News In Brief . . .

Ratification of Standard Chronostratigraphical Divisions and Stratotypes for the Silurian System

At the general assembly of the International (IUGS) Commission on Stratigraphy held in Paris on 9 July, 1980 in conjunction with the 26th Session of the International Geological Congress, the Subcommission on Silurian Stratigraphy presented a number of formal proposals regarding the definition and nomenclature of standard chronostratigraphical divisions for part of the Silurian System.

The scope and background of these proposals, resulting from a majority vote of members of the Silurian Subcommission, has been outlined elsewhere (Holland, 1980). On 6 October, 1980 the proposals were circulated to all Voting Members of the Commission on Stratigraphy for a decision regarding their incorporation within a Standard Global Chronostratigraphical Scale. The result of this ballot was a decision *in favour* of the proposals as summarized below, covering the middle two Series of the Silurian System. Fifteen members out of twenty-one voted in favour, with no votes against. Work is continuing on proposals for the nomenclature and chronostratigraphical subdivision of the first and fourth Series of the System.

Ratification of proposals

1. The name for the second Series of the Silurian System is Wenlock Series.
2. The boundary stratotype for the base of the Wenlock Series is in Hughley Brook 200 metres southeast of Leasows Farm and 500 metres northeast of Hughley Church, Apedale, Shropshire, England (British National Grid Reference SO 5688 9839). The marker point (stratotype) for the base is in the left (north) bank of the stream at the base of lithological unit G as described by Bassett *et al.*, 1975, p.13 and Fig.5; this point is coincident with the standard base of the Sheinwoodian Stage (see below) and the Buildwas Formation, and correlates with the base of the Cyrtograptus centrifugus graptolite Biozone.
3. There are two stages in the Wenlock Series, the Sheinwoodian Stage and the Homerian Stage, as defined by Bassett *et al.* (1975). The boundary stratotype for the base of the Sheinwoodian Stage is that for the base of the Wenlock Series as defined under point 2 above. The boundary stratotype for the base of the Homerian Stage is in the stream section in Whitwell Coppice 500 metres north of Homer, Shropshire, England (SO 6194 0204). The marker point for the base is in the right (north) bank of the stream within a continuous lithological section through part of the Coalbrookdale Formation, as described by Bassett *et al.*, 1975, p. 14 and Fig. 6; this point correlates with the base of the Cyrtograptus lundgreni graptolite Biozone in the section.
4. The name for the third Series of the Silurian System is Ludlow Series.

5. The boundary stratotype for the base of the Ludlow Series is in the quarry at Pitch Coppice on the south side of the Ludlow-Wigmore road 1.6 km northeast of Aston Church and 4 km southwest of Ludlow, Shropshire, England (SO 4726 7301). The marker point for the base is at the base of lithological unit F in the section through the quarry face as described by Holland *et al.*, 1963, p. 139 and Fig. 11; this point is coincident with the standard base of the Gorstian Stage (see below) and the Lower Elton Formation, and correlates with the base of the Neodiversograptus nilssonii graptolite Biozone (Holland *et al.*, 1969). The base of the Ludlow Series automatically defines the top of the underlying Wenlock Series.
6. There are two stages in the Ludlow Series, the Gorstian Stage and the Ludfordian Stage as named by Holland *et al.*, (1980). The boundary stratotype for the base of the Gorstian Stage is that for the base of the Ludlow Series as defined under point 5 above. The boundary stratotype for the base of the Ludfordian Stage is in the section on the northwest face of Sunnyside Quarry in Mary Knoll Valley 2.8 km south-southwest of Ludlow, Shropshire, England (SO 4953 7255). The marker point for the base is at the base of lithological unit C in the section described by Holland *et al.*, 1963, p. 141 and Fig. 13; this point is coincident with the standard base of the Lower Leintwardine Formation and correlates with the base of the Saetograptus leintwardinensis graptolite Biozone in the section.

