[#2207]** In this work, we focused on the spectral analysis of H05 quadrangle on Mercury derived by MESSENGER/MDIS-WAC 8-color mosaic. We defined spectral units from selected spectral parameters. |
| Giacomini L. Carli C. Zambon F. Galluzzi V. Ferrari S. et al. | *Kuiper Quadrangle (H06) Geological Map: Integration Between Morphological and Spectral Characteristics* **[#1934]** We will present the preliminary results of the Kuiper geological map that we performed integrating both morphological and spectral characteristics of the surface by using MDIS MESSENGER data. |
| Mouser M. D. Dygert N. | *Gravitational Instabilities in Mercury's Mantle Produce Diverse Volcanic Source Regions* **[#1482]** Analysis suggests density-driven mixing of distinct layers in Mercury's cumulate mantle can explain the compositional diversity of Mercury's surface. |
| Bose P. Duncan M. S. King S. D. | *Using MESSENGER Data to Model the Thermochemical Evolution of Mercury's Interior* **[#2091]** Inside Mercury / Heat and chemical changes / See me for results. |
| Anzures B. A. Parman S. W. Milliken R. E. Namur O. Cartier C. | *Sulfide Speciation in Mercurian Magmas* **[#2238]** Mercury, oddball. / Sulfur bonds with this and that. / Changes magma and…. |
| Konecke B. A. Vander Kaaden K. E. McCubbin F. M. Northrup P. | *Utilizing Linear Combination Fitting (LCF) to Model Highly Reduced, Multi-Component Mixtures of Cation-Sulfide Species Relevant to Mercurian Melts* **[#1695]** In this study, we develop and test a novel calibration to improve our understanding of the speciation and bonding environment of sulfur in minerals and quenched silicate liquids that crystallized from highly reduced, and iron poor mercurian magmas. |
| Stangarone C. Maturilli A. Helbert J. | *Calculated High Temperature Thermal-IR Spectra of Orthoenstatite: Theoretical Insights on Band Shifts and Temperature* **[#2079]** The two spectral features of a natural orthoenstatite (Ca0.01 Mg1.73 $Fe_2$+0.25 $Si_2$O6) at 986 cm-1 (10.1 μm) and 968 cm-1 (10.3 μm) appear to be sensitive to temperature increase up two 1000 K. Same behavior is forecasted by the ab initio modeling. |
| Killian G. O. Dukes C. A. Bu C. | *Simulation-Derived Thermal Diffusion Parameters in Temperature-Dependent Depletion of Potassium Adsorbed on Magnetite* **[#2776]** SDTrimSP simulations are compared with XPS data for irradiation of potassium adsorbed on magnetite. Initial results sans diffusion parameters are compared with reasonable fidelity in a trend of decreasing potassium atomic composition. |

## [P658]
## POSTER SESSION: VENUS ATMOSPHERE, EMISSIVITY, AND WEATHERING

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| Port S. T. Chevrier V. F. | *Numerical Investigation of Mercury-Bearing Minerals to Address the Low Emissivity Anomaly on the Highlands of Venus* **[#1356]** Using Gibbs free energy minimization software, we investigated the ability of HgTe, and other Hg-bearing minerals, to deposit onto the highlands of Venus. Our data suggests that Hg-bearing minerals are unlikely to explain the low emissivity anomaly. |
| Reid R. B. McCanta M. C. Filiberto J. Treiman A. H. Keller L. et al. | *Assessment of the Effect of Bulk Composition on Basalt Weathering on Venus' Surface* **[#1293]** Mineralogies and abundances of alteration products on samples of alkali and tholeiite basalts, reacted under relevant Venus conditions and atmospheres, suggest that the alkaline composition may weather more readily on Venus' surface. |
| Mohan N. Antony T. Suresh Raju C. Swarup G. Oberoi D. | *Radiative Transfer Simulations to Explain the Subsurface Thermal Radio Emission of Venus* **[#2212]** Brightness temperature of Venus shows a monotonous decrease in decimetre wavelengths and this, in fact, is still a matter of debate. This work focuses on explaining this by studying its emission using GMRT observations and radiative transfer theory. |
| Lopez X. R. Gilmore M. S. Santos A. R. | *Decomposition of Calcite After 30 Days of Venus Conditions in GEER* **[#1383]** Using the NASA GEER chamber, minerals were exposed to the most realistic Venus surface conditions (~460 Celsius and 93.5 bars) for 30 days. In this abstract, we review the alterations of calcite. The surface and cross section were analyzed in an SEM. |
| Helbert J. Mueller N. Dyar M. D. Maturilli A. Smrekar S. E. et al. | *Mapping Venus from Orbit: Opportunities and Challenges of Near Infrared Emissivity Mapping* **[#1899]** We can finally obtain a global map of surface rock types for Venus from orbit using near infrared imaging, but this requires multi-band imaging covering all available surface bands and accurate surface topography. |
| Helbert J. Haus R. D'Amore M. Maturilli A. Arnold G. et al. | *Venus as Seen by the MErcury Radiometer and Thermal infrared Imaging Spectrometer (MERTIS) During the First Flyby of the ESA-JAXA Bepicolombo Spacecraft* **[#1521]** We report here on the MERTIS observations acquired during the first Venus flyby of BepiColombo. |
| Maturilli A. Helbert J. Hiesinger H. D'Amore M. | *MERTIS on BepiColombo Cruise Operations: Flybys to the Moon and Venus* **[#1435]** BepiColombo spacecraft is performing 9 flybys: among them, the Earth/Moon flyby on April 10, 2020, and the Venus flyby on October 15, 2020 (second Venus flyby around August 10, 2021). Among the few instruments that can operate is MERTIS. |
| Ganey T. M. Gilmore M. S. Brossier J. | *Sediment Supply as a Constraint on Yardang Formation Near Mead Crater, Venus* **[#1309]** Aeolian features near Mead Crater are presumed to be yardangs. Local aeolian conditions support this identification, while sediment supply constraints do not. |
| Ganey T. M. Gilmore M. S. Brossier J. | *Distribution and Volume of Impact-Generated Sediment on Venus* **[#2271]** The global volume of impact-derived sediment on Venus is calculated and found to be much larger than the volume accounted for by aeolian bedforms. |

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| Zolotov M. Yu. | *Iron Salts and Oxides in the History of the Surface-Atmosphere-Cloud System on Venus* **[#2615]**<br>Volcanism and gas-solid reactions produced Fe gases in history of Venus. Without volcanism, cosmic Fe could be a major source of atmospheric Fe. Fe sinks from the clouds in sulfates and contributes to the oxide-rich mineralogy of surface fines. |
| Brinckerhoff W. B. Li X. Mahaffy P. R. Atreya S. K. | *Re-Analysis of Phosphorus and Related Trace Species in the Lower Venus Atmosphere from Pioneer Venus Neutral Mass Spectrometer Data* **[#1382]**<br>We have re-analyzed PV Large Probe Neutral Mass Spectrometer (LNMS) data, only recently made widely available, for the presence of P and related trace species over the altitude range 64.2 km to the surface (final scan at 0.2 km). |
| Kumar V. R. D. Pabari J. P. Acharyya K. Jitarwal S. Nambiar S. et al. | *Constraint on Discharge Current Parameters and Streamer Speeds of Venusian Lightning* **[#1768]**<br>In this work, we calculate the expected streamer speeds in Venus's middle cloud conditions. We constrain the possible limits of peak frequency using streamer speed and use the peak frequency limit to find the range of discharge current parameters. |
| Qu HK. Wang A. Thimsen E. | *Laboratory Simulation of Venus Lightening for Atmospheric and Surficial Electrochemistry Reactions* **[#2166]**<br>We conducted two sets of ESD experiments in air and in $CO_2$ under different pressures and obtained V~I curves and plasma spectra with the purpose of studying the electrochemical products from lightning process on Venus. |
| Bhattacharya A. Pabari J. P. Jitarwal S. | *Schumann Resonance in Venus: Dependence on Volcanism and Tracer for Lightning Activity* **[#1398]**<br>The work studies propagation of ELF waves in the subsurface region and dependence of Schumann Resonance frequency modes on the presence of magma in subsurface. The frequency modes act as a tracer for lightning detection on Venus. |

## [P659]
## POSTER SESSION: VENUS VOLCANISM, TECTONICS, AND GLOBAL EVOLUTION

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Hahn R. M. Byrne P. K. | *A New Study of Shield Fields and Their Spatial Relationships on Venus* **[#1130]**<br>Small shields on Venus / Alone or part of a field / How are they arranged? |
| El Bilali H. Ernst R. E. Buchan K. L. | *Maat Mons, Atla Regio, Venus: Magmatic and Tectonic History from Detailed Mapping* **[#2529]**<br>A preliminary geological map of Maat Mons shows >50 flow units, some fed from |

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| | caldera collapse, others likely from dykes. Some small shield volcanoes are aligned along, and hence fed from dykes. |
| López I. D'Incecco P. Komatsu G. Filiberto J. | *Origin of Flat-Topped Venusian Shield Volcano Summits: A Case Study of Idunn Mons* **[#1329]** In this work, we discuss the different hypotheses for the origin of flat-topped volcanoes to explain the observed summit morphology of Idunn Mons, a possible active volcano on Venus. |
| Sanchez J. C. Ernst R. E. Buchan K. L. El Bilali H. | *Canali W-SW of Salus Tessera and Link with Nabuzana Corona* **[#1324]** Mapping of canali W-SW of Salus Tessera, and linkage to Nabuzana corona, confirming their magmatic origin. Topography generally consistent with inferred canali flow directions, suggesting the absence of significant post-canali topographic changes. |
| Guseva E. N. Ivanov M. A. | *Results of Geological and Morphological Analysis of Structures of Venus' Coronae* **[#1104]** We examined all cataloged coronae on Venus and classified them according to their characteristic topographic profiles in order to identify the stages of the coronae evolution. |
| Schools J. Smrekar S. E. | *The Role of Melt Permeability in Linked Magmatic-Tectonic Corona Formation Models* **[#1257]** Venus corona / Topography supported / By emplaced magma. |
| Voss P. R. Grosfils E. B. | *How Much Dike Emplacement Occurs Beneath Radially Fractured Centers (RFCs) on Venus?* **[#1070]** We describe the initial steps of a method that can be used to constrain the minimum degree of dike emplacement required to explain the strain recorded by the pervasive radial lineaments observed at typical RFC systems on Venus. |
| Williams Z. W. Byrne P. K. Balcerski J. A. | *Determination of Structure and Effective Elastic Lithospheric Thickness of Ridge Belts* **[#1583]** Mapped ridge belt structure / Modeled lithosphere thickness / BDT we see! |
| MacLellan L. M. Ernst R. E. El Bilali H. | *Unnamed Lava Flow System Along the Northeastern Margin of Vaidilute Rupes, Venus* **[#1726]** Geological mapping in the Kaiwan Fluctus (V-44) quadrangle, providing insights into the source and history of an unnamed flow system (>650 km) within the lowlands adjacent to Vaidilute Rupes and Astkhik Planum. |
| Brossier J. Gilmore M. S. Head J. W. | *Possible Recent or Current Rift-Associated Volcanism in Ganis Chasma, Venus* **[#1187]** We characterize radiophysical signatures in Ganis Chasma where recent volcanic activity has been reported. More precisely, we describe variation of Magellan radar emissivity with altitude in selected sites showing possible young lava flows. |
| Cirium D. D. Mason P. J. | *Rift–Associated Cluster Volcanism in SW Atla Regio, Venus* **[#2611]** Volcanic alignments were mapped within young shield clusters associated with the SW rift limb of Atla Regio, and analysed to determine their structural controls, evolution, and genesis. |
| Henz T. N. Ganesh I. Carter L. M. | *Measuring the Radar Properties of Pyroclastic Deposits in Eistla Regio, Venus* **[#2150]** This study is looking at the radar properties of mapped pyroclastic deposits in a certain region on Venus to constrain a few key characteristics of the material. Pyroclastic deposits can yield insight into volatile content of the region. |

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| Whitten J. L. Campbell B. A. | *Variations in Venusian Tesserae: Local and Global Variations in Backscatter Coefficient* **[#2514]**<br>Local and global variations in Magellan radar backscatter coefficient (radar brightness) indicated influences from post-emplacements processes (e.g., impact craters), ridge slope distributions, and inherent differences in original tesserae material. |
| Sabbeth L. Smrekar S. E. Stock J. M. Jackson J. M. | *Predicting Venus' Seismicity for Infrasound Detection* **[#2172]**<br>Venus quake forecast / From an infrasound balloon / Faults, volcanoes, boom. We aim to predict which Venusian geologic features are active, which features produce infrasound waves, and what magnitudes of quakes are expected from these features. |
| Ivanov M. A. Head J. W. | *The Evolution of Venus: Assessing the Transition from Potential More Earth-Like Conditions to the Recent Geological and Atmospheric Environment* **[#1400]**<br>We find no evidence for the occurrence of glacial and/or fluvial erosion or deposition in the study area, nor in the more extensive region within the surrounding tessera. |
| Kiefer W. S. Weller M. B. | *Venus, Earth's Divergent Twin: Observations Constraining the Transition from a Mobile Lid Planet to a Stagnant Lid Planet* **[#1792]**<br>Mantle convection on Venus was mobile lid in the past and is transitioning towards stagnant lid at present. The transition was likely driven by a climate-driven loss of pore fluids, resulting in an increase of fault friction. |
| Seales J. Lenardic A. | *The Timing of Habitability for Earth- and Venus-Like Planets: The Role of Tectonic Cooling Efficiency* **[#2014]**<br>We calculate habitable zone entry times for validated Earth-like planets using a coupled interior and surface model. We extend this to planets in the episodic convective regime, which support a habitable early Venus. |

## [P660]
## POSTER SESSION: VENUS INSTRUMENTATION AND AIRBORNE EXPLORATION

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Lemke L. G. Kroo I. Hall D. W. Noe Dobrea E. Z. | *The Low Altitude Venus Aircraft* **[#2669]**<br>We examine the technical feasibility of a heavier-than-air craft capable of cycling between low (near surface) and high altitude Venus powered by the thermal gradient that exists between low and high altitude. |
| Baines K. H. Cutts J. A. Mcgarey P. Sutin B. M. Davis A. B. | *High Spatial Resolution Imaging of the Surface of Venus via a Balloon-Borne Tow-Body Camera System* **[#2498]**<br>Repeated high-resolution (<10 m) near-IR imaging of the surface of Venus is feasible via |

