NEWS IN BRIEF . . .

Duties of IUGS International Research Development Board Expanded

Revised terms of reference for the IUGS International Research Development Program (IRDP) were approved by the IUGS Executive Committee at its 24th session in Bonn, F.R.G. The Program was established by the 1980 IUGS Council at its VI Session in July 1980, to encourage and facilitate geological research, to advance fundamental geoscientific knowledge, and to aid the resolution of economic and social problems. It is intended to complement the funding of deserving and timely programs and to act as a catalyst for promising new projects.

The Advisory Board for Research Development, which manages the Program, will now maintain a watching brief on the ongoing scientific activities of IUGS and other organizations in order to identify possible gaps or opportunities. The Board will then make recommendations to the IUGS Executive Committee to redirect the efforts of existing IUGS programs and projects, initiate new activities, or formulate future research themes.

The Advisory Board will also design the scope and emphasis of the Program, encompassing the new initiatives proposed, and promote and manage a Research Trust Fund to finance these activities.

The Board currently gives priority to:

- activities related to identifying and assessing energy and mineral resources;
- initiatives related to fundamental geological concepts, geological hazards, and environmental concerns; socioeconomic problems; and

- new or continuing projects of special concern to developing countries.

In 1981, with an operating budget of \$30,000 (U.S.), the Program supported a number of ongoing activities, including IGCP projects on Phosphorites (No. 156), and Early Organic Evolution (No. 157), a COGEO DATA workshop on Petroleum Information Systems (SE Asia, December 1981), a regional study of tin and boron in the Lower Palaeozoic of Bolivia, and a meeting on the metallogeny of mafic and ultramafic rocks of the Circum-Caribbean, held in Guatemala in October, 1981.

Among other activities slated for 1982 are two coordinating meetings of the International Lithosphere Program, a Petroleum Resource Assessment Seminar and Workshop in Hawaii in August, several IGCP projects, a major project on basin analysis and hydrocarbon potential, regional tin projects in Latin America and SE Asia, and a paleogeographic map series of the Neogene of Central and Eastern Europe. A major effort will be undertaken to raise funds for the Program and to ensure that the membership of the Board includes both widely recognized scientific experts and successful managers of major scientific programs.

In addition to the Chairman, **Dr. W.W. Hutchison** (Canada), Board Directors now include: **Dr. G. Grasselly** (Hungary), **Prof. P.F. Howard** (Australia), **Sir P.E. Kent** (U.K.), **Dr. T. Nozawa** (Japan), **Mr. G.O. Kesse** (Ghana), and **Ing. G.P. Salas** (Mexico). IUGS President, **Dr. E. Seibold**, **Dr. C.C. Weber** (Secretary-General) and **Dr. J.A. Reinemund** (Treasurer) are ex-officio members of the Advisory Board.

EEC Establishes New Mineral Development Fund

Increasing concern about political instability and lack of investment in mining in developing countries has led the European Economic Community (EEC) to establish a Mineral Development Fund to protect its mineral supplies.

The EEC is heavily dependent on imports for many of its strategic minerals. It currently imports 95 per cent of its requirements of cobalt from a handful of developing countries in Africa, Asia and Latin America (66 per cent of this from Zambia and Zaire), 85 per cent of its tin, 68 per cent of its phosphates, 58 per cent copper, 57 per cent manganese and 38 per cent chromium. By contrast, the U.S.A., which imports 15 per cent of its raw materials and Japan, which imports 90 per cent of its mineral needs, secures these from a wider spread of supplier countries and regions.

SYSMIN, set up under the Lomé II convention, will extend to many African and a few other developing countries. A total of 280 million European Currency Units (ECUs) have been earmarked for specific projects, a third of which will go to Zambia and Zaire. The EEC is also planning to make longer-term financial and technical assistance available under SYSMIN. Eight minerals will be funded under this scheme - copper and cobalt (produced by Zambia, Zaire and Papua New Guinea), phosphates (Togo, Senegal), bauxite and alumina (Guinea, Jamaica, Surinam and Guyana), manganese (Gabon), tin (Rwanda) and iron ore (Mauritania and Liberia). Loans will be available at an annual interest rate of one per cent redeemable over 40 years with a 10-year period of grace.

