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INSTITUTE FOR PURE AND APPLIED PHYSICAL SCIENCES

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February 9, 1983

As a final report on Grant #NASA NGL-05-009-002, Condensation of solids in space - isotope fractionation in the model system C-O, I should like to attach the following documents:

1) Modified version of the research section of our last proposal submitted for this work, and reporting the experimental breakthrough on the problem at hand; chemical fractionation of the single isotope ^{16}O under simulated space conditions. These results provide the first experimental proof of the main theme pursued over the last few years. What we have proposed is that the oxygen isotopic anomaly (and other similar anomalies), seen in meteorites, is unlikely to be of nucleosynthetic origin as is commonly thought, but is a product of chemical fractionation in interstellar or circumstellar space.

2) A recent published article discussing this problem further.

3) A manuscript in preparation outlining the quantitative radiophysical details.

As you know, we had to discontinue this work because of the expressed feelings in the peer review that such effects could not possibly exist, and that continued support of this project would thus be a wasted effort.

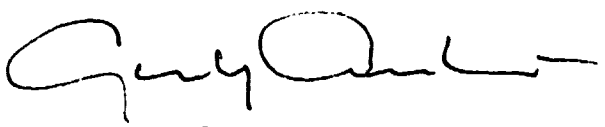
It is little consolation that subsequent developments have fully proven the correctness of our proposal, including the importance of isotopic filtering effects in the earth's atmosphere outlined in our proposal of 1981, and published by Cicerone and McCrumb, the latter as a member of our research group. Furthermore, the filtering effect on single oxygen isotope fractionation was discovered in the actual space medium by Bally and Langer last year; and the effect of resonance excitation by H Lyman α radiation has been corroborated by astronomical observation (Gahm et al; see references in attached articles).

Finally, and most strikingly, the work initiated under the present grant has after its demise fortunately been taken up by Prof. M. Thiemens of this campus, who by means of elegant experiments recently has been able to simulate the chemical fractionation effect of pure ^{16}O at a level, fully corresponding to the effect seen in meteorites, and leaving no doubt about the exclusive importance of this effect. I am attaching a newspaper article from the Los Angeles Times announcing this success (scientific articles are at the present time in press in the Journal of Chemical Physics and Science).

Although much remains to be done to further clarify the physical and chemical processes involved and their counterparts in the space medium, the matter is now in principle established, and the major goal of our five-year research in this field fulfilled. We would naturally have been happy to see the most recent step in this effort have been taken as a result of NASA support in our group; however, we are for the sake of science and the vindication of our concept of course happy to see it coming to fruition also in this way.

I find it symptomatic that foresighted understanding and support of our effort was during the lifetime of this project provided by NASA's scientific research monitor in this field in spite of the lack of understanding, and in some cases outright rejection from academic referees. We wish to take this opportunity to convey our thanks particularly to Dr. W. Quaide for his most profound insight and help, and to NASA for continuing support over many years.

Sincerely,



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Grant No.: NGL05-009-002
Principal Investigator: Gustaf Arrhenius

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