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| | a phase-changed-cooled tow-body at 47 km (100 C) altitude supported by a balloon at more benign altitudes > 52 km. 1-hr excursions cover an area ~220 x 12 km. |
| Horzempa P. | *Calypso Venus Scout* **[#1425]**<br>The Calypso Venus Scout is a mobile, low-altitude survey and mapping mission. It utilizes a unique hardware design that allows it to act as an aerial "rover." Calypso will be able to reconnoiter all crustal provinces on Venus. |
| Krishnamoorthy S. Brissaud Q. Komjathy A. Cutts J. A. Pauken M. T. et al. | *Earth-Analog Experiments for Detecting Seismicity on Venus Using Balloons* **[#2755]**<br>Venus is extremely hot and any landed missions have not survived for longer than two hours. We discuss recent and future experiments to enable seismology from balloons in Venus' atmosphere. |
| Bowman D. C. Rouse J. W. Krishnamoorthy S. Komjathy A. Pauken M. T. et al. | *A Balloon-Borne Aeroseismometer for Locating Seismic Activity on Venus* **[#2054]**<br>Seismic activity on Venus may create acoustic waves that can be captured on balloon-borne platforms. We present the "aeroseismometer," an instrument that can determine the direction of arrival of these waves. This will aid in locating venusquakes. |
| Cutts J. A. Krishnamoorthy S. Jackson J. M. Byrne P. K. Komjathy A. et al. | *Balloon Infrasound Networks for Investigating the Venus Interior* **[#2319]**<br>There is growing evidence that Venus is volcanically and seismically active. This paper describes a concept for a future mission to investigate volcanic activity, seismicity, and interior structure from infrasound signals with a network of floating stations. |
| Simon K. Eshelman E. Sobron P. | *Aerosol Capture and Compositional Profiling of Venus Atmosphere on a Descent Probe* **[#2425]**<br>Venus Optofluidic Liquid TRap (VOLTR) is a scientific payload that passively samples aerosols and performs high sensitivity surface-enhanced Raman spectroscopy (SERS) measurements in real-time, enabling compositional profiling of Venus's atmosphere. |
| Garrett M. P. Jha V. Cook A. M. White B. Dave A. et al. | *NephEx: Nephelometer for Measuring Cloud Particle Size and Density in Planetary Atmospheres* **[#2589]**<br>We describe a compact, two-wavelength nephelometer capable of measuring particle size distributions in planetary atmospheres. |
| Jitarwal S. Upadhyaya T. Pabari J. P. Nambiar S. Kumar D. et al. | *Non-Foster Active Impedance Matching of Short Dipole Antenna for a Lightning Instrument* **[#2162]**<br>In the present work, matching of short dipole antenna to the load by using a Non-Foster Active Impedance matching network is realized using the Negative Impedance Converter. The simulation results of the active matching network prototype are presented. |
| Bhagwat R. S. Alva B. H. Hartwell B. D. Bernard E. O. Rajesh V. V. | *Vibrissae Inspired Mechanical Obstacle Avoidance Sensor for the Venus Exploration Rover AREE* **[#1960]**<br>As part of the NASA "Exploring Hell: Avoiding Obstacles on a Clockwork Rover" challenge, an obstacle avoidance sensor (OAS) was developed with an array of mechanical sensors akin to mammalian vibrissae and associated electromagnetic actuators. |

## [P661]
## POSTER SESSION: EXOPLANETS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Mosqueira I. | *Formation of Extrasolar Planet TOI-849b in a Quiescent Disk* **[#1025]**<br>We consider pathways leading to the formation of gas-depleted planetary runaway cores in inviscid disks. We investigate the migration and delivery of close-in planets without resorting to model parameter fine-tuning. |
| Veras D. Kurosawa K. | *Limits on Small-Impact Crater Ejecta in Extrasolar Planetary Systems* **[#1012]**<br>We compute limits on small-impact crater ejecta in exosystems by using a full-chain analytical prescription, and apply our results to metal-enriched/polluted white dwarf planetary systems which contain asteroids on distant orbits not near the star. |
| Fu S. F. Shim S. H. S. | *Hydrogen Storage in FeSi Alloy at High Pressure: Implications for the Composition and Structure of Rocky Planets' Cores* **[#1735]**<br>We experimentally studied reactions between FeSi alloys and hydrogen at high pressure and temperature conditions. These results can be applied to better understand the structure and composition of cores of Earth-like planets in the universe. |
| Terpstra J. M. Foing B. H. Heras A. M. Foing V. Rusticus Y. J. et al. | *TESS Data and Ground-based Observations* **[#2476]**<br>Comparing data from space-based observatories such as TESS with data from ground-based telescopes can lead to new conclusions. We perform a case study on WASP-140 and AU Mic. |
| Hönes C. J. Heras A. M. Foing B. Rusticus Y. Foing V. et al. | *Shape Characterization and Temporal Analysis of Exoplanet Transits with Deep Learning* **[#2071]**<br>We apply Deep Learning methods to TESS light curve data to analyze the shape of exoplanet transits. This can be used to classify different exoplanet types or to discover new phenomena. We plan to also track variations in the transit shape over time. |
| Kane S. R. Arney G. Crisp D. Domagal-Goldman S. Glaze L. S. et al. | *Venus as a Laboratory for Exoplanetary Science* **[#1156]**<br>Venus is a planet of critical importance in the study of terrestrial atmospheres and the evolution of habitable surface environments. We describe how Venus data is being used to characterize exoplanets and define the limits of the Habitable Zone. |
| Izenberg N. R. Stevenson K. B. Lustig-Yaeger J. Mandt K. E. May E. M. et al. | *The Scientific Case for an Earth Transit Observer* **[#1265]**<br>If we observe Earth / Like we do exoplanets / Will we see life signs? |

## [P662]
## POSTER SESSION: GREAT BALLS OF FIRE: EXPLOSIVE VOLCANISM ACROSS THE SOLAR SYSTEM

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Leight C. J. McCanta M. C. Thomson B. J. Dyar M. D. | *Identifying Volcanic Glass Concentration and Composition with Remote Sensing Using Multivariate Methods* **[#2214]** Multivariate Partial Least Squares (PLS) analysis of MIR and VNIR spectra provides a method to both quantify and characterize glass present in natural tephra samples. |
| Pigue L. M. Bennett K. A. Horgan B. H. N. Gaddis L. R. | *A Tale of Two Mozarts: Investigation of Lunar Pyroclastic Deposits Near Lacus Mozart* **[#2594]** We use Moon Mineralogy Mapper to re-evaluate a lunar pyroclastic deposit named Mozart identified in literature as a "dark mantled valley" and new potential pyroclastic features identified near Lacus Mozart: vents along Mozart rille. |
| Trang D. Tonkham T. Li S. Jozwiak L. M. Elder C. M. | *The Relationship Between Water Abundance and the Physical and Compositional Properties of Lunar Localized Pyroclastic Deposits* **[#1698]** We found that there is a relationship between water abundance of localized pyroclastic deposits and their regolith properties. These properties include radar backscatter from 0.01–1 m sized-rocks and regolith density. |
| Wilson L. Head J. W. Jawin E. R. | *Mode of Emplacement of Vallis Schröteri and the Huge Pyroclastic Cone Surrounding Cobra Head, Aristarchus Plateau* **[#2013]** We quantify volatile contents of magma from parts of the vent system that formed the Schröters Valley rille complex and estimate the eruption duration. |
| Head J. W. III Wilson L. Kreslavsky M. A. | *Sulfates on Mars: A Pyroclastic Airfall Model for Origin, Emplacement, and Initial Alteration of Valles Marineris Interior Layered Deposits (ILD)* **[#2189]** A new martian magma ascent-eruption model shows that co-eruption (tephra-$H_2O$-S species) may account for Valles Marineris interior layered deposits (ILD). |
| Paladino T. Nawotniak S. E. K. Kerber L. Millour E. Karunatillake S. | *Can Explosive Volcanism Explain Hydrated Regolith Patterns on Mars?* **[#2689]** Powerful explosive eruptions on Mars are capable of producing widespread ash deposits. These deposits may be able to partially or fully explain observed patterns of regolith hydration. We use physics-based models to test this hypothesis. |
| Mishev I. Smith I. B. | *Characterization and Mapping of Light-Toned, Layered Deposits on the Plateaus of Western Valles Marineris with SHARAD and High-Resolution Imagery* **[#1694]** A now complete radar mapping of the light-toned layered deposits (LLD) and associated massive (un-layered) deposits that are contiguous with the LLD is presented, along with a morphology maps showing how these deposits eroded/evolved after formation. |
| Sillitoe-Kukas S. Humayun M. Adatte T. Keller G. | *Elemental Evidence for Global Volcanogenic Input at the KPg Boundary Based on Results from El Kef, Tunisia* **[#2292]** Identifying volcanic aerosols and their effects in global KPg boundary sediments based on results from El Kef, Tunisia. |

# [P663]
# POSTER SESSION: PLANETARY VOLCANISM: MORPHOLOGIES, EMPLACEMENT, AND EVOLUTION

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Kumari N. Whelley P. L. Cowart J. C. Glotch T. D. | *Episodic Volcanism and Fluvial Activities in a Floor-Fractured Crater at the Flanks of Arsia Mons* **[#1194]** A crater on the south-west flanks of Arsia Mons indicates that the region has seen multiple episodes of lava flow with evolving magma and erosion both by lava and fluvial processes. |
| Leverington D. W. | *The Shalbatana Vallis Outflow System is a Product of Dry Volcanic Megafloods* **[#1771]** As with all other martian outflow systems, the attributes of Shalbatana Vallis suggest that channel development resulted from the rapid and voluminous effusion of low-viscosity lavas of mafic or ultramafic composition. |
| Chen Y. Head J. W. Wilson L. Kreslavsky M. A. Liu J. et al. | *The Role of Pre-Existing Topography in Modulating Lunar Lava Flow Widths, Depths, and Channel Structure* **[#1818]** In this study, we mapped the results of the eruption and emplacement process of a lava flow and assessed how the observed effects could improve our understanding of tectonic topography formation and lava flow emplacement and cooling behavior. |
| Flynn I. T. W. Crown D. A. Ramsey M. S. | *The Effects of DEM Resolution on Planetary Thermo-Rheological Lava Flow Modeling* **[#1305]** Modeling martian lava flow emplacement yields important results. Many previous studies have used constant slopes which can negatively impact the model. We investigate the effects of DEM resolution on deriving slopes for a lava flow emplacement model. |
| Andrews G. D. M. Kenderes S. M. Isom S. L. Brown S. R. Whittington A. G. | *The Fold Illusion: Large Arcuate Lava-Surface Features are Formed by Tensile Fracturing* **[#1724]** Arcuate ridges and troughs (ogives) on the upper surfaces of silicic lavas are formed by brittle-extension and not folding (ductile-compression) as previously inferred. Therefore, application of fold theory to ogives is invalid. |
| Huang R. I. Radebaugh J. Christiansen E. H. | *Quantitative Analysis of Caldera Shapes on Mars, Earth, and Io* **[#2596]** Study of the shapes of volcanic craters on Earth, Mars, and Io. Classifying volcanic craters based on shape, and how classifications are influenced by sample size. |
| Bardabelias N. M. Holt J. W. Hamilton C. W. Christoffersen M. S. Hadland N. K. | *Characterizing Morphology of Lava Tubes in El Malpais National Monument Using Ground Penetrating Radar and LIDAR* **[#2496]** Lava tubes are subsurface structures that provide shelter from harsh surface conditions for future human and robotic exploration. This work uses ground penetrating radar and LIDAR to determine how radar power returns are effected by lava tube morphology. |
| Magee C. Jackson C. A-L. Kling C. L. Byrne P. K. | *Imaging the Subsurface Structure of Pit Craters* **[#1884]** We use seismic reflection data from offshore NW Australia to image pit craters, which |

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| | can be directly linked to dikes and faults, for the first time. We quantify their 3D geometry and compare them to pit craters from other planetary bodies. |
| Wyrick D. Y. Buczkowski D. L. | *Tectonic Caves: The Role of Dilational Faulting* **[#2007]**<br>Pit crater chains show / Large void space underground with / Potential storage. |

## [P664]
## POSTER SESSION: PLANETARY DIFFERENTIATION

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Futó P. | *The Rocky Planets with Magnesium-Rich Mantle Composition* **[#1017]**<br>The evolution of rocky planets strongly depends on their mineral composition. The mantle of high-Mg/Si planets build up from Mg-rich and oxygen-rich minerals. |
| Futó P. | *Optimal Core Sizes for Earth-Like Habitability* **[#1018]**<br>In terms of this model, those small-Earth-sized rocky planets may have Earth-like character, which have an optimal size of their cores with and core radius fractions smaller than the depth of pv-ppv phase transition. |
| Gigliotti A. E. Hesse M. A. Prodanović M. | *Pore-Scale Simulation of Two-Phase Melt Percolation During Core Formation in Planetesimals* **[#2328]**<br>Here we present 3D pore-scale simulations of the interaction of metal-sulphide and silicate melts in a texturally equilibrated melt network. Our simulations show there is a strong interaction between both phases when flowing. |
| Prissel K. B. Fei Y. | *Disruption of Metal Melt Connectivity in a Partially Molten Silicate Matrix* **[#2149]**<br>Silicate melting / Disrupts metal melt networks / Within small bodies. |
| Maurel C. Gattacceca J. Bryson J. F. J. Nichols C. I. O. Weiss B. P. | *Paleomagnetism of Iron Meteorites: Recent Advances and New Questions* **[#1166]**<br>We review recent findings from nm-scale paleomagnetic studies of iron meteorites, and present new data acquired on iron meteorites from the mm- to the m-scale. |
| Zhang B. Chabot N. L. Rubin A. E. Humayun M. Boesenberg J. S. et al. | *Chemical Composition and Fractional Crystallization of IIIF Iron Meteorites* **[#1640]**<br>We report new elemental concentrations of the IIIF iron meteorites and irons of two pallasites (Zinder and NWA 1911) from INAA and/or LA-ICP-MS. Fractional crystallization modeling is undertaken to explain the inter-element trends of IIIF irons. |

## [P665]
## POSTER SESSION: ATMOSPHERES: DYNAMICS, EVOLUTION, AND COMPOSITION

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Ruedas T. Wünnemann K. Grenfell J. L. Rauer H. | *Impact-Atmosphere-Interior Interactions in Terrestrial Planets on Different Timescales* **[#2237]** Impactors erode, replenish terrestrial and planetary atmospheres, cause atmosphere-interior volatile exchange by out-/ingassing of impact-related melting, weathering. |
| Liggins P. Shorttle O. Rimmer P. B. | *Probing Mantle Redox with Planetary Atmospheres* **[#2001]** We model the composition of volcanic atmospheres, where gases cool and equilibrate to surface temperatures post-eruption. Cooling significantly perturbs the atmospheric composition, making inferences about the mantle redox of the planet more complex. |
| Guzewich S. D. Oman L. D. Richardson J. Whelley P. Bastelberger S. et al. | *Modeling Flood Basalt Volcanic Climate Disruptions: Implications for Terrestrial Planet Habitability* **[#1984]** Volcanoes erupt / Changing the circulation / Water warms the air. |
| Wofford A. Guzewich S. Tsigaridis K. Perlwitz J. Way M. et al. | *Comparative Analysis of Obliquity-Driven Changes in the Martian Atmosphere* **[#2182]** Our work will examine changes to dust lifting, transport, and deposition in the polar regions with varying obliquity and its impact on cloud formation in the martian atmosphere. |
| Scheller E. L. Ehlmann B. L. Hu R. Adams D. Yung Y. | *Crustal Hydration of Ocean-Scale Volumes Controlled Martian Climate and Habitability* **[#1666]** Using hydrogen isotopes, we find that formation of hydrated minerals in the crust significantly reduced water availability on Mars early in its history. We show that crustal water sinks are important controls on planetary habitability. |
| Wordsworth R. D. Knoll A. H. Hurowitz J. Baum M. Ehlmann B. et al. | *A Coupled Model of Episodic Warming, Oxidation, and Geochemical Transitions on Early Mars* **[#2210]** We have built a new stochastic model to understand Mars' climate and chemical evolution through time. We suggest that multiple aspects of Mars' history can be explained by atmospheric fluctuations between reducing and oxidizing states. |
| Aleinov I. Tsigaridis K. Guzewich S. D. Wolf E. T. Perlwitz J. P. et al. | *Modern Mars Simulations with the ROCKE-3D GCM: Sensitivity to $H_2O$ Snow Deposition and Dust Cycle* **[#2418]** We present the ROCKE-3D GCM simulations of the modern martian climate and study its sensitivity to the dust cycle and the resence of $H_2O$ snow in polar caps. |
| Hargitai H. I. | *Model-Based Climate Zone Map and Climate Diagrams of Mars* **[#2102]** The abstract presents the making of the Climate Zone Map and climate diagrams of Mars. |
| Franz H. B. Trainer M. G. Atreya S. K. Wong M. H. Webster C. R. et al. | *Assessing Interannual Variability in the Chemical and Isotopic Composition of the Martian Atmosphere* **[#2012]** We will present results of periodic measurements of volume mixing ratios for major |