Three conditions must be fulfilled before a country can benefit from SYSMIN. First, it must demonstrate that the mineral in question has accounted for 15 per cent or more of

its total exports over a four-year period, although for some of the poorer countries this will be lowered to 10 per cent. Second, the potential recipient must show that its production capacity or its ability to export to the EEC is liable to be reduced substantially (more than 10 per cent), thereby seriously endangering its own development plans. Third, this threat must be beyond the control of the producer nation. In some cases (e.g., Zaire) aid is conditional upon the recipient country agreeing to reform its taxation laws affecting the mining sector.

Groundwater Research Centre Updates Data Base

The International Groundwater Modeling Center (IGWMC), has just reorganized and updated its data base of groundwater model information. Many new models have been annotated, and some old ones have been replaced or deleted. The IGWMC clearinghouse currently has stored information on more than 400 groundwater models.

Coupled with its clearinghouse data base, IGWMC also has a search system that will provide answers to questions regarding existing models. In recent years, groundwater research has resulted in the development of many models, some based on new and advanced methods, while others emphasize model usability and versatility.

IGWMC is located in the Holcomb Research Institute, Butler University, Indianapolis, Indiana 46208, U.S.A.

Deep Heat in Oregon

Prospects for tapping geothermal energy in the NW United States received a boost recently with the discovery of the hottest geothermal temperatures in the country so far. Measurements taken by the United States Geological Survey (USGS) at a test hole drilled 810 m into the summit crater of Newberry Volcano in Oregon show that in the lower 165 m of the hole, temperature gradients were about 600°C per km.

Dr. Robert Tilling, chief of the USGS Office of Geophysics and Geochemistry, said the next step is to determine whether there is enough flow at the site to produce hot geothermal fluids at the volume and rate necessary for a power generating plant to convert the geothermal energy to electricity. If the high temperature gradient continues at lower depths, the potential for development may increase.

The discovery also supports a theory that low temperatures previously found at shallow depths in the nearby Cascade mountain range reflect the effects of shallow lateral flow of cool groundwater rather than the real geothermal potential. Similar results were reported in the Canadian Cascades mountains where geothermal temperatures in the Meagher Creek area of British Columbia were measured at more than 200°C.

(Geothermal Energy magazine)

New Transnational Company

Three national Latin American enterprises (Petroleos de Venezuela, Petroleos Mexicanos and Petroleos Brasileiros) have created a transnational oil exploration company that will allow them to compete with the giant North American and Anglo-Dutch oil companies.

Venezuelan President **Luis Herrera** said the company will be able to assist the region in oil exploration, production and technology. Venezuela, a founding member of the Organization of Petroleum Exporting Countries (OPEC), is Latin America's largest oil exporter. Although Mexico does not belong to OPEC, it is also a major oil producer. Brazil on the other hand is the largest importer of hydrocarbons in the region.

Petros and Martha

A vital aspect of the work of a geochemist studying the origin, evolution and interrelationships of different provinces is the ability to compare the results of geochemical analyses. Ways of doing this vary from ad hoc exchanges of data between individual researchers to setting up national or international geochemical data banks.

Petros is a data bank of major-element chemical analysis of igneous rocks. Analyses in Petros include percentages of SiO₂, Al₂O₃, Fe₂O₃, FeO, MgO, CaO, Na₂O, K₂O, H₂O⁺, H₂O⁻, TiO₂, P₂O₅, MnO, ZrO₂, CO₂, SO₃, Cl, F, S, Cr₂O₃, NiO, BaO. At least nine of these major oxides were determined for each analysis contained in Petros.

