

内閣総理大臣
鈴木 善 幸 殿

日本学術会議会長
伏 見 康 治

国際リソスフェア探査開発計画（DEL P）の
実施について（勧告）

標記について、日本学術会議第83回総会の議決に基づき、
下記のとおり勧告します。

記

国際学術連合会議（ICSU）は1980年9月総会で、固体地球科学に関する新しい長期計画として、国際リソスフェア探査開発計画（Dynamics and Evolution of the Lithosphere Project，略称DEL P）を国際的協力により推進することを決定した。我が国の研究者も国際的立案の段階からこの開発計画の審議に参画してきたが、この国際協力事業に我が国の研究者を参加させることはその意義がきわめて大きいものと考えられる。したがって、その国際的かつ学際的事業を成功させるた

めに，政府は国際リソースフェア探査開発計画（D E L P）の我が国での実施について必要な予算措置等を講じられたい。

本信写送付先

大 蔵 大 臣

文 部 大 臣

通 商 産 業 大 臣

運 輸 大 臣

郵 政 大 臣

建 設 大 臣

科学技術庁長官

海上保安庁長官

気 象 庁 長 官

(説明)

固体地球科学は、1960年代の国際地球内部開発計画(Upper Mantle Project, U M P), 1970年代の国際地球内部ダイナミックス計画(Geodynamics Project, G D P)を契機として、最近約20年間に革命的進展をとげた。すなわち、大陸移動・海底拡大などの確証と、いわゆるプレート・テクトニクス確立はその最大の成果である。

I U G G (国際測地学地球物理学連合)とI U G S (国際地質科学連合)は、U M P, G D Pのもたらしたこれらの著しい成果を高く評価し、1980年代においても周到な準備の下に国際的かつ学際的研究計画が実施されるべきであるとの合意に達し、1977年以来その準備作業をおこなってきた。母体機関である国際学術連合会議(I C S U)は、1980年9月の総会においてI U G G, I U G Sの両連合にまたがる連合間リソスフェア委員会(Inter-Union Commission on the Lithosphere, I C L)を設置し、両連合が策定した国際リソスフェア探査開発計画(Dynamics and Evolution of the Lithosphere Project, D E L P — the framework for earth resources and the reduction of hazards)の推進をはかることを決定した。さらにI C S Uは各国家会員に対してD E L Pへの参加および国内委員会の設置を要請した。

我が国は、U M P, G D Pを通じ固体地球科学の発展に多大の貢献をしてきた実績があり、その上、プレート・テクトニクスにおけるもつとも基本的なプロセスであるプレートの沈み込み帯上に位置する数少ない地学先進国でもある。このような特殊性を考慮すれば、我が国の研究陣が1980年代の固体地球科学研究に

主要かつ指導的役割を果たすべき立場にあることは明らかである。
我が国の D E L P への参加が強くのぞまれるところである。

D E L P 計画は要約すれば、海洋地域のプレートのみならず、大陸や大陸縁辺部のリソスフェアの現状、起源、進化、運動を、学際規模で解明しようという国際協同研究計画であり、その内容は、

- 1 大陸リソスフェアと海洋リソスフェアの比較とその差異の原因を明らかにする。
- 2 プレート相対運動を直接に測定し、プレート運動の原動力を明らかにする。
- 3 プレートが剛体であるという仮説の限界を明らかにし、プレート内の変形、火成活動を解明する。
- 4 プレート境界での物理的・化学的過程を解明する。
- 5 リソスフェアの進化をつかさどる地球内部物性および諸過程を解明する。
- 6 この計画の成果を、地震予知、火山災害の軽減等人類社会に有用な応用面にまで深化させる。

などの目標を追求することによつて、プレート・テクトニクス的主張と、それにもとづく帰結を、検証してゆくことである。これらの目的を達成することは、エネルギー・鉱物資源の発見・利用、災害の軽減、自然環境の保全など、人類の直面する重大問題を解決するうえでの基礎を樹立することにもなる。また、発展途上国の地球科学の振興に資することも、D E L P 計画の大きな目標の一つとなつている。

なお、D E L P 計画は、1 9 8 0 年代の1 0 カ年を研究実施期間とすることがI O L によつて勧告され、5 年目には徹底した成果の評価が予定されている。

(添付資料)