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| | constituents and $CO_2$ isotope ratios of the martian atmosphere by the Sample Analysis at Mars (SAM) instrument spanning Mars years 31-35. |
| Martinez G. M. Vicente-Retortillo A. Savijärvi H. Vasavada A. R. Fischer E. et al. | *Atmospheric Thermal Forcing at Gale Crater, Mars* **[#1205]**<br>We analyze the diurnal variability of the atmospheric thermal forcing at Gale Crater, Mars, by using measurements from the Mars Science Laboratory mission. Then, we discuss potential processes causing such variability. |
| Angell P. Werner H. Christensen P. R. | *Seasonal Temperature Variations Along the Curiosity Rover Traverse in Gale Crater: A Comparison of THEMIS Remote Sensing Data with Ground Truth* **[#1828]**<br>In this project, we compare surface temperatures measured from orbit by THEMIS onboard the Mars Odyssey spacecraft with published values of ground temperatures measured by the Mars Science Laboratory along the Curiosity rover traverse in Gale Crater. |
| Wolfe C. A. Edwards C. S. Piqueux S. | *Characterizing Global Inter-Annual Dust Removal and Deposition Using Thermal Emission Imaging System (THEMIS) Infrared Data* **[#2624]**<br>Using THEMIS IR data, the fine-scale context for Mars surface dust migration is investigated. Variations in thermophysical properties are modeled, allowing dust deposition/removal to be quantified and dust source/sink activity to be constrained. |
| Leseigneur Y. Vincendon M. Stcherbinine A. | *Martian Dust Dynamics Constrained by OMEGA/MARS EXPRESS Orbital Data* **[#1471]**<br>We developed a new method to detect dust storms on Mars based on orbital spectroscopy (OMEGA/MEx). This method is used to characterize dust dynamics, notably the links between dust storms and small-scaled surface phenomena like RSL. |
| Mukundan V. Thampi S. V. Bhardwaj A. Fang X. | *A Modeling Study on the Effect of the 2018 Mars Global Dust Storm on the Ionospheric Peak* **[#1157]**<br>Using a photochemical model, we present how the global dust storm that originated in the northern hemisphere of Mars in June 2018 affected the peak altitude of the ionosphere of the southern hemisphere where only limited observations are available. |
| Bhattacharya A. Jitarwal S. Pabari J. P. Sheel V. | *Proposed Model for Estimation of Atmospheric Dust and Cloud Mass Loading on Mars* **[#1547]**<br>Atmospheric dust and clouds form a major source of microwave attenuation in Mars. The study puts forward a model to retrieve the mass loading profiles of dust and cloud through single and dual frequency radio occultation of the martian atmosphere. |
| Pankine A. | *Vertical Distribution of Water Vapor in the Martian Atmosphere Retrieved from MGS TES Day and Night Observations* **[#1357]**<br>A new approach to retrieving vertical distribution of water vapor in the martian atmosphere using combined day and night nadir MGS TES spectra is presented. |
| Karnes V. M. Sands C. M. Sandtorf-McDonald J. R. Slank R. A. Chevrier V. F. | *Identification and Quantification of Martian Frost Using HiRISE Imagery* **[#2592]**<br>The HiRISE camera on MRO provided RGB image products for Mars that allowed for easier frost identification. These were used to evaluate the extent of frost on Mars in two case studies and create a quantification process for frost using GIS. |
| Fenton L. K. Metzger S. Michaels T. I. Scheidt S. P. Dorn T. C. et al. | *Surface Roughness Length as a Function of Fetch Length at a Planetary Analog Field Site* **[#2287]**<br>Scratchy land tickles the wind. / On the smooth playa, / The wind will still be laughing. °°¤ø,,,ø¤°°`°°¤ø,,ø¤°°¤ø,,_____Ѧ_____. |
| Garcia R. F. Lorenz R. Murdoch N. Spiga A. | *Infrasound Hunt in InSight Data* **[#1922]** |

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| Bowman D. et al. | We present a search for infrasound signals in InSight data set by using both pressure and ground deformation records. Our infrasound candidates are associated to convective vortices, and this link is tested relative to the available data. |
| Grotheer E. Barbarisi I. Bentley M. Besse S. Breitfellner M. et al. | *Using the ESA's Planetary Science Archive to Search for Mars Express VMC Data of an Elongated Cloud Near Arsia Mons* **[#1474]** The Mars Express mission from the European Space Agency offers data from the Visual Monitoring Camera in the Planetary Science Archive. This includes pictures of an elongated cloud near Arsia Mons, and we cover how to find this data in the archive. |
| Creecy E. C. Li L. Jiang X. West R. A. Nixon C. A. et al. | *The Global Radiant Energy Budgets of Titan and Mars* **[#1715]** Energy budget / Titan and Mars dynamic / Evolving climate. |
| Steffens B. S. Nixon C. A. Lombardo N. A. Greathouse T. K. Lacy J. H. et al. | *The Search for n-Butane in Titan's Atmosphere Using IRTF/TEXES Data* **[#1178]** Butane on Titan / Seems likely, but we're not sure... / The search continues... |
| Kauffman J. T. Barnes J. W. Heslar M. | *Constraining Titan's North Polar Haze Structure from Specular Reflections* **[#2532]** Utilizing a broader range of flybys containing specular reflections, we expand upon the work done previously to measure Titan's haze profile in its polar regions, and compare that data to that which was collected by Huygens at the equatorial region. |
| Vidmachenko A. P. | *What Physical Parameters of Saturn's Cloud Layer at the 2010 Equinox Differ from Previous Three?* **[#1101]** Comparison of spectral saturnian data in 1966–2010 with calculations at equinox moments showed that in tropopause tropical atmosphere warmed on 10 K during saturnian year from 1980 to 2010 and existence of effect of lagging changes in the atmosphere. |
| Ovsak O. S. | *Multimode Aerosol Mixture Parameters Recovering Method Based on Spectral Polarimetric Measurements of the Sky* **[#1145]** An efficient practical method for feasible atmospheric aerosol parameters determination averaged over the whole atmospheric column. The method bases on spectral phase dependence analysis of the cloudless sky degree of linear polarization. |
| Liu J. C. Michalski J. R. Tan W. He H. P. Ye B. L. et al. | *Paleosols with Strong Fe LossDirect Geological Evidence for a Reducing Greenhouse Warming on Early Mars* **[#1739]** We identify globally distributed paleosols with strong Fe loss using new spectral indices based on basic chemical processes during weathering. It suggests that anoxic chemical weathering under reducing greenhouse on early Mars. |

## [P666]
## POSTER SESSION: SPACE WEATHERING: KNOW MORE, KNOWLEDGE GAPS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Rubino S. Potin S. Lantz C. Baklouti D. Beck P. et al. | *The NIR Spectral Variations of Ion Irradiated Phyllosilicates Depend on Observation Geometry* **[#1444]** Space weathering can alter the 2.7 µm feature in hydrated silicates, a proxy for aqueous alteration in primitive asteroids. Laboratory BRDF measurements on ion-bombarded samples showed that the geometry of observation can also alter this feature. |
| Magnuson M. P. Loeffler M. J. | *Space Weathering via Vapor Redeposition of Carbonaceous Material* **[#1781]** We present laboratory studies, where we vapor deposit carbonaceous material onto minerals likely to be present in asteroid regoliths, using reflectance spectroscopy as an analytical tool. |
| Prince B. S. Loeffler M. J. | *Mid-IR Analysis of Laser Irradiated Carbonaceous Chondrite Simulants* **[#2688]** Here, we present data on the effects of pulsed laser irradiation on various carbonaceous chondrite simulants in an effort to better understand the changes induced by space weathering in the three-micron spectral region of carbonaceous surfaces. |
| Murri M. Capitani G. Fasoli M. Monguzzi A. Calloni A. et al. | *Silicate Nanoparticles Produced by Laboratory Simulated Space Weathering of Olivine Single Crystals* **[#1251]** The production of silicate nanoparticles to understand space weathering and interstellar processes has been conducted experimentally by liquid phase pulsed laser ablation on olivine single crystals. |
| Jaramillo C. Allain J. P. Pearson N. Clark R. Savin D. W. et al. | *Laboratory Simulations of Solar Wind-Driven Space Weathering on Olivine Powder* **[#2561]** In this work, we descibre the results of laboratory simulations of solar wind-driven space weathering on olivine loose powders. The influence of energetic ions on the reflectance characteristics and surface chemistry of the powders was investigated. |
| Hopkins R. J. Glotch T. D. Catalano T. Nekvasil H. | *Spectral Effects of Roasting Olivine in $H_2$ at High Temperatures as a LunarSpace Weathering Simulation* **[#2325]** We roast olivine at high temperatures for different amounts of time under a reducing hydrogen atmosphere to create experimentally space-weathered materials with different nanophase iron size-frequency distributions, and analyze via VNIR and SEM. |
| Kremer C. H. Mustard J. F. Pieters C. M. Gillis-Davis J. J. Donaldson Hanna K. L. | *Olivine and Plagioclase Largely Unaffected by Lunar-Like Space Weathering in the "Cross-Over" Region* **[#2200]** Space weathering has a modest effect on mineral spectra in the 4–8-µm "cross-over" range of the infrared, compared with the VNIR range. |
| Chrbolková K. Brunetto R. Ďurech J. Kohout T. Mizohata K. et al. | *Comparison of Space Weathering Spectral Changes Induced by Solar Wind and Micrometeoroid Impacts* **[#1246]** We will show a comparison of olivine and pyroxene spectral changes induced by H, He, and Ar ions and by femtosecond-laser irradiation. |
| Hayes T. W. Nixon C. A. Young C. L. Grant M. S. Li S. et al. | *An Investigation of Space Weathering on the Moon with Mineralogy and Hydroxyl* **[#1647]** Water everywhere / What links to space weathering / Can we discover? |
| Nénon Q. Poppe A. R. | *Weathering of Lunar Polar Crater Interiors by Northward/Southward Ions: Ion Observations by the ARTEMIS Probes* **[#1689]** From eight years of in-situ ion measurements at the Moon, we determine the flux of ions |

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| | that travel northward and have a direct access inside south pole craters. In particular, the flux of ions weathering Shackleton's central floor is computed. |
| Nénon Q. Poppe A. R. | *On the Long-Term Weathering of Airless Body Surfaces by the Heavy Minor Ions of the Solar Wind: Inputs from Ion Observations and SRIM Simulations* **[#1691]** Long-term averaged kinetic energy spectra of thermal and suprathermal solar wind minor ions are determined. These spectra are convolved with SRIM simulations to discuss the relative importance of the 'minor' ions to surface weathering processes. |

## [P669]
## POSTER SESSION: ASTROBIOLOGY ANALOGS: CHEMISTRY AND FLUIDS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Baharier B. Semprich J. Olsson-Francis K. Crandall J. R. Filiberto J. et al. | *Reaction Path Reconstruction of a Magmatic Intrusion into Sulfate-Rich Sediments to Constrain Habitability Potential on Early Earth and Mars* **[#1284]** Here the reaction path between a magmatic intrusion into sulfate-rich sediments from the San Raphael Swell was reconstructed by thermodynamic–geochemical modeling to constrain habitability potential on early Earth and Mars. |
| Miyake N. Ishimaru R. Komatsu G. Matsui T. | *Characterization of Microbial Communities in the Land-Based Mud Volcanoes of Tokamachi, Niigata, Northern Japan* **[#1393]** This paper presents evidence of both methanogens and ANME-SRB consortium within the active methane-seeping on-land mud volcanoes, northern Japan. We suggest the old sea-related juvenile water at the source of mud gives an additional input of sulfur. |
| Larrasoaña J. C. Zorzano M. P. Sierro F. J. Roberts A. P. | *Magnetofossil Abundances are Associated with Distal Deltaic Bottomsets and Low Sedimentation Rates in the Guadalquivir Basin, Spain; Implications for the Recovery of Biosignatures from Jezero Crater and Oxia Planum, Mars* **[#1778]** Rock magnetic data from sediments of the Guadalquivir Basin relate preferential formation and preservation of magnetofossils to clay-rich sediments accumulated slowly in distal, deep water deltaic bottomsets, of prime astrobiological interest in Mars. |
| Tavernier A. Garcia A. Pinto G. Ulloa C. Santibañez T. et al. | *EuroMoonMars Atacama (ChileMoonMars): Prospect for the Installation of an Analogue Martian Base in the Arid Central Andes (Puna) and Development of Planetary Sciences in the Atacama Region (Chile)* **[#2253]** This abstract presents the first stages of prospective and inventory aimed at mapping the Puna de Atacama region's potential in terms of planetary analogues, this through an extension, in Chile, of the EuroMoonMars programme. |
| Tarasashvili M. V. Aleksidze N. G. Doborjginidze N. G. Gharibashvili N. G. | *Growth of the Grapevines in the Controlled Greenhouse Environment and Prospects of the Space Agriculture* **[#2545]** |

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| | Suitability of the use of several Georgian Grapevine cultivars for future space settlements has been investigated. This climbing fruiting plant has ordinary and aerial roots, broad leaves, high anti-oxidant content, and can be grown in the greenhouse. |
| Fackrell L. E. | *Plant Growth Experiments Using Martian Simulants: Potential and Limitations of Agriculture on Mars* **[#1684]**<br>Results from plant growth experiments using martian simulants and potential of microbial inoculation in improving plant response. |
| Brown E. K. Buffo J. J. Grantham M. Pontefract A. Klempay B. et al. | *Within the Ice: A Biogeochemical Analysis of Brines in British Columbia's Hypersaline Lakes* **[#2752]**<br>Summary of fieldwork on British Columbia's hypersaline lakes, which pose as interesting analogs for other planetary bodies. We present ionic profiles of ice samples and introduce a numerical model to simulate these environments. |
| Seto E. P. Zacny K. Musilova M. | *Astronaut-Drilling Simulation for Signs of Life* **[#1738]**<br>We simulated an astronaut-drilling mission for signs of life using Honeybee Robotics' surface coring drill. |
| Lee S. Xu H. | *A Simple Method for Synthesizing Siliceous Ferrihydrite: Implication for the Formation of Natural Ferrihydrite and Mars Analogs* **[#2043]**<br>This study presents a simple method to synthesize siliceous ferrihydrite designed to mimic its formation in the natural environment. The siliceous ferrihydrite will help to understand the formation of natural ferrihydrite and Mars soil analogs. |

## [P670]
## POSTER SESSION: BIOMARKERS: HOW TO FIND US

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Johnson P. A. Johnson J. C. Mardon A. A. | *Where to Look Next: Extant Life Niches and Biomarkers on Mars* **[#1081]**<br>The search for extant life on Mars continues. Here, we identify novel understandings about niches that favour different forms of life, biomarkers to aid in the search for these niches, and hot spots for future investigation. |
| Sharma S. | *Machine Learning for Generation of Biochemical Signatures* **[#2747]**<br>Here, we present a framework to practically utilize machine learning methods to reduce Earth-centric bias inherent in the tools and processes currently used for life detection on planetary missions and those planned for use in the future. |
| Stelmach K. B. Dukes C. A. Garrod R. T. | *Adsorption of Tyrosine and Glutamic Acid to the Chiral (101) Face of Quartz: An XPS Study* **[#2685]**<br>X-ray photoelectron spectroscopy was used to monitor sublimation of enantiomers of |