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- A. Martinsson, Chairman, International Commission on Stratigraphy, Department of Palaeobiology, University of Uppsala, Box 564, S-751 22 Uppsala, Sweden;
- M.G. Bassett, Secretary-General, International Commission on Stratigraphy, Department of Geology, National Museum of Wales, Cardiff CF1 3NP, U.K.;
- C.H. Holland, Chairman, Subcommission on Silurian Stratigraphy, Department of Geology, Trinity College, Dublin 2, Ireland.

Publications — Caledonian Stratabound Sulphides

Prof. F.M. Vokes, Project Leader of IGCP Project 60 (Correlation of Caledonian Stratabound Sulphides), has announced that the following publications, resulting from Project activities, are available and may be of interest to EPISODES readers. Unless otherwise indicated, requests for publications should be addressed to the appropriate publishing houses and not to the Project Secretariat.

- Bibliography of stratabound sulphide deposits of the Caledonian-Appalachian orogen (Sangster, D.F., ed.), Geological Survey of Canada, Paper 79-27, 53 p. (GSC, Ottawa, Canada, \$2.50.)
- Review of Caledonian-Appalachian stratabound sulphides (Vokes, F.M. and Zachrisson, E., eds.), Geological Survey of Ireland, Special Paper No. 5, 1980, 81 p. (GSI, Dublin, Ireland, 6 pounds + postage.)
- Stratabound sulphides in the Caledonian-Appalachian orogen (Proceedings of 1979 Trondheim symposium; Vokes, F.M. and Reinsbakken, A., eds.), Norges geologiske undersøkelse, No. 360 (Bull. 57), 1980, 329 p. (Universitetsforlaget, Oslo, Norway; also London and New York, N.kr. 120.)
- Mineral Deposit Maps at 1:1 000 000 are available free of charge or at a nominal cost for most of the participating countries. Order from: H. Stendal, Institutt for Almene geologi, Universitetet i København, Østervoldsgade 5, 1350 København, Denmark; or from: A. Bjørlykke, Norges geologiske undersøkelse, Postbox 3006, 7001 Trondheim, Norway; or from: E. Zachrisson, Sveriges geologiske undersökning, Box 670, 75128 Uppsala, Sweden.

A combined map for the U.K. and Ireland is available from either the Institute of Geological Sciences, Murchison House, West Mains Road, Edinburgh, U.K., or from Mr. P. McArdle, Geological Survey of Ireland, 14 Hume Street, Dublin 2, Ireland.

For Canada and the U.S.A., maps are available as open file reports: - Summary Data on stratabound deposits in the Canadian Caledonides, Geological Survey of Canada, Open file report 677 (Order from Campbell Reproductions, 880 Wellington St., Ottawa, Ontario, K1R 6K7, \$18.75); - U.S. Geological Survey, Reston, Va., Open file report OF-79-1517 (1979).

Additional literature:

- CCSS 1979 Field Excursion guide. Norwegian and Swedish deposits. 40 p., N.kr. 30. Order from: A. Reinsbakken, Geologisk Institutt, N-7034 Trondheim-NTH, Norway.
- CCSS 1981 Field Excursion guide. Scottish Highlands, 26 p. + diags. 4 pounds. Order from: Mrs. A. Gibbs, Institute of Geological Sciences, Edinburgh, U.K.
- CCSS Symposium Volume, Scotland 1981. (Abstracts), 72 p. 5 pounds. Order from: The Secretary, Dept. of Applied Geology, Strathclyde University, Glasgow, U.K.

New Heads of Latin American Geological Surveys

Four Latin American countries have recently announced the appointment of new Directors for their respective Geological Surveys, as follows: Bolivia: **Tnte. Coronel Jaime Cardozo**; Colombia: **Dr. Alfonso Lopez R.**; Mexico: **Dr. José Guerrero**; Peru: **Dr. Francisco Sotillo P.** They replace former Directors **Alvaro Fernandez** (Bolivia), **Michel Hermelin** (Colombia), **Diego Cordova** (Mexico), and **Benjamin Morales A.** (Peru).