1. 要 旨
2. I C S U 会長、I C L 委員長からの来信、および
D E L P 国際計画の要旨
3. U M P 計画、G D P 計画、D E L P 計画の関連
4. 国際リソースフェア探索開発計画 (D E L P) 研究計画
5. 観測船航海計画
6. 研究経費の概要
7. 研究項目および主要な参加機関

資料1 要 旨

固体地球科学は、最近約20年間に革命的進展をとげた。すなわち1960年代の国際地球内部開発計画(*Upper Mantle Project, UMP*)、1970年代の国際地球内部ダイナミクス計画(*Geodynamics Project, GDP*)期間に達成された、大陸移動・海底拡大などの確立と、いわゆるプレート・テクトニクスの確立である。

IUGG(国際測地学地球物理学連合)とIUGS(国際地質科学連合)は、UMP, GDPのもたらした、これらの著るしい成果を高く評価し、1980年代においても周到な準備の下に国際的学際的研究計画が実施されるべきであるとの合意に達し、1977年以来その準備作業を行なってきた。母体機関である国際学術連合会舘(ICSU)は、1980年9月の総会においてIUGG, IUGSの両連合にまたがる連合間リソスフェア委員会(*Inter-Union Commission on the Lithosphere, ICL*)を設置し、両連合が策定した国際リソスフェア探索開発計画(*Dynamics and Evolution of the Lithosphere Project, DELP - the framework for earth resources and the reduction of hazards*)の推進をはかることを決定した。さらにICSUはその会長名において各国家会員に対してDELPへの加入及び国内委員会の設置を要請した。

我が国は、UMP, GDPを通じ、固体地球科学の発展に多大な貢献をなしてきた。その上、プレート・テクトニクスにおける最も基本的プロセスであるプレート沈み込み帯上に位置する数少ない地学先進国でもあり、1980年代の固体地球科学研究に、我が国の研究陣が、主要かつ指導的役割を果たすべき立場にあることは明らかである。我が国のDELPへの参加が強くのぞまれるところである。

DELP計画は要約すれば、海洋地域のプレートのみならず、大陸や大陸縁辺部のリソスフェアの現状、起源、進化、運動を、学際規模で解明しようという国際協同研究計画であり、その内容は、

1. 大陸リソスフェアと海洋リソスフェアの比較とその差異の原因を明らかにする。
2. プレート相対運動を直接に測定し、プレート運動の原動力を明らかにする。
3. プレートが剛体であるという仮説の限界を明らかにし、プレート内の変形、火成活動を解明する。
4. プレート境界での物理的・化学的過程を解明する。
5. リソスフェア進化の定量的モデルを樹立する。

などの目標を追求することによって、プレート・テクトニクス的主張と、それにもとづく帰結を、検証してゆくことである。これらの目的を達成することは、エネルギー・鉱物資源の発見・利用、災害の軽減、自然環境の保全など、人類の直面する重大問題を解決する上での基礎を樹立することにもなる。又、発展途上国の地球科学の振興に資すること、D E L P計画の大きな目標の一つとなっている。

資料2 ICSU会長, ICL委員長からの 来信およびDELP国際計画の要旨

International Council of Scientific Unions

Paris, March 1981

FROM: The President of ICSU

TO: National Members of ICSU

In September 1980, the Eighteenth General Assembly of ICSU approved the establishment of the Inter-Union Commission on the Lithosphere, with the objective of undertaking an international program of interdisciplinary research for an improved understanding of the earth, especially those aspects on which human society depends for its well-being. The program -- "Dynamics and Evolution of the Lithosphere: The Framework for Earth Resources and the Reduction of Hazards" -- is concerned primarily with the current state, origin, evolution, and dynamics of the lithosphere, with special attention to the continents and their margins. One special goal of the program is the strengthening of interactions between basic research and the applications of geology, geophysics, geochemistry, and geodesy to mineral and energy resource exploration and development, to the mitigation of geological hazards, and to environmental maintenance; another special goal is the strengthening of the earth sciences and their effective application in developing countries.

The Inter-Union Commission on the Lithosphere has a constitution which encourages the active participation of all interested countries and all interested ICSU Unions and Committees. The Commission consists of a seven-member Bureau appointed by IUGG and IUGS, the leaders of the scientific Working Groups and Coordinating Committees that will implement the international program, representatives of associated Unions and

ICSU Committees, and liaison representatives as approved by the Bureau and the sponsoring Unions.