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| | tyrosine and glutamic acid from quartz while recording element-specific spectra between 298-670 K in an attempt to detect differences in enantiomer behavior. |
| Srivastava A. Pearson V. K. Schwenzer S. P. Macey M. Toubes-Rodrigo M. et al. | *Are Sulfates the Viable Substrates for the Long-Term Preservation of Lipids?* **[#1084]** The present work explores whether sulfate salts that are abundant on the martian surface can be viable substrates for the preservation and detection of lipid biomarkers. |
| Morland Z. S. Halim S. H. Pearson V. K. Patel M. R. Green S. F. et al. | *Modelling Ejected Martian Biomarkers impacting Phobos* **[#1045]** Here, impact modelling suggests biomarkers could survive impact-driven transport from Mars to Phobos. Collection, recognition, and analysis of this material in JAXA's MMX returned samples could help unravel Mars' astrobiological and geological past. |
| Shumilova T. G. | *Diamond Fossils as an Important New Key for Astrobiology* **[#1134]** Here, we describe in short the features of the impact-preserved organic relicts in the diamond state having relict fragments of cellulose and lignin, pointing to possibility to save organics even under the conditions of diamond formation. |
| Pickersgill A. E. Sapers H. M. Lee M. R. Wildman M. Lindgren P. et al. | *Microtubules, Trichites, and Bioalteration in Impact Glasses* **[#2035]** Small tubules in glass / Could they be biogenic? / Some yes and some no. |
| de Dios-Cubillas A. Carrizo D. Sánchez-García L. López I. Prieto-Ballesteros O. | *Biosignatures of Cold Seep Carbonates to Help Understand the Carbon Cycle Within the Ocean Worlds* **[#1446]** We study the biogeochemistry of different cold seep carbonates to understand the carbon cycle within the ocean worlds. |
| Sturrup C. S. Rogers M. R. Williams A. J. W. | *Organics Detection in Acid Mine Drainage Sediments, with Implications for Organics Preservation in Iron-Rich Acid and Saline Environments on Mars* **[#2126]** The effectiveness of thermochemolysis GC-MS on Earth analog samples to detect FAMEs and Alkanes ties directly into the instrumental capability of current Mars rovers and the search for signs of life on Mars. |
| Moore K. R. Flannery D. T. Tuite M. Tarnas J. D. Bosak T. et al. | *Exploring Relations Between Major Element Cations and Organic Preservation in Silica* **[#2676]** We present results that demonstrate an association among organic matter, magnesium, calcium, aluminum, and silica in chert-hosted biosignatures. We suggest a novel approach to the search for biosignatures on Mars using these chemical signatures. |
| Boles H. O. Williams A. J. Oehler D. | *Organics Detection in Ancient Cratonic Rocks with TMAH Wet Chemistry* **[#1777]** A suite of Precambrian, cratonic rock samples are used as Mars analogs to understand (1) how ancient cratonic samples respond to TMAH thermochemolysis, and (2) how successful a TMAH thermochemolysis experiment on martian bedrock might be. |
| Williams A. J. Lanza N. L. Millan M. McAdam A. C. House C. H. et al. | *Organic Matter Heterogeneity in the Mary Anning/Groken Drill Site, Gale Crater, Mars* **[#1638]** Here, we report on the comparison in organic and inorganic molecules detected by the SAM instrument between two drill targets on the same bedrock block — Mary Anning and Groken. The S-bearing organics present in Mary Anning are not detected in Groken. |

## [P671]
## POSTER SESSION: MICROBES: WHERE WE LIVE

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Coustenis A. Hedman N. Kminek G. COSPAR Panel on Planetary Protection | *The COSPAR Panel on Planetary Protection: Recent Activities* **[#1849]** COSPAR's Planetary Protection Policy and associated requirements are based on examination of the most updated scientific studies and recommendations made by the COSPAR Panel on Planetary Protection. We will describe recent activities of the Panel. |
| Sundin M. Ekberg P. Johnsson A. Bernhardt P. Enger J. | *Mars — Education of Ethics and Planetary Processes* **[#1232]** Do geological formations and planetary processes have intrinsic value regardless of any use they may have to humans? Which planetary processes have shaped the martian landscape? We elaborate on these questions and how they can be used in education. |
| Eigenbrode J. L. Gold R. E. | *Strategies for Stringent Contamination Control for Life Detection Missions* **[#2706]** We report on technology advances that focus on understanding contamination transfer from pre-launch processing to end of mission, and a new full-spacecraft barrier design. |
| Buckner D. K. Wilhelm M. B. Ricco A. J. Jahnke L. Evans T. W. et al. | *Assessment of Electron Beam Irradiation as a Lipid Decontamination Technique for Life Detection Instruments* **[#2168]** Electron beam irradiation was tested as a potential technique for removing astrobiologically-relevant lipid contaminants from life detection instrument hardware. This technique was ineffective at reducing the lipids tested (at doses of 50 and 100 kGy). |
| Citron R. I. Stewart S. | *Large Impacts on the Early Earth: Planetary Sterilization and Iron Delivery* **[#1621]** We examine which types of impacts could have influenced habitability, either sterilizing Earth via global melting or ocean vaporization, or promoting life's emergence via delivery of reducing iron. |
| Schreder-Gomes S. I. Benison K. C. | *Optical Recognition of 830 Million Year Old Microorganisms Trapped in Bedded Halite: Implications for Future Return Samples from Mars* **[#1072]** 830 myo halite from the Browne Formation preserves microorganisms in primary fluid inclusions. Optical petrography documented prokaryotes and eukaryotes. This method is a necessary first step for analyzing returned martian evaporite samples. |
| Cesur R. M. Ansari I. M. Stewart C. R. Schneegurt M. A. Chen F. et al. | *Bacterial Survival and Growth in Fluid Inclusions and Deliquescent Brines of Salt Evaporites Relevant to Cold Arid Worlds* **[#1243]** Demonstration of the growth of desiccated salinotolerant microbes, entrapped in salt evaporites, after rehydration to brine by deliquescence and the relevance of deliquescence and fluid inclusions in salt crystals to Mars and other cold arid worlds. |
| Leopo D. A. Sklute E. C. Neat K. A. Holden J. F. Dyar M. D. | *Detection of Mineral Products Following FE(III) Oxide Reduction by a Thermophilic Autotrophic Bacterium Using Reflectance Spectroscopies* **[#1553]** Thermophilic autotroph, 'Candidatus Desulfothermobacter ferrireducens' strain Ax17, was grown on akageneite, lepidocrocite, and ferrihydrite. Bioreduction products were analyzed by VNIR and FTIR-ATR; they varied by mineral and differed from controls. |
| Cycil L. M. Hausrath E. M. Ming D. W. Adcock C. Raymond J. et al. | *Investigating Algae Growth Under Low Atmospheric Pressures for Potential Food and Oxygen Production on Mars* **[#1609]** |

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| | Long-term space exploration missions to Mars and beyond will require significant amounts of both oxygen and food. Algal systems are promising candidates for human life support due to their fully edible biomass and fast growth rates. |
| Neat K. A. Sklute E. C. Leopo D. A. Holden J. F. Dyar M. D. | *Bioreduction of Nanophase Ferrihydrite, Akaganeite, and Lepidocrocite by the Autotrophic Thermophile Desulfothermobacter Ferrireducens as Seen Through Mössbauer Spectroscopy* **[#1992]**<br>Autotrophic and anaerobic thermophile, 'Candidatus Desulfothermobacter ferrireducens' strain Ax17 grown on ferrihydrite, akagenéite, and lepidocrocite. Bioreduced mineral products were analyzed with Mossbauer spectroscopy; products varied by mineral. |
| Zbeeb H. Z. Joad M. D. Zayed H. H. Luhring T. M. Schneegurt M. A. et al. | *Bacterial Growth Tolerances to Heavy Brines Formed by an Iterative Matrix of Ions and Their Salts* **[#2331]**<br>Measurement of salinotolerant bacterial growth tolerances to various salt solutions relevant to Mars, over a range of salinity, to identify significant interactions with the physical qualities of ions and salts. |
| Tarasashvili M. V. Barjadze S. Z. | *Manganese-Based Bacterial Methanogenesis in Simulated Martian Conditions* **[#1094]**<br>Caves of the manganese ores are similar to the martian conditions; most importantly, they are the sites of the intense biological methanogenesis, thus could partially shed the light on the origin of martian methane plumes. |
| Schaible M. J. Orlando T. M. | *Interactions of Electrostatically Charged Dust Grains with Phospholipids: Production and Mobilization of Charged Grains* **[#2748]**<br>Characterization of damage caused by electrostatically charged dust grains brought into contact with molecular bi-layers of the phospholipid DPPC was studied to help determine the potentially toxic effects of space weathered regolith dust grains. |
| Ratcliffe A. L. Tong J. V. Hoang A. T. Howell S. Schneegurt M. A. | *Bacterial Survival Under the Extreme Physical and Chemical Conditions of Europa and the Ocean Worlds* **[#1551]**<br>Exploration of the survival of salinotolerant bacteria at the potentially extreme hydrostatic pressures, brine salinities, and cryogenic temperatures of Europa and the icy ocean worlds. |
| Laine P. E. | *Life on Icy Worlds? Emergence vs. Panspermia* **[#1895]**<br>The icy moons present some of the promising examples of extended habitable locations in our solar system. If there is life on one or more of the icy moons in our solar system, how could it have got in there? Did it evolve there or come from Earth? |
| Stern S. A. | *Some Implications for Both Life and Civilizations Regarding Interior Water Ocean Worlds* **[#1180]**<br>Interior Water Ocean Worlds (IWOWs) are habitable in a wider range of host worlds and stellar/galactic environments than are External Water Ocean Worlds (EWOWs). Hence, IWOWs may contain life more frequently than EWOWs. We discuss some implications. |
| Limaye S. S. Mogul R. Baines K. H. Bullock M. A. Cockell C. et al. | *Venus, an Astrobiology Target* **[#2171]**<br>We present a case for astrobiology investigation of Venus via future missions. |

# [P672]
# POSTER SESSION: ASTROBIOLOGY: INSTRUMENT AND MISSION CONCEPTS

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| Brucato J. R. Nascetti A. Iannascoli L. Meneghin A. Paglialunga D. et al. | *Astrobio-Cubesat: A Highly Integrated Laboratory to Test in Space Immunoassay Techniques to Detect Biomolecules* **[#2494]** AstroBio-CubeSat mission has the objective to test in medium Earth orbit a highly integrated laboratory using immunoassay techniques exploiting chemiluminescence detection for the search of sign of life in space environments. |
| Johnson P. A. Johnson J. C. | *Novel Robotic System for Improved Motor Control in Microgravity* **[#1076]** Motor control is essential for tasks in microgravity conditions, especially in light of its physiologically compromising effects. We demonstrate a proof-of-concept model for a system that promotes enhanced locomotor activity under these conditions. |
| Coppin J. C. Roig C. A. Matchett A. Massey S. E. Resto O. | *Micrometeoroid Sample Collection in the Upper Atmosphere* **[#2081]** Sounding rockets allow for micrometeoroid collection at altitudes generally untouched by other collection methods such as balloons or the ISS. A team from the UPR has developed a collector for micrometeoroid samples for a sounding rocket payload. |
| Bywaters K. F. Ricco A. J. Boone T. D. Hoac T. Quinn R. C. et al. | *ChIPPS: Charged Information-Storage Polymer Preparation System* **[#2433]** This work couples the primary sample preparation components needed for autonomous polymer detection for life detection missions. ChIPPS integrates a monolithic, microfluidic sample processor that prepares samples for use with nanopore-based analyzers. |
| Wilhelm M. B. Ricco A. J. Buckner D. K. Boone T. Chin M. et al. | *Extraction Instruments to Enable Detection of Origin-Diagnostic Lipids for Life Detection* **[#2634]** To reveal origin-diagnostic information in lipid biomarkers on Mars/icy worlds, lab extraction techniques can overcome analysis challenges. We have translated these techniques to sample processing systems for future life detection missions. |
| Nowicki S. F. He Z. Zhu Y. Parsons A. M. Prettyman T. H. et al. | *Ambient-Temperature Imaging Gamma-Ray Spectrometer (TIGRS) for High-Sensitivity Planetary Elemental Mapping* **[#1702]** We present the concept for a high energy resolution, high efficiency, low mass, low volume, and high signal-to-noise ratio imaging gamma-ray spectrometer (GRS) for planetary science applications based on pixelated CZT detectors. |
| Riedo A. de Koning C. Grimaudo V. Ligterink N. F. W. Keresztes Schmidt P. et al. | *Detection of Biomarkers Using Compact and Sensitive Laser Ablation/Desorption Ionization Mass Spectrometry* **[#1940]** The current measurement capabilities of our miniature LIMS mass spectrometers are presented that allow e.g., the identification of microstructures or single microbes, or the desorption of amino acids at femtomol per mm^2 concentrations. |
| Lavagna M. Brucato J. Fiore F. Bechini M. | *Taste Mission to Deimos: Terrain Analyzer and Sample Tester Explorer with Smallsat* |

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| Capannolo A. et al. | *and Miniaturized Lander* **[#1991]**<br>The combination of a set of miniaturized instruments is here proposed to perform remote and in situ sample collection and analysis on Deimos moon, to contribute answering questions about the origin and evolution of the martian system. |
| Delgado T. Cabalin L. M. Fortes F. J. Garcia-Gomez L. Laserna J. J. | *Laser-Induced Breakdown Spectroscopy of Bacterial Growths in Carbonate Rocks Under Simulated Martian Conditions* **[#2342]**<br>The present study aimed to characterize cyanobacteria by LIBS, exploring the possibilities for its identification and discrimination on carbonate substrates. Promising results under martian conditions are also presented and discussed. |
| Ferrari M. De Angelis S. De Sanctis M. C. Altieri F. Ammannito E. et al. | *Determinating the Ma_MISS Instrument Capabilities for Organics Detection* **[#1914]**<br>Laboratory measurements were performed on different mixtures made with clays and organic compounds with the aim of characterizing the detection capabilities of biosignatures by the ExoMars/Ma_MISS instrument. |

## [P673]
## POSTER SESSION: ANALOGS: MARS, THE MOON, AND MORE

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Sklute E. C. Hopkins R. J. McKeegan R. Dyar M. D. Rogers A. D. et al. | *Raman Spectra of Amorphous Ferric Sulfate Reacted with Mars Regolith Analogues: A Compatible Technique to Assist in XRD Identification* **[#2659]**<br>Ferric sulfate–Mars regolith analogue mixtures were hydrated to deliquescence and then rapidly dehydrate to produce amorphous sulfate–regolith–reaction produce mixtures as analogues for martian soil. Raman and XRD are presented and discussed. |
| Champion E. S. Ewing R. C. Nachon M. Rampe E. B. Horgan B. et al. | *µXRF Investigation of Relationships Between Geochemistry and Physical Grain Characteristics in a Glacio-Fluvial-Aeolian Catchment in Iceland* **[#2429]**<br>This project uses a µXRF to analyze sands along an Icelandic glacial outwash plain to investigate weathering patterns and grain sorting. Iceland serves as an analog to past and present Mars due to the environment and the basaltic volcanic rocks. |
| Mason K. Ewing R. C. Nachon M. Rampe E. B. Horgan B. et al. | *Sediment Sorting and Rounding in a Basaltic Glacio-Fluvio-Aeolian Environment: Þórisjökull Glacier, Iceland* **[#1752]**<br>This research studies changes in sorting and rounding of fluvial-aeolian sediment in SW Iceland. We map the source rocks in the catchment, determine particle size and shape, and evaluate the wind speed required to mobilize available the sediments. |
| Baker D. M. H. Shoemaker E. S. Richardson J. A. Scheidt S. P. Whelley P. L. et al. | *Radar Investigations of Subsurface Ice at Askja Volcano, Northern Iceland* **[#2627]**<br>We conducted analog field ground-penetrating radar investigations of pyroclasts and |