The data file also includes reference (author, date); geographic or petrologic major and minor province; latitude and longitude to the nearest degree; rock name; geologic age by era, period, or epoch; type of igneous rock body in which the sample occurs (flow, pyroclastic, plutonic, or altered); author's analysis number; analytical information; and sample

number within Petros. Data sources for Petros include published works and theses, as well as some unpublished analyses. It will be updated periodically as new data are published. When possible, errors discovered in the data are rechecked with the source.

A description of the organization of Petros is contained in Martha, another data bank. Martha has sample identification formats and codes, bibliographies giving the sources of analyses for each major group in Petros, and a program to list the contents of the Petros data bank. Petros is available on a single magnetic tape together with the Martha documentation file through: *U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, National Geophysical and Solar-Terrestrial Data Center, Boulder, Colorado 80303, U.S.A.*

Antarctic Mineral Exploration and Exploitation Assessed

Specialists who met in Nebraska in May 1981, at the request of the ICSU Scientific Committee on Antarctic Research (SCAR), reported on a model study to assess the possible impact of mineral (mainly hydrocarbon) exploration and exploitation in the Antarctic in terms of intensity, duration and extent.

Among the research areas they singled out as of major importance are:

- geology and geophysics of the Antarctic continental shelf;
- iceberg scour;
- hydrocarbon composition of the Antarctic environment;
- baseline survey of petrogenic hydrocarbon levels;
- behaviour of oil and dispersants in Antarctic seas and associated ice;
- microbial degradation of oil in the Antarctic environment;
- impact of oil, dispersants and detergents on Antarctic marine organisms;
- rates of reestablishment of disturbed Antarctic benthonic communities; and
- studies of oil-spill tracking and clean-up techniques that are especially relevant to Antarctic conditions.

In reviewing these recommendations for a model study, the SCAR executive urged the specialists to elaborate on some areas before submitting them to the Antarctic Treaty preparatory meeting on minerals, to be held in mid-1982 in New Zealand.

Indonesia Plans Krakatau Commemoration

The Indonesian Institute of Sciences (LIPI) is sponsoring a two-year program of expeditions and research to commemorate the 100th anniversary of the August 27, 1883, eruption of Mount Krakatau. The program will culminate in a symposium on or about August 27, 1983.

The scientific activities and the symposium will centre on volcanology and geology, marine and terrestrial biology, oceanography and social aspects related to the Mount Krakatau eruption which killed 36,000 people.

Scientists and institutions wishing to participate in the program and the concluding seminar should submit their proposals directly to: *Dr. D. Sastrapradja, Deputy Chairman for Natural Sciences, LIPI, JL. Teuku Chik Ditiro 43, Jakarta, Indonesia.*

LITHOPROBE – A Canadian Program of Deep Crustal Studies

The Canadian Committee for the Lithosphere Program (CANDEL) recently established a major research project which will involve university, government and industry geoscientists in a series of deep crustal studies along specific corridors in various parts of Canada. LITHOPROBE, a national project on a scale never before attempted, will use advanced high-resolution seismic techniques, deep drilling, computer-based interpretational methods, and geological models of the latest plate tectonic concepts to try to determine the third dimension of crustal geology.

It is well known that processes of continental separation, collision and aggregation have been complex. The continents contain 3 700 Ma years of the geological record, unlike the oceans where only the past 170 Ma years of earth history has been recorded. CANDEL scientists believe that continental tectonics is the major challenge to earth scientists in the 1980s, and that improved understanding of the dynamics and evolution of the continental lithosphere can only come from studies of the interrelationship between the deep structure of the lithosphere and surface geology.

In basic terms, solving key geological problems in continental regions requires knowledge of the geometrical configuration of major rock units so that similarities between surficial geological environments and those buried beneath the earth's surface - environments which may be host to economic resources - can be recognized.