The Bureau of the Commission met in December 1980 to establish the general organization of the program, including the leadership and the terms of reference of the scientific Working Groups and Coordinating Committees. The report of that meeting is appended to this communication. The first meeting of the Commission, scheduled for July 1981, will be concerned with further development of the program, and will provide an opportunity to take account of advice and recommendations offered in response to the December 1980 report of the Bureau and the August 1980 report of the joint IUGG-IUGS Steering Committee that was submitted to ICSU and which is also appended to this communication.

ICSU considers the study of the lithosphere to be one of the most important scientific activities for the future of mankind. Therefore, National Members of ICSU are invited to encourage and support the participation of their scientists in the Lithosphere Program; and, through their appropriate national committees, to establish national committees for the Lithosphere Program that will foster the active collaboration of geologists, geophysicists, geochemists, and geodesists and other interested scientists in pursuing the goals of the Lithosphere Program.

The schedule for the Lithosphere Program calls for a formal synthesis and evaluation of the principal achievements to be submitted to the sponsoring unions in 1985, for review and transmittal to ICSU. The evaluation is to include specific recommendations, as warranted, for changes in the organization and activities, but not the basic objectives, during the second half of the program.

Copies of this letter are being sent to the several ICSU Unions and Committees which have an active interest in problems of the solid earth -- IUGG, IUGS, IGU, IUPAC, IUPAP, IAU, IUTAM, SCAR, SCOR, COSPAR, SCOSTEP, SCOPE, COSTED, CODATA, INQUA,

IAB, and the WDC Panel -- with the suggestion that they forward copies to their national members. ICSU hopes that national committees and projects for the Lithosphere Program can be established with fullest cooperation among all the scientific groups interested in the problems of the earth's interior.

Signed: D. A. Bekoe
President, ICSU

INTER-UNION COMMISSION ON THE LITHOSPHERE

Kingston (Ontario), September 1980

To: National Members of ICSU

and National Members of IUGG, IUGS, IGU IUPAC, IAU, CCMP,
COSTED, SCAR, SCOPE, SCOR

This new international interdisciplinary research program, which has been established by ICSU in response to a joint proposal from IUGG and IUGS, will build upon the scientific achievements and the spirit of international interdisciplinary cooperation that were fostered by the Geodynamics Project, in an attempt to meet some of the new challenges of the 1980's. The Geodynamics Project was concerned with the dynamic processes that have shaped the earth's surface. It coincided with a conceptual renaissance that affected virtually every branch of the solid earth sciences, and was focussed in the plate tectonic theory, particularly its application to the evolution of the ocean basins. Its role in fostering the international interdisciplinary cooperation for this scientific renaissance cannot be overemphasized.

The earth sciences are approaching, for the first time, a consistent comprehensive perception of how the earth works. The earth is now seen as a dynamic body, undergoing convection that is driven by its internal heat, and is expressed at the surface as relative velocities of only a few centimeters per year, which, although seemingly insignificant, produce very significant results over intervals of many millions of years. It is generally accepted that new ocean crust is created where hot, buoyant material from the earth's mantle rises to the surface and

spreads laterally in the form of rigid plates of young cooling oceanic lithosphere, and that older ocean floor is destroyed where older, colder plates of lithosphere sink back into the mantle. Continents are fragmented along rift zones, and the fragments drift apart as ocean basins form between them; but they grow by accretion where fragments collide and become welded together when intervening ocean basins disappear. The oceanic lithosphere, which underlies about 70% of the earth's surface, is viewed as the upper boundary layer of the convective circulation. It cools, contracts, and subsides as it flows away from the zone of upwelling. This simple model readily accounts for the observed variation in heat flow, elevation, and age of the ocean floor, and also for the otherwise perplexing observation that virtually all of the rocks sampled on the ocean floor are less than 200 million years old and therefore, formed during the last 5% of the earth's history.

Although our understanding of the ocean basins is far from complete, the success of the plate tectonic theory has focussed attention to the continents, which because of their different composition, have a lower mean density, remain buoyant in the mantle, and survive over major portions of the earth's history. If the old oceans have vanished forever, it is the continents that contain what remains of the first 95% of the earth's history. But the continents contain superimposed records of a multitude of thermal and deformational episodes. The evolutionary history of the continental lithosphere is complex, and is much less well understood than even the imperfect evolutionary history that has been outlined for the oceanic lithosphere. One of the principal motives behind the Lithosphere Program is to fill this great gap in our knowledge of the part of the earth that has provided virtually all of our mineral and energy resources, and the space in which we live.