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| | buried ice layers within the Askja Caldera, Iceland and use these to interpret airborne L-band SAR data. |
| Szynkiewicz A. Bishop J. L. Burton Z. F. M. | *Review of Sulfate Sources in Antarctic Polar Environments — Geochemical Implications for Sulfate Origin on Mars* **[#1366]** The main objective of this study is to critically evaluate chemical weathering and atmospheric processes that contribute to the formation of secondary sulfates in surficial deposits of Antarctica. |
| Tomasi I. Massironi M. Meyzen C. M. Sauro F. Pozzobon R. et al. | *Formation and Evolution Processes of Large-Size Lava Tubes as Planetary Analogues: The Example of La Corona Lava Tube System (Lanzarote, Spain)* **[#2537]** Weak layers of pyroclasts or regolith could play a primary role in inflationary mechanisms forming lava tubes. |
| Perrier I. R. Foing B. H. Kołodziejczyk A. Komenda K. Clain M. et al. | *Preparing Future Engineers and Astronauts for Moon Exploration: EMMPOL EuroMoonMars Poland 2020 Campaign* **[#2562]** Analog missions allow us today a better understanding of the future space exploration. During the October 2020 Moon analog EMMPOL missions, we trained and prepared as future engineers and astronauts respecting a strict schedule. |
| Smrčinová L. Kletetschka G. | *Nature of Magnetism Recorded in Utah Concretions — Relation to Mars?* **[#2286]** Our work presents an analysis of ferrous concretions which may have recorded magnetic reversals of Earth dynamo. Terrestrial concretions provide an analog for similar formation processes on Mars where Mars blueberries can preserve a similar record. |
| Kong X. Liu W. Li J. Santos L. Boman J. et al. | *Chemical Characterization of Surface Salts in Qaidam Basin: Implications for Climates of Planet Earth and Mars* **[#1191]** The Qaidam Basin has been considered as a good terrestrial analogue for Mars, so here we study the physical and chemical properties of salt samples from the Qaidam Basin to shed light on the climate systems on planet Earth and Mars. |
| Provow A. W. Hausrath E. M. Peretyazhko T. S. Rampe E. | *Examining Weathering of Magnesite in an Arid Environment: Implications for Jezero Crater* **[#2656]** Preliminary data on magnesite weathering in arid environments in order to better understand what might be seen in Jezero Crater. |
| Grau Galofre A. Osinski G. R. Jellinek A. M. Chartrand S. M. | *The Canadian Arctic Archipelago: A Mars Glacial Analogue Site* **[#2076]** Arctic polar ice / Sculpted channels on the ground / Could Mars be alike? |
| Salvatore M. R. Levy J. S. Head J. W. Dickson J. L. | *The "Flashy" Hydrology of the McMurdo Dry Valleys of Antarctica and Implications for Past and Present Martian Cryospheric Processes* **[#2046]** The hydrology of the McMurdo Dry Valleys of Antarctica is episodic, punctuated, and spatially limited. This "flashy" hydrological system can provide valuable clues regarding the generation of liquid water on past and present Mars. |
| Kuentz L. Levy J. Salvatore M. | *Mapping the Extent and Timing of Water Tracks with High Temporal Resolution Satellite Imagery in the McMurdo Dry Valleys, Antarctica: Can Subsurface Melt Conditions be Deduced from Orbital Imagery for RSL-Analogs?* **[#1711]** Damp streaks change daily / Rapid repeat satellites / Reveal their thawing. |
| Andres C. N. Osinski O. R. Godin E. | *The Applicability of 3D Ground Penetrating Radar and Periglacial Sedimentology for Subsurface Ice Volume Estimation in Ice-Rich Planetary Polygonal Networks* **[#2501]** 3D-GPR / Networks of ice-rich landforms / How much ice is there? |
| Sander H. Hiesinger H. Hauber E. Johnsson A. | *Movement of Sorted Stone Circles on Svalbard, Norway* **[#2482]** |

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| Schmedemann N. | This study focuses on the movement of sorted stones circles on Svalbard and analyzes the movements of the stones within the circle to obtain more information about the behavior and formation of the circles. |
| Tavernier A. Demarzo M. Pinto G. Ulloa C. Garcia A. et al. | *Exokite, Design of an Aerial Decision-Support Platform in a Martian Inhabited Space Exploration Context* **[#2278]** The ExoKite project aims to federate young professionals around a multidisciplinary technical project oriented towards the design of an aerial decision-support platform for the simulation of scientific field campaigns in a martian analogue context. |
| Sevy J. M. Radebaugh J. Kerber L. McDougall D. Rabinovitch J. | *Yardangs in the Argentine Puna: Using Dedos and Cap Slopes to Understand Yardang Morphology* **[#2655]** Ignimbrite exposed / Wind blows sand across the landscape / The Yardang stands firm. |
| McDougall D. Radebaugh J. Kerber L. Sevy J. Rabinovitch J. et al. | *Morphometry and Sampling of Terrestrial Yardangs to Aid Geologic Mapping of Martian Yardang Regions* **[#2758]** Earth and Mars yardangs / Appear to grow from nothing / But do the rocks help? |
| Sinha P. Horgan B. Rudolph A. Ewing R. C. Rampe E. et al. | *Decorrelation Stretches (DCS) of Visible Images as a Tool for Assessing Sediment Provenance on Earth and Mars* **[#2682]** Rover-based Mars-analog study, Iceland: Testing the predictive capability of color analysis to identify mineralogical variability within basaltic sediments along a glacio-fluvio-eolian transport pathway. |
| Veneranda M. Saiz J. Manrique J. A. Lopez-Reyes G. Medina J. et al. | *Planetary Terrestrial Analogues Library (PTAL): A Novel Multi-Analytical Database to Support ExoMars and Mars2020 Missions* **[#1343]** The present abstract introduces the Planetary Terrestrial Analogues Library (PTAL) project, which aim is to provide the scientific community with a database of analogue samples analyzed by diffractometric and spectroscopic instruments. |
| Sudhakar A. Sklute E. C. Carey C. Glotch T. D. Dyar M. D. | *opcon.mtholyoke.edu: A Web-Based Tool for Determination of VNIR Optical Constants from Multi-Grain-Size, Multi-Phase-Angle Powdered Mineral Spectra* **[#1619]** Web-based tools that facilitate scientific research aid in the accessibility, efficiency, and transparency of government funded projects and can engage the general public. We present a web-based, open-source tool for determining optical constants. |

## [P674]
## POSTER SESSION: INTRINSIC AND SPECTROSCOPIC PROPERTIES OF ANALOG MATERIALS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Ahern A. A. Rogers A. D. Macke R. J. Thomson B. J. Kronyak R. et al. | *Thermal Inertia and Conductivity Measurements of Mars Analog Samples* **[#2290]** New setup measures / Thermal conductivity / Of Mars analogs. |

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| Tripathi P. Garg R. D. | *Raman Spectroscopic Study of Terrestrial Geological Samples: Possible Analogs for Lunar Breccia* **[#1602]**<br>Raman spectroscopy has extensive capabilities for planetary mineralogy. It can be an essential tool for future lunar robotic and human-crewed planetary missions. |
| Cao F. Ling Z. Ni Y. Deng R. Liu C. | *Chemical and Spectroscopic Characteristics of Synthetic K-H3O-Na Alunite Solid-Solutions* **[#2321]**<br>We synthesized 16 K-H3O-Na alunites under a hydrothermal environment and characterized their chemical, Raman, and infrared spectral features. Raman data will be a good analog for identifying alunite-group minerals by future Raman payloads on Mars. |
| Bishop J. L. Yeşilbaş M. Talla D. Hiroi T. | *Spectral Properties of Fe Hydroxy Sulfates and Implications for Mars* **[#1159]**<br>Fe-rich hydroxy sulfates have unique NIR spectral features at 2.236 and 2.37 µm for $Fe_2$+ samples, at 2.226 and 2.4 µm for an $MgFe_2$+ sample, and at 2.230 and 2.4 µm for an Fe3+ sample that can explain unusual features in sulfate-rich regions of Mars. |
| Loizeau D. Pilorget C. Poulet F. Lantz C. Bibring J.-P. et al. | *Analogue Rock Characterization with MicrOmega, Within the $H_2$020/PTAL Project* **[#1452]**<br>Within the PTAL project, we characterized >100 planetary analogue rocks with a spare of the MicrOmega/ExoMars instrument. The hyperspectral microscope provides detection and maps of mineral species at the surface of the sample. |
| Luu N. C. Hausrath E. M. Rampe E. Peretyazhko T. S. | *Reevaluation of CheMin Data: New Constraints on the Nature of Poorly Crystalline Materials on Mars* **[#2343]**<br>To further constrain the poorly crystalline materials on Mars, we are expanding the FULLPAT library with additional Mars-relevant X-ray amorphous and clay mineral materials. The database will be used to reanalyze XRD patterns collected by MSL Curiosity. |
| Hubbard K. M. Haberle C. W. Elkins-Tanton L. T. Christensen P. R. | *Thermal-Infrared Emission Spectroscopy of Graybody Materials: Sulfide* **[#2322]**<br>A new thermal-infrared emission laboratory technique was developed to accurately determine the absolute emissivity of materials lacking a Christiansen Frequency in the mid-infrared. Pyrrhotite exhibits broadband graybody behavior in the mid-infrared. |
| Campione M. C. Murri M. M. | *Reactivity and Electrostatic Properties of Astronomical Silicate Nanoparticle Analogues Produced by Pulsed Laser Irradiation of Olivine Single Crystals* **[#1294]**<br>The study of the electrostatic properties and reactivity of laboratory-produced silicate nanoparticles could be applied to distinguish among different grain origins and better understand the cosmic evolution of dust particles. |
| Michalik T. Maturilli A. Cloutis E. A. Jaumann R. Matz K.-D. et al. | *Assessing the Effects of Heating Vesta-Like Material on its Spectral Characteristics* **[#2164]**<br>We investigate the spectral behavior of Vesta-like materials upon heating to different temperatures for different time spans in order to understand the spectral characteristic of the pitted terrains' material on Vesta. |

## [P675]
## POSTER SESSION: INSTRUMENTS: DUST, PLUME, AND UNIQUE

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Della Corte V. Rotundi A. Bertini I. Di Paolo F. Inno L. et al. | *DISC, the Dust Impact Sensor and Counter, on Board Comet Interceptor ESA Space Mission, for In Situ Dust Environment Characterization of a Dynamically New Comet* **[#2332]** The DISC instrument will be the sensor devoted to the dust environment in situ characterization of the comet target of Comet Interceptor ESA mission. DISC performances will allow the measurement of masses of particles in 1-200 microns sizes range. |
| Di Paolo F. Della Corte V. Bertini I. Inno L. Longobardo A. et al. | *Dust Impact Sensor and Counter (DISC) for Comet Exploration: Laser Simulations of Hypervelocity Impacts* **[#1238]** DISC instrument onboard Comet Interceptor is expected to measure the mass distribution of dust emitted from the comet. Since S/C velocity will reach 70 km/s, a calibration by means of laser-simulated hypervelocity impacts will be performed. |
| Nambiar S. Pabari J. P. Rashmi Jitarwal S. Acharyya K. et al. | *Comparative Analysis of Two and Three Channel Hypervelocity Dust Detectors* **[#1904]** Impact Ionization Detector (IID) is used to study interplanetary dust particles (IDPs). Simulation is carried out to compare two and three channel IID using SIMION software. Two channel detector shows better efficiency, though with its limitations. |
| Sim C. K. Choi Y.-J. Ye S.-J. Jin H. Seon J. et al. | *Korea's First Scientific Instruments on the Lunar Surface* **[#1806]** Korea's scientific instruments for CLPS: GrainCams to image regolith structure and levitating dust; LVRad to investigate radiation environment; LSMAG to measure magnetic field on a swirl; LUSEM to detect high-energy particles of tens keV to tens MeV. |
| Metzger P. T. Dove A. Conroy M. Gloria J. O'Reilly A. et al. | *Ejecta Sheet Tracking, Opacity, and Regolith Maturity (Ejecta Storm): An Instrument for Lunar Landing Plume Effects and Dust Dynamics* **[#2616]** The Ejecta Sheet Tracking, Opacity, and Regolith Maturity (Ejecta STORM) instrument has undergone flight tests. It measures optical density, particle concentration, and particle size distribution in a lunar lander plume-induced ejecta cloud. |
| Mezilis J. A. Ridenoure R. W. | *Lunar ExoCam: Active Flight Test of Camera and Sensor Payload System for Remote Capture of Lunar Lander Descent and Landing* **[#2213]** The Lunar ExoCam remote imaging/sensor system was recently awarded grant funding through NASA's Flight Opportunities program. This poster outlines research to be carried out in 2021 to advance overall system architecture in accordance with the award. |
| Saxena N. R. | *Technical Concept of Energy Production at Lunar Poles by Means of Meshed Network Arrangements of Thermoelectric Generators* **[#2379]** A technical introduction to the Thermoelectric Generators and how this tech can be evolved and used in a mesh-like arrangement for the purpose of easy generation of usable energy around the sites of 'Peaks of Eternal Light' near the lunar poles. |
| Johnsen T. K. Gulick V. C. | *Multimodal Machine Learning with Dual-Band Raman Spectroscopy for* |

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| | *Mineral Classification* **[#2464]**<br>Multimodal machine learning uses input from multiple instruments, in a form of sensor fusion. This can be used to enhance autonomous rovers' decision-making processes. We show an application using Raman spectroscopy to classify minerals in rocks. |
| Becker M. C. Presley M. Clark G. B. Brandt P. C. Parker C. W. et al. | *Spaceflight Instrumentation Enabled by Additive Manufacturing: A Case Study Analysis with the JUICE/JoEE Instrument* **[#1080]**<br>JHUAPL fabricated an electron collimator using additive manufacturing techniques that will fly to Jupiter for an ESA mission. Science requirements were achievable that otherwise couldn't be obtained with conventional manufacturing. |
| Martell J. Alwmark C. Holm-Alwmark S. Hall S. Hektor J. et al. | *Neutron Tomography as a Tool for Pin-Pointing Meteoritic Components in Impactites* **[#2086]**<br>Combined neutron- and X-ray tomography on an impactite sample from the Lockne impact structure, Sweden, aiming to localize the meteoritic component (non-destructively). |
| Sallum S. Skemer A. Stelter D. Briesemeister Z. Batalha N. et al. | *SCALES: Instrument Overview and Expected Science Outcomes* **[#2412]**<br>We will present an overview of the Santa Cruz Array of Lenslets for Exoplanet Spectroscopy (SCALES), a 2-5 micron, adaptive optics fed integral field spectrograph currently being developed for Keck. |
| Alvarez-Llamas C. Purohit P. Moros J. Lucena P. Laserna J. et al. | *A Multipurpose Thermal Vacuum Chamber for Planetary Research Compatible with Stand-Off Laser Spectroscopies* **[#2330]**<br>A Multipurpose Thermal Vacuum Chamber installed in the UMALASERLAB. This TVC, with a volume of 22 m^3, is capable of operating under representative conditions (temperature, gas composition, pressure, radiation flux …) of space exploration targets. |

## [P676]
## POSTER SESSION: INSTRUMENTS: ORBITAL AND ATMOSPHERIC MEASUREMENTS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Saiki K. Ohtake M. Nakauchi Y. Shiraishi H. Ishihara Y. et al. | *Development of Two Types of NIR Spectral Camera for Lunar Missions SLIM and LUPEX* **[#2303]**<br>The concept and development status of two spectroscopic cameras for the lunar missions Smart Lander for Investigating Moon (SLIM) project and Lunar Polar Exploration (LUPEX) project are introduced. |
| Mustard J. F. Kremer C. H. Pieters C. M. Green R. O. | *Imaging Spectroscopy in the 5-7 Micrometer Wavelength Region for Quantitative Analysis of $Fe_2$+ in Olivine and Hydration* **[#2367]**<br>The 5-7 micron wavelength region has been largely unexploited for science and |

