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NASA RESEARCH GRANT NGL 05-007-003

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SEMIANNUAL REPORT FOR PERIOD

MARCH 1, 1971 THROUGH AUGUST 31, 1971

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THE UNIVERSITY OF CALIFORNIA, LOS ANGELES

INSTITUTE OF GEOPHYSICS AND PLANETARY PHYSICS

NASA RESEARCH GRANT NGL 05-007-003

SEMIANNUAL REPORT FOR PERIOD

MARCH 1, 1971 through AUGUST 31, 1971

Submitted by

W.F. Libby, Institute of Geophysics and Planetary Physics

**UNIVERSITY OF CALIFORNIA
LOS ANGELES**

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INTRODUCTION

As the Sustaining Grant Program nears completion, it becomes even more evident that the step-funding arrangement, designed by NASA was an outstanding program for furthering research. While we are not supporting any new programs, we are able to continue support for ongoing programs.

We have made some additions to the crystal growing laboratory which will enable us to use the UCLA cyclotron for the analysis of smog particles.

The new doctoral program in Environmental Science and Engineering is progressing through the academic committees for approval. The initial support for this program, directed by Dr. Willard Libby and Dean Chauncey Starr, was from the NASA 05-007-003.

We are now receiving support from the National Science Foundation as well as several private foundations.

Professor Coleman's group is continuing work in the applications of Space Technology to everyday problems. Their work with the UCLA hospital is increasing and several proposals have been submitted with them. Discussions have also begun with our seismologists to see if some techniques might be helpful in the area of earthquakes

MAGNETICALLY SHIELDED TEST FACILITY

P.Coleman

448623

The magnetic test facility has been used during the reporting period for testing magnetometer sensors and the prototype magnetometer instrument for the Applications Technology Satellite F spacecraft. Developmental prototype and flight unit qualifications and acceptance testing was performed for the Apollo 15 and 16 subsatellite magnetometer.

ELECTROCHEMICAL STUDIES RELATED TO SYNTHETIC NITROGEN FIXATION

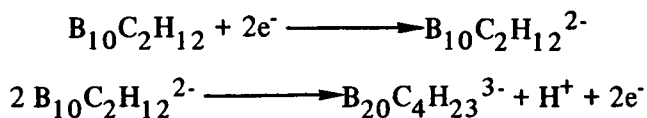
M.F. Hawthorne and R.J. Wiersema

448612

The study of nitrogen fixation by transition metals has been a topic of great interest and accordingly the number of people who are studying this process has increased. Consequently, it was felt that the direction of this project should be shifted to investigations of a more important and unique nature. The emphasis has now been placed on the study of the electrochemistry of carboranes ($B_{10}C_2H_{12}$), monocarbon carboranes (B_9CH_{10}) and the preparation of tumor specific boron containing materials for use in neutron-capture cancer therapy.

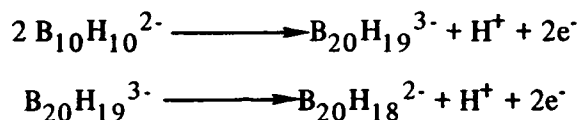
The project involving neutron-capture cancer therapy has been very successful in its preliminary stages. The results of these preliminary investigations using *in vitro* systems are summarized in the enclosed preprint of a manuscript. Further studies of this application are anticipated and will focus on *in vivo* studies using transplantable tumor systems.

1, 2- $B_{10}C_2H_{12}$ undergoes a two-electron reduction to form $B_{10}C_2H_{12}^{2-}$, which forms complexes with various transition metals. Preliminary results indicate that the $B_{10}C_2H_{12}^{2-}$ ion prepared electrochemically can be oxidized to yield a product containing coupled carborane cages, according to the following scheme

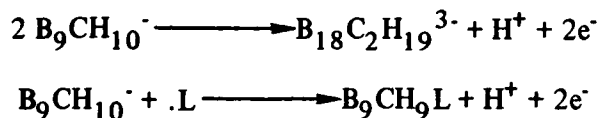


The present studies which have concentrated on $B_{10}C_2H_{12}$ will be extended in the future to include $B_8C_2H_{10}$, $B_7C_2H_9$, and $B_6C_2H_8$

It has been demonstrated in the past that $B_{10}H_{10}^{2-}$ can be oxidized chemically and electrochemically to yield $B_{20}H_{19}^{3-}$ and $B_{20}H_{18}^{2-}$ according to the following scheme.