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27th IGC: Update

Moscow, U.S.S.R., August 4 - 14, 1984

Following a meeting held in May between IUGS President **Dr. E. Seibold** and Secretary General **Dr. C.C. Weber** and members of the 27th IGC Organizing Committee - **Acad. A. Sidorenko**, **Dr. N. Bogdanov**, **Acad. V.V. Menner** and **Dr. R. Volkov** (see EPISODES 1981, No. 1, p. 30), it was tentatively agreed that the Organizing Committee members would meet with representatives of the IUGS constituent bodies early in February 1982 to discuss the scientific program proposed for the Congress. The meeting will in all likelihood take place in Paris, thus taking advantage of the presence of geoscientists attending the annual IGCP Scientific Committee and Board meetings.

A draft copy of the proposed scientific program has been widely circulated for comment. Current plans are to have the Congress' First Circular ready for distribution by the end of 1981. (Address all enquiries on the 27th IGC to: **27th IGC Secretariat, Lithosphere Institute, 22 Staromonetny per., 109180 Moscow, U.S.S.R.**; Tel: 238-8588.)

Petroleum Resources Assessment

A two-day Symposium and Workshop dedicated to the assessment of energy resource potential in the Circum Pacific is being planned by IUGS in cooperation with other organizations to precede the Circum Pacific Energy and Mineral Resources Conference in Honolulu in August 1982.

The topic, vital to the well being of the human race in the foreseeable future, is particularly timely in view of the fact that petroleum is such a prime commodity. The Symposium will highlight, in a series of papers, the status of research on the basic concepts involved in the assessment process and analysis, and the significance of resource estimates, particularly the methodologies developed in the U.S.A. and Canada. The Workshop will focus on the strengths and limitations of the various estimation techniques to show how they can be integrated subjectively with minimal bias to produce an assessment.

Current plans call for the Symposium and Workshop to be conducted Friday and Saturday, August 20 and 21, 1982, and to be co-sponsored by the CPEMR Council, the East-West Centre, CCOP and SOPAC. An organizing committee is being set up under the chairmanship of **Dr. C. Masters**. Some funds will be available to assist participants from developing countries and the results of the Symposium will be published. (Address enquiries to: **Dr. C. Masters, U.S. Geological Survey, Reston, Virginia 22092, U.S.A.**; tel: 703-860-6681)

Portuguese Uranium Production

Portugal may become Europe's second largest producer of uranium by the mid-1980's. The Portuguese National Uranium Company (ENU) is signing agreements with French, German and British mining interests as part of Portugal's expansion program. Eleven mines are now operating in the districts of Guarda and Urgeirica, where sulphuric solutions are used to leach low-grade ores *in situ*. Plans now include the development of new mines at Guarda and new mines and a mill at Nisa, both in the interior of the country. The existing treatment plant at Urgeirica will be expanded and modernized.

Portugal produced 48 tonnes of 89.5% pure uranium oxide. It hopes to produce 130 tonnes in 1981, and if expansion goes according to schedule, 390 tonnes by 1985. Estimates of Portugal's uranium stocks vary between 600 and 800 tonnes. Japan, Brazil, France and Britain currently purchase uranium from Portugal. In 1980, Iraq agreed to buy 130 tonnes in return for guaranteed oil supplies.

European Geoscientists Unite

European geologists, geophysicists and geochemists have formed a European Union of Geosciences (EUG), the General Assembly of which was held during its first scientific meeting April 13-16, 1981 in Strasbourg, France (see Conference Reports...).

The prime goal of the EUG is to maintain cooperation among earth scientists working in a wide variety of disciplines and even in other scientific fields such as biology, mathematics and astronomy. Intended to serve the interests of the research scientist rather than the "practitioner of geology", the Union will provide the communications framework for researchers to work together toward a better understanding of the geological evolution of the Earth.

General meetings will be convened biennially in Strasbourg, while complementary specialized meetings called "Terra Incognita Conferences" will be sponsored by the EUG as a means of fostering more intensive scientific activity throughout Europe. The Union has been recognized as the official working group of the Parliamentary Assembly of the Council of Europe. Membership is open to individuals rather than representatives of any national organization, and while any geoscientist in the world may be a member of the EUG, its officers must be citizens of one of the 21 member countries of the Council of Europe - Austria, Belgium, Cyprus, Denmark, France, F.R.G., Greece, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey or the U.K. Student membership has been encouraged and some travel funds for attendance at meetings are available on request.