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| | exploration using reflected or emitted radiation. We report here on an instrument concept for implementing the science we call Hyperspectral Imaging Spectrometer 57: HIS-57. |
| Mischna M. A. Pagano T. Reale O. Fauchez T. Desouza-Machado S. et al. | *Hyperspectral Infrared Sounding for Improving Weather Prediction on Mars* **[#1217]** Nadir-viewing, cross-track scanning, hyperspectral infrared (HSIR) sounding of the martian atmosphere can now be achieved in a SmallSat or CubeSat form factor. Vertical resolution and altitude coverage meets or exceeds current IR profiling methods. |
| Mokrousov M. I. Golovin D. V. Mitrofanov I. G. Kozyrev A. S. Litvak M. L. et al. | *ADRON Instrument for Future Missions to Moon and Mars: Active Gamma-Ray Sensing of Shallow Subsurface* **[#1952]** Active neuron and gamma-ray sensing ADRON instruments technical details for future landing mission will be presented. The results of laboratory measurements and numerical simulations will also be presented for post-pulse emission of neutrons and gamma rays. |
| Hobbs S. W. Lambert A. J. Ryan M. J. | *Evaluating the Utility of Low-Cost Sensors for Deep Space Applications* **[#1184]** This work focusses on the utility of low-cost sensors for deep space red-edge detection applications and reports on initial tests in near-space environments. |
| Schmedemann N. Hiesinger H. Wohlfarth K. Wöhler C. Bauch K. et al. | *BepiColombo — Correction of MERTIS Geometry* **[#1290]** Based on lunar observations, we calibrated the observation geometry of the MERTIS instrument on board the BepiColombo spacecraft. |
| Hong P. Ishibashi K. Sato S. Okudaira O. Otsuki M. et al. | *Initial Test for the Breadboard Model of TCAP Tracking Mirror of DESTINY+ Mission* **[#1741]** Telescopic Camera onboard DESTINY+ spacecraft is equipped with a tracking mirror to obtain unblurred high-resolution images during the high-speed flyby of Phaethon. We have conducted conceptual studies of the scan mirror and developed a BBM. |
| Ishibashi K. Hong P. Okamoto T. Ishimaru T. Okazaki N. et al. | *Development of Cameras Onboard DESTINY+ Spacecraft for Flyby Observation of (3200) Phaethon* **[#1405]** We present the development status of two cameras onboard DESTINY+ spacecraft for observing the asteroid (3200) Phaethon and the preparation for the flyby imaging with them. |
| Okada T. Fukuhara T. Tanaka S. Sakatani N. Shimaki Y. et al. | *Thermal Infrared Imager Onboard Hera to Observe S-Type Binary Asteroid Didymos* **[#1449]** A thermal infrared imager with multi-wavelength bands is being developed to investigate thermophysical properties and constituent materials of the surface of S-type asteroid binary Didymos and Dimorphos in the European Space Agency Hera mission. |
| Smith J. C. Morris R. L. Rumpf C. Longenbaugh R. McCurdy N. et al. | *An Automated Bolide Detection Pipeline for GOES GLM* **[#1801]** An automated bolide (bright meteor) detection pipeline has been developed for the GOES satellite GLM instruments. Detections, now in the thousands, are promptly published on a NASA-hosted publicly accessible website, https://neo-bolide.ndc.nasa.gov. |
| Di Marco S. Civitani M. M. Frigeri A. Lavagna M. | *Lunar Gravity Exploitation to Enhance X-Ray Telescope Operational Flexibility Through Fractionated Architecture* **[#2488]** This study presents the feasibility of a fractionated X-ray telescope, the mirror of which is placed on an orbiting platform in the cislunar environment and the sensor on the lunar surface, considering Earth-Moon gravity and lunar mass distribution. |

# [P677]
# POSTER SESSION: INSTRUMENTS: RAMAN AND LASER/LIBS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| Cattani F. Cohen B. A. Olsson J. | *Application of the Potassium-Argon Laser Experiment (KArLE) to Ordinary Chondrites* **[#1969]** We work on extending the KArLE technique and data analysis methods to ancient and K-poor samples as lunar analogs. The results obtained yield K-Ar ages with uncertainty and precision (2σ) better than 20% even with K content at the detection limit. |
| Noe Dobrea E. Z. Roush T. L. Colaprete A. Landis D. A. | *The Laser Spectrometer for Ices and Mineralogy* **[#1728]** We report on the development of a super-continuum-base spectrometer for the study of minerals and ices in dark planetary environments. |
| Acosta-Maeda T. E. Porter J. N. Sharma S. K. Lucey P. G. | *Long-Range Active Laser Spectroscopy Instruments for Planetary Exploration: LIBS for Elemental Analysis of Lunar Regolith* **[#2735]** A two components remote focus LIBS system provides good data on feldspar and ice using small optics near the sample and low laser power. |
| Konstantinidis M. Lalla E. A. Lopez-Reyes G. Lymer E. A. Freemantle J. et al. | *Laser Ablation Molecular Isotopic Spectrometry and Time-Resolved Laser-Induced Breakdown Spectroscopy: Implications for Planetary Exploration* **[#2585]** We present the latest iteration of the LIBS Raman Sensor (LiRS) instrument, a multicomponent future mission breadboard. The newest capabilities include Time-resolved LIBS and isotopic characterization of geological samples. |
| Lalla E. A. Daly M. G. Quaglia A. Walker S. Flynn G. et al. | *Combined Measurements by Laser Induced Breakdown Spectroscopy and Laser Ablation Molecular Isotopic Spectrometry for Planetary Exploration* **[#2266]** We present the Laser Ablation Elemental Isotopic Spectrometer (LABEISS) instrument, a breadboard prototype that features Laser-Induced Breakdown Spectroscopy and Laser Ablation Molecular Isotopic Spectrometry for planetary exploration. |
| Vogt D. S. Schröder S. Hübers H.-W. Richter L. Deiml M. et al. | *The VOILA Instrument: Laser-Induced Breakdown Spectroscopy at the Lunar South Pole* **[#1439]** VOILA is a LIBS payload for the geochemical analysis of the surface at the lunar south pole. It is capable of detecting all major elements as well as hydrogen. Here, we present first results from the recently completed laboratory setup. |
| Rammelkamp K. Gasnault O. Forni O. Bedford C. C. Dehouck E. et al. | *Optimization of Clustering Analysis for Classification of ChemCam Data from Gale Crater, Mars* **[#1463]** We present a classification approach of MSL ChemCam LIBS data from Gale Crater, Mars based on repeated k-means clustering. Six dominant chemical compositions were identified and described in this study. |
| Diotte F. Lemelin M. Doucet F. | *Utilizing Laser-Induced Breakdown Technology for the Identification and Quantification of Volatiles in Lunar Regolith* **[#1710]** |

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| | LIBS-based imaging instrument could allow to discriminate between different forms of water ice in regolith simulants based on its local spatial configuration. Results of qualitative and semi-quantitative analysis of emission spectra are introduced. |
| Ogura A. J. Yumoto K. Cho Y. Niihara T. Kameda S. et al. | *Elemental Analysis of Lunar Meteorites Using Laser-Induced Breakdown Spectroscopy* **[#1729]** Laser-Induced Breakdown Spectroscopy was applied to two lunar meteorites. Results demonstrate accurate composition prediction for an Al-rich highland rock and mineral identification for a mare basalt, showing the capability of LIBS on the Moon. |
| Liu C. Q. Ling Z. C. Fu X. H. Wu Z. C. Zhang J. et al. | *LIBS Calibration Standards Applicable for MarsCoDe Onboard the Rover of Tianwen-1* **[#1743]** Calibration standards are crucial for MarsCoDe to obtain precise and accurate elemental compositions on Mars. 259 terrestrial rocks were prepared to build a LIBS database and a model based on MarsCoDe for elemental composition interpretation on Mars. |
| Bai H. C. Ling Z. C. Liu C. Q. Tian S. K. | *Quantification of Iron in Martian Basalt Using LIBS Data with Penalized Shrunken Regression Methods* **[#2108]** With the purpose of better quantitative analysis of iron, we investigated LIBS peaks overlay between iron and other major elements, feature selection of iron, and compared the results of different quantitative iron models for basaltic samples. |
| Laserna J. Alvarez-Llamas C. Purohit P. Moros J. Luna S. et al. | *Combined LIBS and Acoustics for Differentiating Minerals with Similar LIBS Spectra* **[#2157]** The use of the plasma related spectroscopic and acoustic signals combined provide an innovative approach to characterize minerals with similar composition. This approach can help in the interpretation of the future data collected by M2020 mission. |
| Waldron A. Colón A. Carter J. C. Sharma S. Angel S. M. | *A Miniature Monolithic Spatial Heterodyne Spectrometer for Remote Raman and LIBS, 1D Raman Imaging, and In-Situ Raman Using a Drone Camera Detector* **[#1196]** A monolithic spatial heterodyne spectrometer, where the optical components of the spectrometer are bonded to make a solid, one-piece structure, can be small, compact, and stable, suitable for planetary spacecraft and rovers. |
| Veneranda M. Manrique J. A. Lopez-Reyes G. Sanz-Arranz A. Saiz J. et al. | *Combination of Remote Raman-LIBS Data: Novel Mineral Discrimination Strategies to Support SuperCam on Mars* **[#1344]** The present abstract investigates the advantages provided by the combination of Raman and LIBS data in the identification of mineral phases on Mars, this being the analytical approach of the SuperCam instrument onboard the Perseverance rover. |
| Wiens R. C. Gasda P. J. Reyes-Newell A. Newell R. Ganguly K. et al. | *OrganiCam: First-Light Results from a Compact Time-Resolved Laser-Induced Fluorescence Imager and Raman Spectrometer with Flight Qualified Parts* **[#1114]** We have built and started testing a stand-off imager/spectrometer to detect and ID organics and biosignatures to exclusion of fluorescing minerals. It uses flight parts (SuperCam heritage) and has detection limits in the low ppm to ppb range. |
| Jakubek R. S. Fries M. D. | *Novel Use of an Internal Mercury-Argon Lamp for the Calibration of Raman Wavenumber, Bandwidth, and Relative Intensities in Large Raman Images of Astromaterials* **[#1207]** Raman band parameters drift as a function of time and lab temperature. This decreases data precision in Raman images of astromaterials. Here, we characterize the band parameter drift and propose methods for its calibration. |

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| Mori S. Belenguer T. Boettger U. Buder M. Cho Y. et al. | *Verification of the Autofocusing System for the Raman Spectrometer on the MMX Rover* **[#1757]**<br>We manufactured a development model of the autofocusing system for the Raman spectrometer for the rover of JAXA's Martian Moons Exploration mission. We conducted several tests and these were successful. Here, we report the results of these tests. |
| Rodd-Routley S. A. Belenguer T. Böttger U. Buder M. Cho Y. et al. | *Optical Design and Breadboard of the Raman Spectrometer for MMX-RAX* **[#1923]**<br>This paper reports the laboratory confirmation of an optical design for a 0.2 numerical aperture confocal miniaturized, ruggedized Raman visible light spectroscope (RAX) to be borne by an autonomous rover landed on the martian moon, Phobos. |
| Sobron P. Eshelman E. Simon K. Barge L. Davila A. et al. | *Ultra Sensitive Raman Spectrometer for Planetary Sciences* **[#2421]**<br>The in-situ Spectroscopic Europa Explorer (iSEE) is a next-generation ultra-compact laser Raman Spectrometer that enables chemical identification and sub-ppb quantitation of compounds in landed missions. iSEE will be at TRL6 in 2022. |
| Cloutis E. Daly M. Caudill C. Lalla E. Potin S. et al. | *LunaR: A Versatile Raman Spectrometer for Lunar Exploration* **[#1473]**<br>The LunaR concept is for a suite of Raman spectrometers for lunar surface exploration adaptable for use on landers and rovers and varied types of terrains. |

## [P678]
## POSTER SESSION: INSTRUMENTS: SURFACE AND SUBSURFACE MEASUREMENTS

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
|---|---|
| VanBommel S. J. Gellert R. Gross J. | *Simulated Performance of a MSL-Generation APXS in a Lunar Setting* **[#1688]**<br>Performance characterization of a MSL-generation APXS as part of a future landed payload on the lunar surface through analyses of simulated spectra of an Apollo 12 olivine basalt composition. |
| Els S. G. Almaeeini S. Almarzooqi H. | *The Science Instrumentation for the Rashid Rover of the Emirates Lunar Mission* **[#1905]**<br>The Emirates Lunar Mission consists of the "Rashid" rover, one whose objective is to conduct scientific investigations. Here, we outline the requirements for the science program and describe the selected scientific instruments of the Rashid mission. |
| Grindrod P. M. Stabbins R. B. Motaghian S. Allender E. J. Cousins C. R. | *Optimizing ExoMars PanCam Multispectral Science: Cross-Rover Mission Comparison* **[#1340]**<br>Rover eyes see Mars / Colours reveal chemistry / Use errors to tell. |
| Stabbins R. B. Grindrod P. M. Motaghian S. Allender E. J. Cousins C. R. | *Optimizing Exomars Pancam Multispectral Science: Investigating the Limits of Material Classification* **[#1912]**<br>We present a tool for investigating the ability of ExoMars PanCam, or any equivalent |

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| | multispectral imaging system, to distinguish one material in contrast to a background set, using hematite at the Oxia Planum landing site as an example. |
| Turchi L. Payler S. J. Sauro F. Pozzobon R. Massironi M. et al. | *A System for Supporting Distributed Field Science Operations During Astronaut Training and Planetary Exploration: The Electronic FieldBook* **[#1118]** The Electronic FieldBook (EFB) is a deployable system being developed by ESA to support field mission operations, scientific data gathering, and direct interaction with mission control and science support teams through automatic data transmission. |
| Evans M. E. Leonard M. Morgan J. A. Zanetti M. R. Graham L. D. et al. | *Initial Prototype Work on Artemis "Gandalf's Staff" — Science Suite on a Lunar EVA Walking Stick* **[#1303]** Lunar walking stick / Initial design and plans / Comm, lights, and LiDAR. |
| Leonard M. J. Morgan J. A. Evans M. E. Graham L. D. Zanetti M. R. | *Restoration of NASA's Mobile Analytical Lunar Platform (MALP) as a Prototype Science Exploration Device Using a Public, Private, Academic (PPA) Model* **[#1754]** NASA's need for a telerobotic platform, MALP, to demonstrate capabilities and train operators has been successfully implemented using the PPA model, engaging NASA scientists, T STAR personnel, and TAMU faculty and Capstone students. |
| Noe Dobrea E. Z. Banks M. E. Candela A. Clark R. C. Gaylord D. R. et al. | *Tools for Autonomous Rover Science: Preparing for Analog Field Exercises* **[#2371]** We report on preparation for field exercises to test autonomous rover science tools and techniques. |
| Lorenzo J. M. Patterson D. A. Stryjewski W. Karunatillake S. Haviland H. et al. | *Seismic Wheel for Shallow Characterization (0–1 m) of Soils on the Moon and Mars* **[#2173]** Preliminary vibration analyses of small (tens g, cm3) durable, piezoceramic-based, pulser and source system for high-frequency (kHz) signals show working potential for this payload mounted on the mock wheel of a rover. |
| Litvak M. L. Kozlova T. O. Mitrofanov I. G. Kozyrev A. S. Il'in A. G. et al. | *The Sampling Acquisition Instrumentation for the Lunar Missions* **[#2045]** The sampling acquisition robotic arm and depth drilling system developed for the Russian south polar landing missions Luna-25, 27, 28. |
| Carter L. M. Rincon R. R. du Toit C. F. Perrine M. Lu D. et al. | *Development of the Space Exploration SAR (SESAR) for Planetary Science Missions* **[#1268]** SESAR is a digital beamforming P-band (435 MHz) synthetic aperture radar that is designed to see tens of meters below the surface to detect and map ice, buried fluvial channels, lava tubes, pyroclastics, and other volcanic and sedimentary structures. |
| Eshelman E. Simon K. Willis M. Van Hoesen D. Yanchilina A. et al. | *A Probe for Exploring Regolith and Ice by Subsurface Classification of Organics, PAHs, and Elements (PERISCOPE)* **[#2340]** PERISCOPE is a compact instrument for detecting organic compounds in subsurface rocky and icy environments. Here, we report on the development of the breadboard instrument and experiments to determine sensitivity to relevant organics. |
| Zacny K. Chu P. Vendiola V. Seto E. Quinn J. et al. | *TRIDENT Drill for VIPER and PRIME1 Missions to the Moon* **[#2400]** We are presenting ice mining drill called TRIDENT that is part of two lunar missions: PRIME1 and VIPER scheduled to fly to the Moon in 2022 and 2023. |
| De Sanctis M. C. Altieri F. Ammannito E. De Angelis S. Ferrari M. et al. | *Ma_MISS on ExoMars Rover: The Investigation of the Martian Sub-Surface* **[#1887]** The main goal of the Ma_MISS instrument is to study the martian sub-surface environment. Access to the martian subsurface is crucial to constrain nature, timing, and duration of alteration and sedimentation processes on Mars, as well as habitability conditions. |