As reported in the September, 1981, issue of *Geoscience Canada*, CANDEL suggests a number of LITHOPROBE transects within the Appalachian Orogen/Mesozoic Passive Margin, Arctic, Eastern Cordillera, Western Cordillera and Modern Pacific Margin, and the Precambrian Shield (Fig. 1). The initial phase will concentrate on onshore-offshore profiles of NE Newfoundland, and SE Cordillera.

LITHOPROBE will use high-resolution seismic reflection techniques - to date the only means available for determining three-dimensional crustal structure in the detail required. This method has produced spectacular results when used in several parts of the U.S.A. by COCORP, a research program for deep crustal studies. Since most seismic reflection

Location of proposed LITHOPROBE transects. Base map from *Geology and Economic Minerals of Canada* (ed. R.J.W. Douglas), Geological Survey of Canada, 1970.

surveys do not yield accurate velocity estimates, regional three-dimensional seismic refraction surveys (areal coverage with close receiver spacing) will be done across most LITHOPROBE targets.

Because of the cost of high-resolution seismic reflection and refraction technology and of more traditional geological-geophysical measurements, it is estimated that an initial capital investment of about \$5 million (U.S.) will be necessary, with each corridor costing an additional \$7.2 million on average. It costs about \$0.25 million to drill, core and log a 2-km hole on land; CANDEL will try to defray some of this cost by using existing and planned industry deep-drill holes as well as those drilled for the disposal of radioactive wastes. Five or six LITHOPROBE corridors could be completed within five years.

Mineral Investment Needs Projected

Recent low prices for metals and other nonfuel minerals reflect slower world economic growth in the 1970s than was once envisaged. Various projections now suggest, however, that by the mid-1980s mineral demand may be 25-40 per cent above its mid-1970s level; by the end of the century, it could be 90-190 per cent higher.

Considerable investment will be necessary to develop the capacity to meet the extra demand. The world total, including infrastructure and capacity expansion in minerals, may be \$12.5 billion a year (1977 U.S. dollars), and \$5.5 billion a year in developing countries for the rest of the century. It is estimated that three-quarters of the investment in developing countries will have to be financed externally.

Estimates of capital investment needed in the period 1977 to 2000 for additional capacity in some key "minerals" are shown in the following table:

"Mineral"	World (Billions of 1977 dollars)	Developing Countries
Bauxite	6.9	5.2
Alumina	24.4	6.1
Aluminum	76.6	17.6
Subtotal	107.9	28.9
Copper	58.0	29.0
Nickel	12.5	5.0
Iron Ore	98.2	31.4
Tin	1.7	1.4
Total	278.3	95.7

World Bank Development Report, 1981

Life in the Antarctic Cold Desert

Recent work by **Dr. E. Imre Friedman** (Florida State University, U.S.A.) has revealed that a variety of microorganisms live under the surface of rocks in the dry valleys of Antarctica. They colonize extensive areas, producing considerable biomass, and thereby exert an influence on the weathering processes in these ice-free "oases".

Dry winds descending from the Antarctic ice plateau create true desert conditions in an area up to 5 000 km² which is without snow or ice cover. Air temperatures range between 15°C and 0°C in the summer and go down to near -60°C in the winter. In summer the relative humidity ranges from 16 to 75 per cent. Although there is no visible sign of plant or animal life in this frigid desert, numerous microorganisms have been isolated from dry valley soils. Most, if not all of these, however, are derived from atmospheric contaminants carried by winds and they survive in the frozen soil without actively growing.

The principal habitat for life in the dry valley desert is a narrow 1-cm zone just under the surface of rocks which is colonized by endolithic microorganisms - cyanobacteria (blue-green algae) and lichens. Two types occur, chasmoendoliths which live in rock fissures and cracks, and cryptoendoliths which inhabit the structural cavities within and around crystals and grains.