The Union's journal *TERRA cognita* will publish appropriate review articles and information about scientific activities in Europe. Abstracts of papers presented at the first meeting were published in the journal's first "special" issue, available from Claude Froidevaux, Editor, Laboratoire de Géophysique et Géodynamique interne, Université Paris Sud, 91405 Orsay, France.

Ocean Margin Drilling Program

Under the auspices of the National Science Foundation, U.S.A., an Ocean Margin Drilling Program (OMDP) has been designed to explore the transition zones between ocean floor and continent and to probe the deeper layers of the ocean crust.

While scientific drilling has taken place in the open ocean for more than a decade, the possibility of encountering hydrocarbons at great depths in the ocean margins requires a drilling system with adequate safeguards. No such system has yet drilled into water depths beyond 5 000 feet. The OMDP will use an advanced drilling system with full well control and greater environmental tolerances to permit drilling in 13 000 feet of water and to depths as great as 20 000 feet beneath the sea floor.

Joint Oceanographic Institutions Inc. (JOI), a consortium of ten U.S. oceanographic institutions, will plan and carry out the scientific activities associated with OMDP. The first drilling is currently planned for 1984, and the deep ocean work vessel GLOMAR EXPLORER is a prime candidate for conversion to the drilling platform for OMDP. A Scientific Advisory Committee, consisting of one representative from each of the JOI member institutions, one from each of the participating oil companies, and three other members, will be responsible for the OMDP scientific program; the Committee has already initiated a series of syntheses of existing geological and geophysical data in geographic regions of the world targeted as feasible drilling areas.

Antarctica's Tectonic History

One of the world's largest complexes of mineral-bearing rock may be contained in the Dufek intrusion, an upwelling of mafic magma which occurred when Antarctica was edging away from Africa 170 Ma ago. In 1978 it was estimated to be approximately 8000 km² in extent. Recently, a series of traverses with aircraft carrying magnetic and sonar detection equipment has convinced a team of U.K. and U.S. scientists that Dufek covers about 50 000 km² - second in size only to the South African magma lake, the Bushveld complex, which by 1973 had earned South Africa some \$3697 million in mineral sales.

The geological team conducting the surveys is primarily interested in revealing the tectonic history of the Antarctic continent, which is believed to be a composite of four plates. The scientists are using radar to penetrate the ice, and this is reflected by the rock surface below. The returning signal from the intrusion is characteristically different from that for the surrounding sedimentary rocks. Dufek is highly magnetic, but the surrounding rocks are not; magnetic and radar detectors therefore together reveal the boundary of the intrusion quite clearly.

The Dufek intrusion arose relatively recently in the Earth's history - during the break-up of the protocontinent of Gondwanaland.

International Mineral Exploration Fund

The United Nations Revolving Fund for Natural Resources Development (UNRFNR), established in 1975 to provide funds for mineral exploration in addition to those administered under the UNDP program, was intended to counterbalance the decline of activity in developing countries by multinational private mining corporations. The Fund received voluntary contribution pledges from Belgium, Canada, Indonesia, Iraq, Italy, Japan, Netherlands, Panama and the U.S.A., field operations began in 1976, and payments received by the end of 1979 totalled over \$22 million.

At that time, there were three operational projects in Argentina, Cyprus and Panama, with two projects completed in Ecuador and Sudan. An important landmark in the Fund's history was its first exploration success in Ecuador, where work undertaken by the Fund identified an economically exploitable deposit of high grade silver with associated lead and zinc. (The Fund had spent \$2.4 million, but found a deposit valued at many times that amount; the Government of Ecuador has since indicated its intention to develop the mine, and several investors have shown an interest in it.)

Three operational projects in early 1980 were either on schedule or in advance of the established work program. By the end of 1980, nine Revolving Fund projects were to be fully operational in various locations spread across the developing world. New Fund projects were begun in Guyana and Liberia, and others were planned in Kenya, the Philippines, Sudan and Surinam. Unfortunately, the level of voluntary member contributions is now not sufficient enough to allow the Fund to finance all the projects being requested.

