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AIRMAIL

Dr. Christian D. Assoun
Docteur de l'Universite de
PARIS VII

Paris, FRANCE

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SUBJ VISIT TO JPL ON 8/6/81

DEAR DR ASSOON

WE LOOK FORWARD TO YOUR VISIT TO JPL ON AUGUST 6 WE WILL EXPECT
YOU ABOUT 10:00 AM

DR WHOLFGANG H STEURER

157-316

JET PROPULSION LABORATORY
4800 OAK GROVE DRIVE
PASADENA CALIF 91109 USA
TELEPHONE 213-354- 2845

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National Aeronautics and
Space Administration

Washington, D.C.
20546

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OCT 27 1980

Reply to Attn of: EM-7

Dr. Christian D. Assoun
Docteur de l'Universite de
PARIS VII

Paris, France

Dear Dr. Assoun:

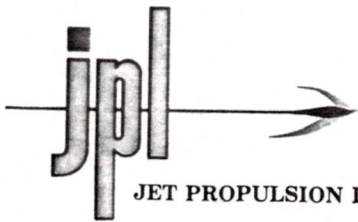
Thank you for your letter of September 20, 1980, in which you described your interest in the use of plasmas for various materials preparation possibilities. I have forwarded a copy of your letter and the attached list of activities to Dr. W. Steurer, Jet Propulsion Laboratory, Pasadena, California, who is responsible for defining new techniques for the processing of extraterrestrial materials. I am sure that he will be in touch with you concerning the technical details about which he is performing some preliminary analysis. Thank you for your interest in the program.

Sincerely,

John R. Carruthers
Director, Materials
Processing in Space

cc:
JPL/Dr. Steurer
AE/Mr. Bradley

TELEX | ||



JET PROPULSION LABORATORY California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103

January 15, 1981

Refer to: 3543:81:020

Dr. Christian D. Assoun
Docteur de l'Université de
Paris VII

Paris, France

Dear Dr. Assoun:

Your letter of September 20, 1980 to Dr. Carruthers, Director of Materials Processing in Space, was forwarded to me, since I am directing a program in the Processing of Extraterrestrial Materials for Dr. Carruthers at the Jet Propulsion Laboratory of the California Institute of Technology. Please accept my apologies for the delay in my response.

Our program is presently focused at the definition of feasible and promising processes for the extraction of useful materials from the mineral resources of the asteroids, the moon and the mars system. The predominant raw material is in the form of silicates of variable metal oxide content totaling approximately 81%, while the rest is made up of free metals (Fe, Ni) and approximately 6% FeS. This composition applies to the majority of the asteroids, our moon and very likely also to the Mars moons. Some asteroids also contain variable amounts of chemically bound water (1-20%) and a few percent of bound carbon. There are, finally, some so-called Iron and Stony Iron asteroids which exhibit high amounts of free metals (up to 98%).

Since silicates represent the predominant raw material resource of the asteroids and the exclusive resource of the moon, we are attempting to devise processes for the extraction of metals from these metal-oxide assemblages. Conventional chemical processes as practiced on earth are impractical since they would require the costly supply of such processing agents as carbon, chlorine or water from earth. This implies utmost reliance on extraterrestrial resources, primarily the unlimited high vacuum and solar energy as well as low gravity conditions.

One process concept which we are presently evaluating and which is exclusively based on the use of vacuum and solar (-electric) energy is what we call "vapor-phase reduction". It consists of the vaporization and dissociation of the oxides, followed by the extraction of individual metal species (as well as oxygen) by fractional distillation, or by electrostatic and electromagnetic means in the case of an ionized vapor. This places the



Dr. C. D. Assoun

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January 15, 1981

process in the realm of plasma physics. The generation of a plasma further offers attractive advantages in high-temperature containment and manipulation as practiced in nuclear fusion.

I am enclosing a short description of three potential process concepts. Please regard the sketches only as illustrations of the basic concepts and not as apparatus designs. They do not yet include plasma techniques and we would be grateful for your views on (1) the feasibility of using plasma techniques and (2) the research work which would be required, particularly on such subjects as:

- o generation of and characteristics of the plasma
- o containment and manipulation
- o selective extraction of individual metals, preferably deposition in a specific shape, which may directly be used as a thin-wall structural element.

I wish to thank you for your interest in our endeavors and look forward to your response and to the establishment of an active dialogue. I may add that I used to speak french fluently years ago. While I lack the practice to write you in french, I expect no problems of reading any papers or reports which you may send me.

With best regards.

Sincerely,

Wolfgang H. Steurer
Program Manager
Extraterrestrial Materials
Processing

WHS/sm