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| Kumamoto A. Miyamoto H. Nishibori T. Tsuchiya F. Ishiyama K. | *FDTD Simulation and Radar Experiments Using Scale-Down Model for Radar Sounding of the Asteroid* **[#1838]**<br>Radar experiment and FDTD simulation of radar sounding of the asteroid internal structures with a scale-down model has been performed. From inversion using synthetic echo data, we could obtain clear distribution of the reflectance in the asteroid. |
| Lawson C. S. Evans M. E. Niles P. B. | *Development of MEMS-Based Inertial Gravimetry for Planetary Exploration* **[#2583]**<br>A project that supports wider efforts to mature MEMS gravimeters for planetary exploration is discussed. A proof-of-concept instrument and methodology are introduced and proposed applications of such devices are discussed. |
| Harms J. | *Lunar Gravitational Wave Antenna* **[#1668]**<br>Gravitational waves (GWs) produced by cataclysmic astrophysical events excite weak vibrations of the Moon. Its seismically quiet environment makes it possible in principle to detect these signals. We describe a new concept for a Lunar GW Antenna. |
| Yanchilina A. Simon K. Eshelman E. Sudlik C. Pochettino O. et al. | *DiSCO (Dual In-Situ Spectroscopy and Coring)* **[#2662]**<br>Presenting DiSCO (Dual In-Situ Spectroscopy and Coring) capable of doing in-situ auto-focus without any moving arms mineralogical analysis of surface and sub-surface rock and sediment samples. |
| Steven C. J. Dyar M. D. McCanta M. C. | *Preliminary Results of Quantifying Oxygen Fugacity in Solar System Materials with X-Ray Absorption Spectroscopy of Pyroxenes* **[#1401]**<br>Oxygen fugacity of igneous systems across the solar system is a key factor in the magmatic evolution and origin of solar system materials. We explore the application of X-ray absorption spectroscopy to resolve redox ratios in pyroxenes. |

## [P679]
## POSTER SESSION: PLANETARY SPATIAL DATA INFRASTRUCTURE (PSDI) POSTERS

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| Hargitai H. I. | *The Pocket Atlas of Mars: A Public Outreach Project* **[#2109]**<br>The abstract presents the Pocket Atlas of Mars, a public outreach project, also a sample for the use of multiple feature databases integrated into one map, showing one of the uses of the planetary spatial infrastructure. |
| Shiner J. E. Noe Dobrea E. Román-Correa N. N. Romero A. J. | *Virtual Reality Tools for Mars Exploration: MarsVR* **[#2554]**<br>MarsVR is a virtual reality program created with the purpose of providing an immersive way to explore Mars and query Mars data. The current iteration supports exploration of the Mars Science Laboratory's (MSL) field site, Gale Crater. |
| O'Shea C. O. Johnson J. R. Fraeman A. A. | *An Archive of Mars Science Laboratory ChemCam Passive Visible/Near-Infrared* |

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| Lemmon M. T. | *Surface Spectra* **[#1028]**<br>We describe a PDS archive of MSL ChemCam passive radiance (240–905 nm) and relative reflectance spectra (400–840 nm) from ~23,800 surface observations acquired through Sol 2075, and the concurrent availability of new Python-based calibration software. |
| Heyer T. Hiesinger H. Raack J. Jaumann R. | *The Multi-Temporal Database of Planetary Image Data (MUTED): Web-Processing of Orbital Images of Mars* **[#1124]**<br>MUTED is a web-based tool to support the identification and processing of orbital images of Mars. |
| Volat M. Quantin-Nataf C. Mandon L. Thollot P. | *MarsSI: Martian Surface Data Processing Service* **[#1230]**<br>MarsSI ("Mars d'Information," French for Mars Information System) is a platform and service to catalog, process, and retrieve data from orbiters. |
| Dickson J. L. Ehlmann B. L. | *Image-to-Image Registration for a CTX Mosaic of Mars at the Global Scale: Estimations of Offset in MRO CTX Image Pointing* **[#2453]**<br>Image-to-image registrations of 159,821 CTX pairs show that CTX pointing can be trusted to be within one MOLA pixel (463 m) of overlapping data with 99.90% confidence for fully transmitted data, and 99.13% confidence for partially transmitted data. |
| Burris M. Rios K. Anderson Z. Anwar S. Dickenshied S. et al. | *Uploading and Viewing Images in JMARS Using the Custom Map Upload Tool* **[#2504]**<br>The JMARS custom map tool allows users to upload their own images into the application. Recently, the custom map upload tool has been rewritten to accommodate larger maps in additional file types, formats, and projections. |
| Wren P. F. Dickenshied S. Anwar S. Hagee W. Noss D. et al. | *Java Mission-Planning and Analysis for Remote Sensing: "Mission Planning" is JMARS' Middle Name* **[#2645]**<br>JMARS is more than a free, highly-useful planetary GIS package. It began in 2001 as a mission-planning tool for the THEMIS instrument on Mars Odyssey, and is now in use by several other missions for observation planning. |
| Anderson Z. Rios K. Carter S. Anwar S. Burris M. et al. | *Modernized Graphical User Interface for JMARS Application* **[#2696]**<br>Since its creation over 20 years ago, JMARS has grown and evolved substantially. As a result of this growth and ever increasing demand for software capabilities from JMARS user community, and at NASA Headquarters' request, GUI updates are necessary. |
| Robbins S. J. Kirchoff M. R. Hoover R. H. | *Fully Controlling Mars Reconnaissance Orbiter Context Camera Images and Producing Photometrically Stable Mosaics (2021 Update)* **[#2066]**<br>Control big data and / Make pretty mosaics of / The martian surface. |
| Zuschneid W. Michael G. G. Walter S. H. G. Dumke A. Gwinner K. et al. | *HRSC on Mars Express — Recent Advances in the Processing of Quadrangle Image Mosaics* **[#2049]**<br>We describe recent technical improvements to the generation of HRSC (Mars Express) high-resolution image mosaics and to their dissemination via the FUB's Planetary Science department's Mapserver. |
| Wagstaff K. L. Francis R. Golombek M. Lu S. Riloff E. et al. | *The Mars Target Encyclopedia Now Includes Mars Pathfinder and Mars Phoenix Targets* **[#1278]**<br>What about Yogi? / Mars mission targets abound / You can find them here. |
| Le Mouélic S. Caravaca G. Mangold N. Wright J. Carli C. et al. | *Using Virtual and Augmented Reality for Planetary Surfaces Investigations — A Case Study on Mars and the Moon* **[#1514]** |

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| | This poster describes use cases of virtual and augmented reality to investigate the surface of Mars and the Moon. VR and AR generally helps to better understand the environment, the scales, and the relationships between different morphological units. |
| Leeburn J. M. Jozwiak L. M. Patterson G. W. Stickle A. M. | *Building a GIS Framework for Co-Analysis of Mini-RF Bistatic Radar Data with Other Lunar Datasets* **[#2577]** A new data package is discussed which includes multiple LRO datasets useful for co-analysis of regolith properties, volcanism, or lunar volatiles. |
| Henriksen M. R. Manheim M. R. Walsh J. M. Harris C. P. Robinson M. S. et al. | *Regions of Interest: Availability of and Access to LROC NAC Data Products* **[#2578]** LROC NAC Data Products, including Digital Terrain Models, Photometric Sites, Controlled Mosaics, Map Sheets, and more, are available for many features of interest globally distributed across the Moon. |
| Legrand C. Chevalley P. | *Virtual Moon Atlas 7 Freeware* **[#1002]** Virtual Moon Atlas version 7 is a mapping freeware linking topographic, geologic, chemical and historical maps with databases, documents, and pictures libraries. It uses datas from NASA, USGS, JPL, Smart-1, LP, Kaguya, Chandrayann, and Chang'E probes. |
| Carr K. A. C. Azubuike O. A. Tran A. T. Carreira C. C. Alfaro C. A. et al. | *Lunar Crater Maturity Analysis in Python: Developing a Toolkit for Ejecta Analysis* **[#2387]** Crater lunar kit / Diviner LOLA Mini-RF / Combined analysis. |
| Jung D. Schrempp F. Son S. | *Fast and Accurate: Real-Time Soft-Shadowed Ray Traced Lunar and Planetary Global Terrain for Lighting and Landing Simulations* **[#1330]** A fast and accurate interactive ray tracer for simulating lunar and planetary terrain is presented. Unlike previous works, this simulator can seamlessly render full global terrain at arbitrary scales with atmosphere for lighting and landing studies. |
| Mittal P. Pandey H. Sekhar G. Ramakrishna B. N. | *PRADAN: Data Browse and Dissemination Web Application for Chandrayaan-2* **[#1774]** PRADAN stands for 'Policy based data Retrieval, Analytics, Dissemination And Notification system.' We describe the features and design of this web interface developed for Chandrayaan-2 where PDS4 standard data is available to the public. |
| Zou X.-D. Becker K. J. Li J.-Y. | *Tools for Images and SPICE Data of Comet Missions* **[#2569]** This project is to relieve investigators the time and effort required to perform complex control/bundle adjustment techniques to register images to shape models. |
| D'Amore M. Helbert J. Knollenberg J. Berlin R. Peter G. et al. | *The Mercury Radiometer and Thermal Infrared Imaging Spectrometer (MERTIS) Onboard Bepi Colombo: Moon and Venus Flybys Data Format* **[#1140]** MERTIS will observe Mercury's surface at 500 m scale and combines a spectrometer and a radiometer covering the 7–14 µm and 7–40 µm ranges. MERTIS observed the Moon in April 2020 and Venus in October 2020, and its archival data are stored in PDS4 format. |
| Zamarialai S. Shi Z. Foing B. Perenboom M. J. L. Kruijver A. | *Monitoring Temporal Developments from Remote Sensing Data Using Fine-Grained Segmentation* **[#2279]** Multi-Task Convolutional Neural Network (CNN) with three objective functions for fine-grained segmentation of RS imagery into classes which generalizes on different resolutions RS imagery. |
| Wang J. Scholes D. Arvidson R. E. Guinness E. A. | *Recent Updates of the PDS Geosciences Node's Orbital Data Explorer* **[#1394]** |

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| Zhou F. | A brief introduction of NASA's PDS Geosciences Node's web-based search tool, ODE, and a summary of its latest update in data inventory and web interface for improved orbital data search and download across missions and instruments. |
| Politte D. V. Arvidson R. E. Stein T. C. Arvidson L. E. | *Pilot Data Analysis of PDS Geosciences Data in the Cloud with the Java CRISM Analysis Tool (JCAT)* **[#2396]** We provide a rationale and methodology for the analysis of planetary data on the cloud, with CRISM analysis as an example. |
| Zink A. E. Hunter M. A. Buban H. C. Bogle S. R. Dickman A. D. | *Improvements to Information Services in AstroLink* **[#2579]** This abstract presents progress on AstroLink's ongoing efforts to digitize and make publicly available its unique, historical documents, photographs, and maps. |
| Camplone V. Zinzi A. Massironi M. Rossi A. P. | *Geological Maps into MATISSE* **[#1949]** MATISSE is an implementation tool, designed to develop planetary spatial data infrastructures.It allows to access to data of the planetary exploration missions and to their analysis. The team worked on the inclusion of geological maps into MATISSE. |

## [P680]
## POSTER SESSION: MACHINE LEARNING APPLIED TO PLANETARY SURFACES: "I'M AFRAID I CAN DO THAT!"

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| Civilini F. Weber R. C. | *Detecting Moonquakes Using Convolutional Neural Networks* **[#1168]** We built a machine learning convolutional neural network model that was able to successfully detect lunar seismicity in both Apollo PSE and LSPE records despite only being trained on Earth seismic data. |
| Daket Y. Honda C. Demura H. | *Application of Machine Learning Technique for Mapping Rayed Craters, Rilles, and Ridges on the Moon* **[#1805]** We aim at detecting rayed craters, rilles, and ridges on the Moon by using machine learning. We prepared composed images of spectral and topography images as training dataset, and customize the architecture. Then we applied the model to Imbrium area. |
| Fairweather J. H. Lagain A. Servis K. Benedix G. K. Kumar S. S. et al. | *Automated Crater Detection on the Moon at High-Resolutions* **[#1403]** We present the initial results from the application of our team's automated crater detection algorithm on high-resolution NAC images. The algorithm performed exellently in the detection of fresh craters on both a highland and mare surface. |
| Nefian A. Shirley M. Colaprete T. Elphic R. | *Automatic Crater Detection at the Lunar South Pole* **[#2519]** The proposed fully automatic for crater detection method has been tested successfully in Lunar Pole LRO-NAC imagery for craters down to 8m in diameter and captured in various illumination conditions. |

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| Gao A. L. Daubar I. J. Wexler D. Wagstaff K. L. Bickel V. et al. | *Using Machine Learning to Complement New Martian Crater Inventories* **[#1674]**<br>Machine learning finds / Fresh impacts on Mars that we / Missed before, what now? |
| Sakimoto S. E. H. Lewis D. D. Dileep S. Memon P. Beveridge J. R. et al. | *Deep Learning for an Inventory of Small to Midsize Volcanic Edifices on Mars* **[#1626]**<br>Volcanic constructs are key to understanding geological evolution and habitable environment potential. We demonstrate that deep learning easily detects small (3-50 km basal diameter) martian volcanoes, and discuss its use in inventory construction. |
| Williams J. M. Scuderi L. A. Newsom H. E. | *Remote Sensing Computer Automation to Detect Erosional Scarps on Mars* **[#1846]**<br>This study utilizes (CNN) computer automation to detect meter-scale escarpments on Mars and extracts morphometric (height, headwall, slope angle, etc.) and spatial (location, orientation clustering, etc.) information on a global scale. |
| Wilhelm T. Nocon R. Stepcenkov S. Wöhler C. | *DoMars24k: Expanding Automated Geomorphic Analysis on Mars by Wind and Ice Shaped Landforms* **[#1901]**<br>We group data from the Mars Reconnaissance Orbiter Context Camera into a set of 22 different landforms. The grouping is then used to automatically derive geomorphic maps with the help of machine learning. We focus on landforms shaped by wind and ice. |
| Liu-Schiaffini M. Christian S. Miller R. C. Grima C. Ng G. et al. | *Machine Learning Classification of the Martian Surface: Application to Radar Reflectometry* **[#1224]**<br>We classify the martian surface with an unsupervised machine learning technique applied to SHARAD and MOLA data. We discuss how this approach could help integrate the multiple dimensionality of terrain characters rendered by different data sets. |
| Nodjoumi G. Pozzobon R. Rossi A. P. | *Deep Learning Object Detection for Mapping Cave Candidates on Mars: Building Up the Mars Global Cave Candidate Catalog (MGC^3)* **[#1316]**<br>In this study is presented a novel approach for mapping possible cave candidates and update the MGC^3 (Cushing et al.) with promising results. Based on Deep Learning methods and tools, with the possibility to be applied on other terrestrial planets. |
| Phillips M. S. Moersch J. E. Warren-Rhodes K. Hinman N. W. Cabrol N. A. et al. | *Convolutional Neural Network Image Classification of Mars-Analog Terrain: Preliminary Results and Implications for the Search for Life on Mars* **[#2510]**<br>In this abstract, we employ a convolutional neural network to perform semantic segmentation on the astrobiologically-relevant Mars analog, Salar de Pajonales, Chile. |
| Clabaut E. Lemelin M. Germain M. | *Generation of Simulated "Ultra-High Resolution" HiRISE Imagery Using Enhanced Super-Resolution Generative Adversarial Network Modeling* **[#1935]**<br>An Enhanced Super-Resolution Genarative Adversarial Network (ESRGAN) model is trained to build ultra-high spatial resolution HiRISE imagery. The images are higly convincing with much sharper outlines and no artifact that could be noticed. |
| Kerner H. R. Wagstaff K. L. Lu S. Francis R. Kulshrestha S. | *Novelty-Driven Onboard Target Selection in Grayscale and Color Mars Rover Images* **[#2618]**<br>Rovers are searching / Color images reveal / Novel rocks and veins. |
| Lu S. Zhao B. Wagstaff K. L. Cole S. B. Grimes K. | *Content-Based Classification of Mars Exploration Rover Pancam Images* **[#1779]**<br>This work describes the creation and evaluation processes of the first machine learning application (to the best of our knowledge) that annotates MER Pancam image content and enables users to quickly find images of interest. |
| Koeberl C. Bechtold A. Paar G. Traxler C. Garolla F. et al. | *Planetary Scientific Target Detection via Deep Learning: A Case Study for Finding Shatter Cones in Mars Rover Images* **[#1209]** |