The Revolving Fund is designed to increase the natural resources freely available to the entire world in the future. Countries of the developed world are being asked to recognize its advantages and make available the necessary resources to allow the Fund to begin operations on a number of additional projects. In return, the Fund offers a means for mutual assistance and eventual technical cooperation among the countries of the developing world.

For the mineral exploration programs, the Fund provides the finance, personnel, expertise and equipment necessary to locate a mineral resource and then to determine its grade and

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tonnage - usually by drilling but, if necessary, by underground entry. No cost of this work is borne by the government of the recipient country, and there is no national counterpart contribution, since all project costs are covered by the Fund, including the salaries of personnel of the recipient country employed on the project. The Fund is careful to select only those programs which offer the most prospect of success because of favourable geology, mining conditions and mining legislation. Costs of an unsuccessful exploration are borne by the Fund; the recipient government pays a contribution only from productive mines resulting from successful exploration.

The concept of a revolving fund implies that profits from past successful ventures are "ploughed back" into future prospecting programs. For the Fund to become self-sufficient financially, all governments receiving UNRFR programs sign a legally binding Project Agreement, by which they agree to make replenishment contributions to the Fund if exploration work results in the identification of a mineral deposit of proven economic grade and its subsequent development into a producing mine within the 30 years' duration of the agreement. The award of exploration rights is entirely the right and responsibility of the government. Unlike some aid programs, these replenishment contributions are not repayments of loans but a means of allowing the Fund to share in the benefits from its successful programs, and to finance further exploration work in the developing world.

From its previous experience in mineral exploration and mine development, combined with a desire to be fair to the developing countries, the UN has established a replenishment rate for the Fund of 2% of gross value of production; this is for a maximum period of 15 years from the start of commercial output, or until the termination of the 30-year agreement, whichever period is shorter. There is also a maximum limit on the total replenishment contribution of 15 times the original outlay of the Fund on the exploration program which found the mine. It is also possible for governments to ask the UN to consider negotiating a different limit for specific projects. The Fund is not designed to make a profit, but it is hoped that it will become self-sufficient within 25 years.

New Theory on Earth's Early Evolution

Geologist **Don Anderson** of the California Institute of Technology has advanced an intriguing explanation for why geologists have not been able to discover on Earth rocks that are as old as the planet itself. The "genesis rocks", according to Anderson, sank into a huge ocean of liquid rock early in the life of the planet, for Earth was a seething liquid cauldron about 4 Ga ago.

Anderson's theory, presented at a meeting of the American Geophysical Union in May, differs from that of lunar formation: "At the higher pressures on Earth, the first forming crystals would have been denser than the melt, and they would sink instead of floating," he explained. "The chemical elements that were concentrated into Earthly crust were therefore deeply buried in the mantle. As the Earth cooled further, lighter crystals began to separate out of the melt and form the upper mantle. The crystals, however, were depleted in those elements that formed the first layer, making the two layers complementary in their chemistry. Such a scenario explains the absence of an early crust on Earth and the two contrasting magmas found at ocean ridges and ocean islands."

He supported his theory with interpretations of seismic measurements that show distinct discontinuities in the Earth's mantle at depths of about 220 and 670 km - apparently the boundaries of the two ancient layers formed as the Earth was cooling down from its initially high temperatures.

France Plans Geoscience Centre

Plans to establish in Paris an "International Center for Geological Exchanges and Training", first announced by the former President of the Republic of France, **M. Giscard d'Estaing** during the 26th International Geological Congress last July, have progressed to the point where the Center's role and its statutes have now been defined.

The objectives of the proposed Center are wide-ranging - to promote exchanges between representatives of all nationalities working in the earth sciences, to facilitate communications, to encourage technical and scientific training, to support and collaborate with national and international, private and public organizations serving the earth sciences. It is envisaged that the Center will distribute information about the evolution of the geological sciences, their impact in developing countries, the activities of organizations specializing in international exchanges; it will serve as a professional base for geoscientists travelling through France; it will organize appropriate meetings and symposia and encourage or coordinate publications in the geological sciences as the need arises.