The isoelectronic $B_9CH_{10}^-$ can be oxidized electrochemically with [$E_{p/2} = +1.65v$ $E_{p/2}(B_{10}H_{12}^{2-}) = +0.45v$]. The possible oxidation products are shown below



If the coupling product is obtained this will again afford, as in the oxidation of $B_{10}C_2H_{12}^{2-}$, new carborane species to be investigated.

A HISTOCHEMICAL METHOD FOR THE DETECTION OF LEAD IN LIVING PLANT TISSUE

R. Glater

A quick, simple method for identifying and distinguishing lead from other heavy metals in living plants has been developed using sodium rhodizonate ($C_6O_6Na_2$) which forms a scarlet precipitate with lead at approximately 2.8 pH. Hand sections of plant tissues are treated with rhodizonate reagent, buffered, and examined microscopically. Very little time and/or effort is required for this method. Those cells and tissues contaminated with lead turn scarlet – color intensity being directly related to concentration. Lead may be detected in quite low concentrations and, most importantly, may be observed *in situ*, its entry and movement through the plant can thus be followed. In a moderately trafficked area of Downey, California (Southeast Los Angeles), lead was found abundantly on leaves as well as *on* and *in* roots of garden-grown lettuce; origin of this lead is presumed to be from car exhausts

DIAMOND-CEMENTING

J.C. Haygarth and H. Katzman

448622

Our colleague Professor G.C. Kennedy has applied to the National Science Foundation for a large press with which we could manufacture large pieces of the cobalt bonded diamond material so its properties can be tested better with some actual applications. We would be most pleased to collaborate with governmental and industrial groups interested in testing potential uses. Those that have been suggested so far are

1. To build the million atmosphere laboratory press lining the conventional tungsten carbide
2. Machine tools
3. Well drilling bits

ANALYSIS OF THE SOLAR WIND USING WASHINGS OF THE LUNAR FINES

W.F. Libby, P. Payton, J. Verba and J. Arnold (UCSD)

448617

For some months we have been planning and have begun execution of an attempt to analyze the non-volatiles in the Solar Wind by use of gentle washings of the Lunar Fines. The hope is

that the tiny craters made by each atom would leave that atom accessible to mild leaching solutions such as warm water or ethyl alcohol or weak acids and bases. The studies of these craters made by Price and co-workers and Lal and co-workers reveals them to be about 0.2 microns deep. The long exposure times should have left measurable amounts of many of the ordinary elements assuming the solar wind to have the cosmic abundance. Our main effort to date has been to develop the most sensitive analytic techniques, atomic absorption, neutron activation and proton excited x-ray fluorescence.

ENVIRONMENTAL SCIENCE AND ENGINEERING

W.F. Libby

448627

This graduate program has progressed tremendously during the past year. The proposal to the University's academic committee has been submitted, and the comments we received have been favorable.

Twenty-two students, enrolled in various departments, are participating this year – eight being on fellowships from the Scafe Family Charitable Trust of Pittsburgh.

This past summer, two experiments on the third year, problem solving course were run with support from the Scafe Family and the Environmental Protection Agency. The areas being studied were, "Air Pollution – Urban Land Use" and "Mahbu Watershed Management." The results of the latter are the basis of a new research proposal in conjunction with the Las Virgines Municipal Water District.

Major support for the first year is coming from a grant from the National Science Foundation with strong indication of additional funding for the second and third years.

PUBLICATIONS

Katzman, H. and Libby, W.F.
Sintered Diamond Compacts with a Cobalt Binder

Libby, W.F.
Promising Catalyst for Auto Exhaust

Libby, W.F.
**Terrestrial and Meteorite Carbon Appearing to Have the Same
Isotopic Composition**

Libby, W.F. and Corneil, P.
Water on Venus?

Seckback, J., and Libby, W.F.
Planetary Atmospheres