Thus the central theme of this new program is the elucidation of the nature, dynamics, origin, and evolution of the lithosphere, with special attention to the continents and their margins. Further investigation of the suboceanic lithosphere will be required; and it is obvious that a full understanding of

the lithosphere will require further research on the structure and composition of the deep interior of the earth and the processes that operate there.

The uniformitarian dictum, that the present is the key to the past, obviously will provide one important starting point for analyzing the evolution of earlier Precambrian lithosphere, but another important starting point is comparative planetology, and the application of new knowledge concerning the moon and planets to the analysis of the early stages of terrestrial evolution. The identification and analysis of ancient heterogeneities involving the earth's continental lithosphere may be a matter of considerable practical significance as it relates to metallogenic provinces.

The special goals of the Lithosphere Program involve a particular effort to extend the scope of participation in the program so as to benefit both the program and the additional participants. Productive interaction between basic research and applications in mineral and energy resources exploration and development, and in environmental geosciences, represents one example; participation of geologists, geophysicists, geochemists, and geodesists in developing countries is another.

The key of the success of the entire program is international interdisciplinary participation. International working groups and coordinating committees are being established by the Inter-Union Commission on the Lithosphere. Each will involve a task that requires international interdisciplinary cooperation. National committees that coordinate interdisciplinary participation in individual countries can develop and coordinate national programs and provide liaison with the international program.

The Inter-Union Commission on the Lithosphere seeks the views of scientists and national and international scientific organizations concerning the various aspects of the Lithosphere Program as outlined in the enclosed documents. We request

careful thought and recommendations on the development, organization, and implementation of the program. We seek to establish liaison with prospective participants, and we urge organizations to respond as soon as possible.

Responses should be directed to Dr. Edward A. Flinn, Secretary-General of the Inter-Union Commission on the Lithosphere, c/o NASA Headquarters (Mail Code ERG-2), Washington, DC 20546, USA.

We look forward to hearing from national committees for the Lithosphere Program. Prior to the formal establishment of such national committees, we urgently request the designation of a national correspondent who can maintain communication with the Inter-Union Commission on the Lithosphere on behalf of scientists and scientific organizations in his or her country.

Signed: Raymond A. Price
 President, Inter-Union Commission on the Lithosphere

DYNAMICS AND EVOLUTION OF THE LITHOSPHERE

The Framework for Earth Resources and the Reduction of Hazards

INTRODUCTION

This new international interdisciplinary research program in the solid earth sciences was established in September 1980 by the International Council of Scientific Unions at the request of the International Union of Geological Sciences and the International Union of Geodesy and Geophysics. It seeks to provide an improved understanding of the development of the Earth, especially those aspects on which human society depends for its well-being.

The main objective of the program is the elucidation of the nature, dynamics, origin, and evolution of the lithosphere, with special attention to the continents and their margins. Investigations of the lithosphere beneath the oceans, and of the parts of the Earth below the lithosphere will also be required in order to meet the scientific objectives of the program. The problems to be investigated are global and interdisciplinary in scope. International cooperation, involving the coordinated efforts of geologists, geophysicists, geochemists, and geodesists will be required to solve these problems. The full scientific potential of the program can only be achieved with the participation of scientists who are concerned primarily with applications of geology, geophysics, geochemistry, and geodesy, and of scientists from the developing countries.

The strengthening of communication and mutual cooperation between geoscientists whose activities are primarily in the applied fields, and those in basic research, is a special objective of the program. Scientists with primary interests in applications of the earth sciences have been active in the

planning of the program, and will be involved in its implementation. In addition to purely scientific achievements, the research will contribute knowledge and techniques needed in the search for additional supplies of non-renewable energy and mineral resources and in their optimum utilization; but at the same time, the research program will benefit from the detailed knowledge of the nature and evolution of the outer part of the Earth's lithosphere that has been accumulated in the course of exploration for and development of mineral and energy resources.

The assessment, prediction, and mitigation of geological, geophysical, and geochemical hazards, natural and induced by human activities, is another of the principal areas of immediate applicability of the research results to be achieved under this program. The research will contribute to the development of improved methods for assessing the most likely locations of future great earthquakes and volcanic eruptions, and perhaps of better ways of estimating the time intervals between their occurrence. It will also support other research directed to learning how to make timely forecasts of specific events.