The Center, although international in character, will be under French jurisdiction and subject to French law. National organizers of the Center hope that international organizations such as Unesco, the UN and IUGS will participate in its operations. The Center's statutes call for two members of the governing Administrative Council to be appointed by Unesco and two by IUGS out of a total of 24 members, five of whom will be appointed by the French Ministers of Foreign Affairs, Mines, Research, Universities and Cooperation respectively.

At present, IUGS has made no official commitment to participate in the Center, although the feasibility of its involvement will be discussed at the 24th IUGS Executive Committee meeting in Bonn next February. The Center's statutes also call for a scientific executive committee of internationally respected individuals who will assist the Administrative Council.

In a joint letter dated March 31, 1981 and addressed to the heads of national delegations who participated in the 26th IGC, **Prof. Jean Aubouin** and **Mr. Paul Sangnier**, President and Secretary General of the 26th IGC respectively, have asked for comments on the proposed Center from the international scientific community.

African Lake Sediments

The National Science Foundation (U.S.A.) and Elf Aquitaine (a French oil company) are providing funds for a preliminary survey for a proposed drilling project in Africa, whereby deep cores taken from African lake sediments will be studied for clues to past climates.

Scientists involved in the project seek to reconstruct a climatic record that will run back a continuous 5 or 10 million years. Lake sediment studies previously carried out in Africa provide information going back only about 45 000 years. Cores from the multi-disciplinary project will be a source of valuable information for geologists, geophysicists and petrologists, as well as paleoanthropologists, biologists and archaeologists.

Columbia University geologist **Neil Opdyke**, one of the scientists involved, and his colleagues initially drew up a plan for surveying eight lakes and organizing a planning meeting to gather various specialists, including experts from the Deep Sea Drilling Project. Because of limited funds, however, only four lakes will be studied at this time: Lake Bosumtwi in West Africa, and in East Africa - Lakes Turkana, Tanganyika, and Malawi.

U.S. Oil and Gas Discoveries Projected

A two-year study for the U.S. Geological Survey and the Department of Energy conducted by the Rand Corporation, a research group based in California, reports that future oil and gas discoveries in the U.S.A. are severely limited. These projections contrast sharply with previous government and industry estimates.

The Rand report claims that in the U.S., oil discoveries have declined steadily since the 1930's; natural gas discoveries have declined since the 1950's. The report concludes that apparently "more than half of the conventional petroleum reserves that will ultimately be produced have been produced". The reasons for this are geological rather than economical: oil is usually found in large pools, geologically determined and few such geologically suitable areas remain unexplored in the U.S.

By 1979, 121 billion barrels of oil had been discovered in the U.S., and the report notes that there is only a 50% probability that 20 billion more barrels would be produced as a result of new discoveries. The principal author of the Rand report, geologist **Dr. Richard Nehring** has explained that Rand's methodology differed from that used in the past in that it looked closely at individual fields rather than statistical abstractions such as the number of barrels discovered for each foot drilled.

As for natural gas potential, the Rand study estimates there is a 50% chance of finding 170 trillion cubic feet of natural gas beyond the 570 trillion cubic feet already discovered.

A study released by the U.S. Interior Department on February 25, 1981 showed a 22% increase in the mean estimate of the nation's undiscovered natural gas resources, while the mean estimate for oil resources remained the same as the last study conducted in 1975. The U.S. Geological Survey report summarized the results of a 16-month investigation and set mean estimates for undiscovered recoverable conventional petroleum resources at 594 trillion cubic feet of gas and 83 billion barrels of oil. (The mean estimates of the 1975 USGS study were 484 trillion cubic feet of gas and 82 billion barrels of oil.)

According to **Dr. Betty M. Miller**, USGS Assistant Director for the Eastern Region and a resource specialist, "these new estimates incorporate geological and geophysical information compiled since the completion of the last intensive study by the USGS in 1975 and include assessments for each of 137 petroleum provinces in the country. Part of the increase in natural gas estimates represents increased optimism for prospects in several of the frontier areas. Some of the increase, however, simply reflects a nearly 70% increase in the amount of offshore area assessed in the latest study."