The endolithic microbial communities have a photosynthetic primary producer. Only translucent rocks, such as Beacon sandstone, granite, granodiorite and marble, are suitable substrates; non-porous volcanic rocks (e.g., Ferrar dolerite) are not. The activity of cryptolithic lichens in sandstone results in a characteristic exfoliation; the cement between sandstone grains is apparently dissolved at the level of the lichens and the outer rock crust peels off, exposing the lichen. Hyphae then penetrate deeper and form a new lichen zone. In this way subsequent layers are peeled off, resulting in a step-like weathering pattern.

Cryptoendolithic lichens also mobilize iron compounds within the Beacon sandstone; as a result the rock is leached of iron-bearing minerals in a narrow whitened zone, while the thin weathered crust above and the fresh rock below appear darker because of iron deposition at these levels.

The conspicuous absence of organisms on the rock surface, which contrasts with the rich microbial zone a few millimeters below, raises the question of possible causes for the abiotic conditions on the surface. The critical environmental factors are temperature and availability of water. The latter can be gauged by measuring the relative humidity in the airspaces. In one test humidity remained above 80 per cent for at least five days, while in the air above, it repeatedly dropped below 20 per cent.

Perhaps the most important single factor for the abiotic rock surface, however, is the rapid fluctuation of temperature due to the gusty winds common in the dry valleys. For example, on December 25, 1980, in 42 minutes, the temperature on the rock surface fluctuated between -1.8°C and 5.9°C, crossing the 0°C mark no less than 14 times.

The inorganic nutrients required for the endolithic microorganisms are probably available in the rock substrate. Nitrates and ammonium compounds are generally present in the upper few centimeters of the Antarctic rocks, having been brought there by snow or dry fall-out. The Antarctic dry valleys have been considered the closest terrestrial analogue to the Martian environment, and hypotheses about the possibility of life on Mars were based on this comparison.

The endolithic microorganisms observed by Friedman cannot be regarded as examples of primitive life. Such a community

may have evolved when conditions for life deteriorated (e.g., because of glaciation) forcing the organisms to retreat to the protected niche inside the porous rocks. In this way, they are able to survive in an inhospitable environment without actually adapting to its extremes.

Reorganization of European Geophysical Society Proposed

The President of the European Geophysical Society (EGS), **Prof. Hans Ramberg**, in his address to the 8th plenary meeting on August 26, 1981, in Uppsala, Sweden, reported on developments that will affect the society's future activities.

A new constitution proposed at the meeting would formalize a natural division of general geophysics in the following three major fields of study: solid Earth and planets; the hydrosphere and atmosphere; and the upper atmosphere, ionosphere, magnetosphere and interplanetary medium (or Internal, Surficial or Superficial and External geophysics). Although the majority of geophysicists work within one of these sections, Prof. Ramberg said that geophysicists, for example, are equally at home in the atmosphere and ocean as they are in the Earth's mantle or core. It is hoped that the society's new structure will bolster its scientific activities by inspiring closer cooperation among members.

Prof. Ramberg also referred to the 7th meeting in Budapest, Hungary, as a "milestone in the history of the EGS" because it was the first meeting conducted in an East European country. The council will attempt to ensure that geophysicists from other East European countries are able to participate in future meetings.

As reported in a recent issue of their newsletter, the EGS is also planning to publish a journal and to cooperate with the American Geophysical Union in publishing *Tectonics*.

Dr. W.D. Carter, co-leader of IGCP Project 143, "Remote Sensing and Mineral Exploration," is shown here with his 45 students at the Center for Remote Sensing in Geology, operated by the Geophysical and Geological Exploration Brigade, Ministry of Geology, Beijing, People's Republic of China. Dr. Carter and his class survived a strenuous course schedule which consisted of four hours/day, six days/week from February 8-March 1, 1982. Course participants include Dr. Carter (front row, 5th left); Mr. Chen Yin xiang (front row, 4th left), Deputy Chief of the Centre; Mrs. Gu (front row, 3rd left), lecture translator; and Mr. Tan Xiao pe (front row, 3rd right), Director of the Centre.