Human activity has become a prominent geological force. The impact of man on the surficial portion of the lithosphere is now comparable with the results of natural geological processes. The rational use and protection of the environment requires a full understanding of the intricate relationships among the component parts of lithosphere, hydrosphere, biosphere, and asthenosphere, and of the influence of human activity on these. The research planned as part of this program will contribute to this understanding. The program will provide the framework within which force systems, hazards, and environmental problems are investigated and understood.

Another area of special concern to the program is the strengthening of geology, geophysics, geochemistry, and geodesy in the developing countries. Because the earth sciences contributes to societies in essential ways, especially with regard to resource development and environmental management, it

is important that these disciplines be encouraged in countries striving toward full development. The research in the Lithosphere Program will require data and analysis from all parts of the world, and therefore, the coordination and integration of facilities and talents in diverse disciplines from many countries, including those in which the earth sciences are not yet fully developed. Specific projects that will contribute to the achievement of the program goals will be designed to be carried out within the technical and financial capabilities, and the national interests, of the developing countries.

The International Lithosphere Program is organized around a series of nine scientific Working Groups, each of which will approach a group of scientific problems that require, in an essential way, an interdisciplinary and international effort for their resolution. Some of the working groups are concerned primarily with processes that operate now; others are concerned with changes that have occurred in the Earth during its long history.

Eight Coordinating Committees have been established to foster integration within the whole program, to facilitate participation of earth scientists from developing countries and those earth scientists who are concerned primarily with applications, and to promote regional international interdisciplinary cooperation. Lists of the Working Groups and Coordinating Committees are given on the next page, and their Terms of Reference are given in the next section of this Report.

Working Groups

1. Recent Plate Movements and Deformation
2. Phanerozoic Plate Motions and Orogenesis
3. Proterozoic Lithospheric Evolution
4. The Archean Lithosphere
5. Intraplate Phenomena
6. Nature and Evolution of the Oceanic Lithosphere

7. Paleoenvironmental Evolution of the Oceans and the Atmosphere
8. Subduction, Collision, and Accretion
9. Processes and Properties in the Earth that Govern Lithospheric Evolution

Coordinating Committees

1. Environmental Geology and Geophysics
2. Mineral and Energy Resources
3. Geosciences within Developing Countries
4. Evolution of Magmatic and Metamorphic processes
5. Structure and Composition of the Lithosphere and Asthenosphere
6. Continental Drilling
7. Data Centers and Data Exchange
8. Coordinating Committee of National Representatives

The program is being developed and administered by a Commission comprising a seven-person Bureau appointed jointly by the sponsoring Unions, the Chairmen of the nine Working Groups and Eight Coordinating Committees, and representatives of the sponsoring Unions, with participation of observers from other interested Unions and from UNESCO. The Bureau members at present are:

Raymond A. Price (IUGS), President
Edward A. Flinn (IUGG), Secretary-General
Eugene V. Artyushkov (IUGG)
Umberto G. Cordani (IUGS)
J. Henning Illies (IUGS)
Kurt Lambeck (IUGG)
Seiya Uyeda (IUGS and IUGG)

資料3 UMP計画, GDP計画と DELP計画との関連

経緯：これらの計画は，“地球”という対象を全世界の科学者の協同作業によって研究することが，極めて有効であるという認識にもとづく一連の国際協同研究計画であるが，その各々において画然たる目標を定め，著るしい成果をあげてきている。

UMP計画の目標と成果：

1960年代のこの計画では，大陸・大洋地域での地殻構造，地磁気重力，熱流量，堆積物，地質構造などの調査が主目標とされ，その結果，大陸移動，海洋底拡大などの現象が確立され，遂に，プレート・テクトニクスの考えが有力な仮説として提案された。

GDP計画の目標と成果

1970年代のこの計画では，プレート・テクトニクスの仮説の検証が主目標とされたが，深海掘削などとも協力して，その目標はほぼ完全に達成された。すなわち，過去約2億年間，海洋プレートがいかに運動してきたかが，検証されたのである。又，この成果にもとづいて，造山作用一般をプレート・テクトニクスの枠組において理解するという，統一モデル — 新しい地球観 — が提出された。

DELP計画の目標

新しい地球観モデルは，プレート・テクトニクスをその一部として含む，総合的モデルであり，DELP計画はこれを具体的に実証し，その成果を人類社会に有用な応用面にまで深化させようというものである。

この主目標のためには，

- ① 45億年に及ぶ全地球史の究明
- ② プレート運動の実測
- ③ プレートの生成，進化，消滅過程の物理・化学