In the 1975 study, the offshore areas were assessed out to 200 m water depth. The 1980 study includes offshore provinces on the U.S. continental slopes out to 2 500 m water depth, thereby increasing the offshore areas assessed for the 1980 study by an additional 400 000 square miles. The deeper water areas were included in the 1980 assessment because current offshore technology have made these areas more accessible to possible development.

The undiscovered recoverable conventional oil resource estimates are provided again by the USGS at the 95 and 5% probability levels and are estimated to range from at least 64 billion barrels on the low side to more than 105 billion barrels of oil on the high side. The undiscovered recoverable conventional gas resource estimates at the 95 and 5% probabilities range from at least 475 trillion cubic feet to more than 739 trillion cubic feet. This compares to the 1975 estimates of at least 50 to more than 127 billion barrels of oil, and a resource estimate for gas of at least 322 to more than 655 trillion cubic feet.

The estimates show no significant change in the mean estimate for undiscovered oil resources and about a 22 per cent increase in the mean estimate for undiscovered gas resources.

An 18-page report summarizing the results of the revised estimates, entitled "Estimates of Undiscovered Recoverable Resources of Conventionally Producing Oil and Gas in the United States, A Summary," has been released for public purchase as USGS Open File Report No. 81-192. The report includes tables and maps describing the broad regional appraisals. Copies may be purchased from the *Open-File Services Section, Branch of Distribution, USGS, P.O. Box 25425, Federal Center, Denver, Colo. 80225, U.S.A.* Prices are \$2.25 (paper copy); \$3.50 (microfiche copy). A more detailed technical report will be published by the USGS as a circular.

Energy in a Finite World

With advanced study techniques, an unusual amount of international cooperation, and access to good data, the Energy Systems Program Group of the International Institute for Applied Systems Analysis has projected world energy resources and energy needs through to the year 2030. The Group's projections show increasing use of liquid fuels, at high cost, and the use of breeder reactors; energy conservation will be a necessity, not a choice, for the energy needs of a world population will have doubled between 1980 and 2030.

No prospective energy source was found free of problems. "The two forms of primary energy, nuclear and solar, can be thought of as competitive, but we prefer to think of them as complementary, since it is likely that both will be needed and both will be used on a large scale," the report stresses. The key, apparently, lies in making energy technology commitments "investive" rather than "dead-end". The report concludes that "the bad news from this analysis is that it could take the better part of a century to make the transition to abundant energy forms; the good news is that in less than a century we can make the transition."

The report, entitled "Energy in a Finite World" and published in March, involved 140 scientists from 20 countries led by **Wolf Häfele** (F.R.G.). The International Institute for Applied Systems Analysis is based at Schloss Laxenburg, Austria and is a non-governmental consortium of scientific institutions from 17 nations.

International Management of Mineral Resources

A recently published 350-page volume of papers and discussions contains definitive statements on the problems of consumer and producer countries and companies in relation to both long- and short-term supplies of mineral raw materials, and on the role of governments and governmental bodies in balancing supply and demand. Also reviewed are a variety of topics such as exploration geology, mining, mineral processing, extractive metallurgy, economics, statistics, exploration strategy, metallurgical processes, oil and ocean mining, and political problems of consumer countries.

The volume, entitled "National and International Management of Mineral Resources" (edited by Michael J. Jones, priced at 46 pounds) constitutes the proceedings of a joint meeting of the Institution of Mining and Metallurgy, the Society of Mining Engineers of AIME and the Metallurgical Society of AIME, held in London 27 to 30 May, 1980. For further information, contact: *Publications, The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BA, U.K.*

Birth of the Solar System

With the discovery of unexpectedly high concentrations of potassium-41 in the Allende meteorite, one of the oldest rocks known, some scientists are concluding that the first solid particles of the Solar System condensed from a nebula approximately 110 000 years after a nearby supernova triggered its collapse.

