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Publications of the Exobiology Program for 1986

A Special Bibliography

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INTRODUCTION

The Exobiology Program, within the Office of Space Science and Applications of the National Aeronautics and Space Administration, is an integrated program to investigate those processes that may have been responsible for or related to the origin, evolution, and distribution of life in the universe.

This report contains a listing of 1986 publications resulting from research supported by the Exobiology Program. Our intent in compiling this report is twofold: We want to provide the scientific community with an annual publication listing (as we have done since 1975) of current NASA-supported research in this field, and we hope to stimulate the exchange of information and ideas among scientists working in the different areas of the program.

Research supported by the Exobiology Program is explored in the areas of ***Cosmic Evolution of Biogenic Compounds, Prebiotic Evolution, Early Evolution of Life, and Evolution of Advanced Life.*** Pre-mission and pre-project activities supporting these areas are supported in the areas of ***Solar System Exploration and Search for Extraterrestrial Intelligence.***

EACH AREA IS DEFINED AS FOLLOWS:

COSMIC EVOLUTION OF BIOGENIC COMPOUNDS focuses on the history of the biogenic elements (C,H,N,O,P,S) and their compounds in the galaxy and the early solar system. This includes: (1) tracing the physical and chemical pathways taken by the biogenic elements and their compounds from their origins in stars to their incorporation in the pre-planetary bodies; (2) determining the kinds of measurements that can be made on the biogenic elements and compounds in the galaxy and solar system and the prebiotic evolution and origin of life; (3) determining the ways in which the physical and chemical properties of the biogenic elements and compounds may have influenced the course of events during the formation of the solar system and the component bodies.

PREBIOTIC EVOLUTION involves research and analysis in two major areas: (1) the consequences of planetary evolution on the physical environments of the Earth and planets, and (2) the evolution of molecules and molecular systems under the constraints imposed by physical environment and the appearance, a posteriori, of living systems on Earth. It also assesses the importance of the physical-chemical processes associated with the dynamic development of planetary surfaces.

EARLY EVOLUTION OF LIFE focuses on the nature of the most primitive organisms, determining the environment in which they evolved, and the way in which they influenced that environment. Investigations are executed through the use of the molecular record in living organisms and the geological record in rocks. These records are used to determine when and in what setting life first appeared; to determine the characteristics of the first successful

living organisms; to understand the phylogeny and physiology of microorganisms that inhabit hydrothermal areas now thought to be analogs of primitive environments; to determine the original nature of biotic energy transduction, membrane function, and information processing through study of extant microbes; and to elucidate the physical, chemical, and biotic forces operating on microbial evolution.

EVOLUTION OF ADVANCED LIFE examines the influence of astrophysical, stellar and solar system events on the evolution of advanced life on Earth. Research in this area also attempts to develop a program plan for a paleontological data base; to understand possible evolutionary pathways for advanced life; and to investigate ancient atmospheres.

SOLAR SYSTEM EXPLORATION focuses on providing specific information on the elemental and chemical composition, mainly in respect to gases and volatiles, of the atmospheres and surfaces of solar system bodies, including planets and their satellites, comets, asteroids, meteorites, and dust in space. Improved methods, instrumentation, and experiments will be developed for in situ chemical analyses of the volatile species associated with the bodies to be investigated.

SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) involves the search for extraterrestrial intelligent life by detecting signals in the electromagnetic spectrum. Principal emphasis has been on technology development for the microwave observing project.

This bibliography is divided into the six areas noted above. Within each research area, references are listed alphabetically by author. Authors who are principal investigators are identified by an asterisk. In addition, current addresses for all Principal Investigators are given in the Appendix.

We wish to thank all the participants in the Exobiology Program for their cooperation in responding to our request for a listing of their 1986 publications. We also wish to thank Janice Susan Wallace for her editorial and technical assistance and John Bourdeau and Janet Vaughn Powers for their technical assistance.

John D. Rummel
Exobiology Program Manager
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