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| | Using a deep learning approach, we try to automate possible discovery of shatter cones in planetary surface images. |
| Drozdovskiy I. Sauro F. Payler S. J. Jahoda P. Franke M. et al. | *Recognition of Planetary Rocks and Minerals Using Deep Learning Based Multi-Spectral Unmixing and a Custom Mineralogical Database* **[#1119]** The ESA-PANGAEA Mineralogical Toolkit is a set of tools aiming to enhance the recognition of planetary minerals. |
| Hess M. Wilhelm T. Arnaut M. Wöhler C. | *Uncertainty-Based Unmixing of Space Weathered Lunar Spectra* **[#1048]** We present a Bayesian approach to spectral unmixing to model the uncertainties of the abundances. We are using the LSCC catalog and additionally an artificially space weathered plagioclase endmember to accurately reconstruct highland spectra. |

## [P681]
## POSTER SESSION: A DIVERSE AND INCLUSIVE WORKFORCE: WHO WE ARE AND CAN BE

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| Rathbun J. A. Hendrix A. R. Porter A. M. Rivera-Valentín E. G. | *Results of the 2020 Planetary Science Workforce Survey, Funded by the DPS* **[#2094]** Thank you for filling out the 2020 workforce survey! Now see what everyone else had to say. |
| Rivera-Valentín E. G. Rathbun J. A. Keane J. T. Diniega S. Richey C. R. et al. | *Demographic Study of the Planetary Science Workforce* **[#2163]** Our work shows that in the next decade the field should work toward intersectional diversity initiatives. |
| Zellner N. E. B. Rathbun J. A. Seidel A. M. Martindale N. L. | *18 Years of LPSC Attendance and Presentation Data: An Assessment of Participation by Women* **[#2227]** The LPSC Organizing Committee does well in allocating speaker slots to women. We recommend, however, that self-reported demographic data be collected, to better understand general participation at the LPSCs. |
| Scully J. E .C. Cerretti G. Viswanathan A. Steckloff J. K. Richey C. et al. | *Foreign Nationals Employed and Studying in Planetary Research in the United States, and Recommendations for Supporting this Group* **[#1493]** A significant number of foreign nationals are employed, and/or studying, in planetary research in the U.S. Our recommendations for how to support foreign nationals fall into four categories: evidence, engagement, edicts, and empathy. |
| Milazzo M. P. Piatek J. Venkatesan A. Vaughan A. | *The Growing Digital Divide and Its Negative Impacts on NASA's FutureWorkforce.* **[#2612]** Digital divide / Covid-19 impacts all / NASA's new workforce. |
| Bennett K. McAdam M. Milazzo M. Garcia P. Shelton J. et al. | *The Preventing Harassment in Science Workshop: Summary and Best Practices* **[#2434]** We summarize the discussion fostered at the Preventing Harassment in Science |

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| | Workshop, including suggested best practices and action items. |
| Strauss B. E. Rasmussen K. C. Maier E. R. Borges S. R. Durbin M. et al. | *Nonbinary Systems: Gender-Inclusive Study Methods in Planetary Science* **[#2306]** We aim to address the future of gender equity and the inclusion of nonbinary and transgender people in planetary science by recommending better survey practices and institutional policies based on a more complex and profound approach to gender. |
| Vander Kaaden K. E. Ryan C. Rivera-Valentín E. G. Phillips C. B. Haber J. et al. | *Fostering Inclusive, Supportive, and Safe Environments in Planetary Science for Members of the LGBTQ+ Community* **[#1088]** LGBTQ / In planetary science / Inclusion is key. |
| Gardner-Vandy K. G. Scalice D. M. | *Relationships First and Always: A Guide to Collaborations with Indigenous Communities* **[#2657]** Relationship building between Indigenous communities and scientists must be the foundation of all collaborations. We outline the best practices and provide recommended guidelines for relationship-building efforts. |
| Tiscareno M. S. Scalice D. M. Thompson M. L. Noviello J. L. White V. et al. | *Planetary Nomenclature and Indigenous Communities* **[#2346]** Let's co-create, not / Appropriate! What we need / Is relationship. |
| Piatek J. L. Brooks S. M. Masiero J. R. Molaro J. L. Rathbun J. A. et al. | *All Conference Talks Need Captions* **[#2723]** Presentations at conferences, whether virtual or in-person, need to have captions so information presented via the speaker is also shared as text. |
| Vance S. D. Elder C. Hofmann A. Howell S. Milazzo M. et al. | *Addressing Mental Health in Planetary Science* **[#2552]** We summarize the available evidence for a mental health crisis among academics. We describe how this problem intersects with issues of EDI. Addressing the problems is a necessary step toward creating a more creative and effective workforce. |
| Campbell L. Gary-Bicas C. E. Glotch T. D. Holme E. A. Paul B. et al. | *Formation of an Equity, Diversity, and Inclusion Committee in the Department of Geosciences at Stony Brook University* **[#2027]** Stony Brook Geo / EDI committee formed. / Progress, lessons learned. |
| Grier J. Schmidt G. Focus Group Team | *Towards a More Equitable, Diverse, and Inclusive Workforce — The NASA SSERVI EDI Focus Group* **[#2145]** An equitable / Workforce is a choice — taking / Action for justice. |

## [P682]
## POSTER SESSION: EDUCATION AND AUDIENCE ENGAGEMENT: BUILDING BRIDGES TO AUDIENCES

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| Authors (*Denotes Presenter) | *Abstract Title and Summary* |
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| Wadhwa M. Williams D. A. Swann J. L. Anbar A. D. Mead C. J. et al. | *The NASA SMD Community of Practice for Education (SCoPE): A New Science Activation Program Integration Project to Connect SMEs with NASA SCIACT* **[#2515]** We introduce our newly funded project from the NASA Science Activation program, |

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| | SCoPE (SMD Community of Practice for Education). We will connect NASA-supported Subject Matter Experts with educators to better support their initiatives. |
| Shaner A. J. Shupla C. Shebby S. | *Developing an Evidence-Based Model for Preparing Planetary Scientists to Engage Underserved Audiences* **[#2597]**<br>Planetary ReaCH / SMEs, diverse audiences / Engagement model. |
| Buxner S. R. Kortenkamp S. Hong S. Tsinajinie G. Topor I. et al. | *Project POEM: In Person and Virtual STEM and Mentoring Programs for Students with Visual Impairments* **[#2606]**<br>We discuss Project POEM, a STEM enrichment program for middle and high school students with visual impairments. |
| Foing B. H. Glukhova E. Sitnikova A. Mulder F. Ten Helden C. et al. | *ArtMoonMars Cultural and Artistic Activities* **[#2595]**<br>ILEWG ArtMoonMars programme of cultural and artistic activities was started by ILEWG with ESA ESTEC and partners including IAF ITACCUS, Global Science Opera, Todays Art, KABK, WDKA, with workshops, residencies, projects, and MoonGallery.eu for launch. |
| Waltemathe M. Hemminger E. Foing B. | *Cultural and Educational Aspects of Space Exploration* **[#2441]**<br>Space-exploration relies on complex connections between different cultures of academia, like science and humanities. An interdisciplinary teaching program makes students stakeholders in the societal and academic discourses on science and technology. |
| Metzger P. T. Grundy W. M. Sykes M. V. Stern S. A. Bell J. F. III et al. | *Reductionist vs. Folk Taxonomies in Planetary Science* **[#1083]**<br>Review of the literature from Galileo yielded an unexpected result: planetary taxonomy among scientists was reductionist and insightful until the intrusion of an 1800s folk taxonomy rooted in teleology that redefined the public's concept of a planet. |
| Kaliwoda M. Junge M. Hentschel F. Hoffmann V. Schmahl W. W. | *Education and Public Engagement in the Mineralogical State Collection Munich (Germany), Meteorites from Mars and Moon as an Attraction for the Public* **[#2471]**<br>Meteorites are an important field of research and investigation. Thereby, it is important to raise the interest of the public. So, we want to show different methodes to work with grown ups and children on meteorite samples within a state collection. |
| Whelley N. Barry C. Richardson J. Wasser M. | *NASA's Planetary Analogs Website: A New Science Communication Resource* **[#2295]**<br>NASA's new Planetary Analogs website highlights Earth's remarkable role in the quest to understand our solar system, for broad audiences. Phase 1 content focuses on geologic analogs in context. Future phases are currently in development. |
| Gross C. Balthasar H. Dumke A. Neu D. Schreiner B. et al. | *Looking Back to 17 Successful Years of High Resolution Stereo Camera Image Release on ESA's Mars Express Mission* **[#1480]**<br>During the past 17 years, the experiment has collected image data from more than 21.000 orbits, resulting in a steadily increasing set of image, mosaic, and movie releases. Altogether more than 1.273 high quality image PR products have been created. |
| Olgin J. O. | *Increasing Student Enrollment, Academic Curriculum, and Community Involvement in STEAM Careers and Awareness Centered in Planetary Science Through NASA's SOLVE Programs, Lunar and Planetary Institute's Augmented Reality, and Zooniverse's Citizen-Science Activities in Service Learning* **[#2470]**<br>The aim is to further expand the use of online citizen science projects to augment STEM classes, specifically in the geosciences and outreach through EPCC's service-learning program (SLP) and Tejano Passport program (TPP). |

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# POSTER SESSION: EDUCATION AND OUTREACH IN A PANDEMIC: PIVOTING TO VIRTUAL ENGAGEMENT

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| Jones A. J. P. Wasser M. L. Tiedeken S. Shaner A. Barry C. et al. | *Outreach in a Pandemic: Strategies that Led to Record-Breaking Participation in International Observe the Moon Night 2020* **[#2466]** Global pandemic / Makes outreach complicated / But doesn't stop us. |
| Shupla C. Shaner A. Webb S. | *Preparing Virtually for Virtual Programs* **[#2603]** Virtual programs… / Hard to get/keep attention… / We share tips to help. |
| Harris R. S. Dillon J. J. Lancaster J. M. | *Expanding the Reach of Space and Planetary Science Education During a Global Pandemic: The Fernbank Science Center At-Home Planetarium Experience* **[#2629]** The global pandemic has presented unique challenges and opportunities to engage students and communities in space and planetary science. |
| Shankar B. | *Engaging the Next Generation of the Canadian STEAM Workforce Using Space Science — Through a Pandemic* **[#2602]** We summarize the efforts and initiatives taken as a social enterprise to engage youth in the K-12 sphere, and recent STEAM graduates in the Space sector. |
| Gemma M. E. Roe C. Acinapura M. Emmart C. Ebel D. S. et al. | *OpenSpace: Interactive Public Outreach in a Virtual World* **[#2206]** Originally envisioned as a robust tool for immersive on-site environments, broad use of the OpenSpace software during 2020 has revealed the software's power to engage public and professional audiences through livestreamed and recorded videos. |
| Buxner S. R. Hendrix A. R. Grier J. A. Prettyman T. H. Domingue D. L. et al. | *TREX Public Engagement: Virtual Engagement Through the First Year of the Pandemic* **[#1812]** We present a summary of virtual programming for the past year for the TREX public engagement team. Partners included Chabot Space and Science Center and Howard University. |
| Bérczi Sz. Hargitai H. I. Kereszturi A. Illés I. | *Planetology Video Lectures for Remote Learning During the COVID-19 Pandemic* **[#2161]** Pandemic restrictions gave the opportunity to prepare a complete series of lectures of planetology giving a cross section of classes for students in planetary astronomy and astrogeology at ELTE Eötvös University. |
| Vizi P. G. Sipos A. | *Simulated Mars Rover Competition — The Pandemia Challenge* **[#1311]** The annual Simulated Mars Rover Competition was cancelled by regulations because of COVID-19. But it lives. It went online and 'home office.' The challenge gave special solutions for the organisers and for the competitors also. Let us announce. |

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# POSTER SESSION: EDUCATION AND WORKFORCE TRAINING: PREPARING THE NEXT GENERATION

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| Quick L. C. Murchie S. L. Turtle E. P. MacKenzie S. M. Miller R. et al. | *The Dragonfly Student and Early Career Investigator Program: Broadening Participation on Planetary Mission Teams* **[#2653]** We describe the Dragonfly Mission to Titan's Student and Early Career Investigator Program and introduce our first cohort of student investigators. |
| Klug Boonstra S. Garcia D. Kretke K. Acuna A. R. Stickel H. et al. | *NASA's Lucy Student Pipeline Accelerator and Competency Enabler (L'SPACE) Program: Reimagining Workforce Development for Diverse Undergraduate Students at Scale* **[#2701]** The L'SPACE Program is designed to attract and train diverse STEM students to help meet the growing needs of the Exploration Ecosystem's STEM workforce. |
| Rivera-Muñiz B. Machín A. Virkki A. | *The Arecibo Observatory's STAR Academy: Achievements, Status, and Future* **[#1372]** This abstract presents the achievements, status, and future plans of The Arecibo Observatory's STAR Academy. Additionally, results of student engagement and career plans obtained from a survey are presented. |
| Caro F. Colón J. Rivera-Muñiz B. Mercado C. | *Designing a Small-Scale Satellite for Habitable Exoplanet Research* **[#1376]** The main goal for this project was to explore the possibility and design a small-scale satellite for habitable exoplanet research. This work was completed as part of a high school level project developed at The Arecibo Observatory's STAR Academy. |
| López A. Rivera-Muñiz B. Colón J. | *Designing a Submarine for the Exploration of Titan's Methane Seas* **[#1379]** The goal for this project was to explore the possibility of and design a prospect submarine for the exploration of Titan's methane seas. This work was completed as part of a high school level project developed at The Arecibo Observatory's STAR Academy. |
| Vargas G. Quintana B. Ginés A. Ramos M. Rivera-Muñiz B. et al. | *The Effects of Increasing the Amount of Time in Space Missions on Astronauts' Cognitive Functions* **[#1374]** This project was completed as part of the requirements for graduation at STAR Academy at The Arecibo Observatory. The goal was to explore the effects of increasing the amount of time in space missions on astronauts' cognitive functions. |
| Vermeulen N. M. J. Villa-Massone J. Waltemathe M. Hemminger E. Kolodziejczyk A. et al. | *Euro-Moon-Mars Astronautics Training Academy* **[#2341]** At the EuroMoonMars Astronautics Training Academy we train researchers and young professionals in order to prepare them for a possible role in the space industry. Therefore, we developed a unique training programme based on international experience. |
| Losiak A. Baranowska M. Gaidzik K. Gajewska K. Goébiowska I. et al. | *Teaching Planetary Geology to Engineers During European Rover Challenge (ERC)* **[#2117]** |

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| | The 2020 European Rover Challenge was the only major robotics competition that took place during the global pandemic, and included an extended scientific task that allowed engineers to develop their mapping and geology skills. |
| Horvai F. | *Planetary Science as a Tool to Integrate Instrumental, Laboratory, and Modelling Aspects Under Research Activity in Hungary* **[#1179]**<br>Reviewing recent planetary science activities in Hungary, the research topics could be classified according to the contribution of computer modelling, laboratory, and field activities, what supports to estimate their specific industry relations. |
| Carmona Reyes J. A. Attai S. L. York J. Ranney K. Hyde T. W. | *Student Engagement as a Mediator to Increase Interest in STEM Areas* **[#1144]**<br>Understanding elementary school student engagement can help produce interventions that will increase interest in STEM areas. This research will describe the current efforts and results, and how this can lead to an increase in STEM interest. |
| Bérczi Sz. Polgári M. Gyollai I. Ságodi I. Vizi P. G. | *How NASA Lunar and Antarctic Meteorite Sample Studies Helps Planning New Measuring Complexes in Our Planetary Science Education: Instruments for Extended Structural Hierarchy Table with Parallel Structures* **[#1498]**<br>Textural structure of meteorites (ALH 84001, ALH 77005) and NASA lunar samples were investigated according to structural hierarchy for living fossils, from high magnification OM to IR, RAMAN, and nuclear level components. |