Previous meteorite studies using plutonium-244 indicated that the pre-solar nebula was enriched from supernova explosions during two major episodes - 500 and 100 million years before it condensed. Later studies, using magnesium-26 (decay product of aluminum-26 which has a half-life of a million years) implied that a supernova episode enriched the pre-solar nebula only a few million years before the birth of the Solar System. The recent discovery of potassium-41 (decay product of calcium-41 with a half-life of only 140 000 years) lowers this estimate to 110 000 years.

The theory, based on work conducted by **Drs. Wasserburg, Heneke and Armstrong** at the California Institute of Technology, was discussed at a Royal Astronomical Society meeting in London earlier this year. Because isotopic investigations can now accurately determine concentration differences to one part in 10 thousand, this is helping to establish accurately a time scale of events in the formation of the Solar System.

Manganese Nodules Discovery in India

A huge carpet of manganese nodules, containing nickel, cobalt and copper, was discovered during a recent expedition by the oceanic research vessel *Gaveshani* to Mauritius in the Indian Ocean. According to **S.Z. Qasim**, Director of the National Institute of Oceanography in India's western city of Goa, a square meter of the seabed contained about 2.5 kg of nodules; they were found in depths from 3 600 m to 4 500 m, and ranged in size and weight up to 8.3 cm and 200 gm respectively.

News of the discovery was first carried by the Press Trust of India. The exact location of the nodules has not been disclosed, apparently due to the international competition that exists in ocean mining.

AGI to Publish "Earth Science"

Earth Science, a quarterly magazine for amateur geologists, will now be published by the American Geological Institute and edited by **Wendell Cochran**, editor of *GEOTIMES*. The first issue under AGI auspices will appear in July 1981 and will include articles on recent volcanism, forensic geology, and strategic minerals. The magazine will also carry reviews of recent books on geology for amateur geologists and popular books with geological emphasis such as "Basin and Range" by John McPhee; **M. Dane Picard**, a professor of geology at the University of Utah, will be a regular contributor, closing each issue with a column called "One Geologist's Earth."

Founded in 1947 by Robert B. Berry, an Omaha naturalist, Earth Science was most recently published by Richard Pearl (a professor of geology at Colorado College when he became editor in 1973) and, following his death in 1980, by Mrs. Pearl.

According to **A.G. Unklesbay**, Executive Director of AGI, Earth Science "provides AGI an opportunity to expand our information and education services to the increasing ranks of amateur geologists." Wendell Cochran has pointed out that "Earth Science will not be another *GEOTIMES*. We are going to move slowly but determinedly toward a magazine that appeals to a public we know is interested in our living Earth."

EPISODES, Vol. 1981, No. 2.

Many readers will have had no formal education in geology; others may have had a five-hour undergraduate introductory course; but we will assume most readers are just plain fascinated by the ways our living Earth moves and talks to us." (Information on Earth Science available from: AGI, 5205 Leesburg Pike, Falls Church, Virginia 22041, U.S.A.)

Sea Level Changes

Sea level, which has been rising at a rate of a few millimeters a year for decades, is apparently increasing this rate to as much as a foot in twenty years in some areas. A photographic survey conducted by scientists **Harold R. Wanless** and **Peter Harlem** at the University of Miami's School of Marine and Atmospheric Sciences (Florida, U.S.A.), showed that barnacles attached to bridge pilings and sea walls in the local area are now living approximately six inches higher than those of 10 to 20 years ago.

Additional evidence of this rise comes from a comprehensive survey of more than 800 tide-measuring stations throughout the world by **Kenneth O. Emery** of the Woods Hole Oceanographic Institute (U.S.A.). This survey showed a sea level rise of about one inch in ten years. If this trend continues, areas where the sea level changes are significant, such as Florida, will experience problems with accelerated coastal erosion and marine infiltration of fresh water.

Film: "When the Earth Moves"

The U.S. Geological Survey has recently released a new film on natural hazards entitled "When the Earth Moves". This half-hour 16 mm colour, sound motion picture describes hazards such as earthquakes, volcanic eruptions, subsidence, floods, landslides, and swelling soils, and relates some of the methods now being practiced to avoid or lessen their destructive impact. The film is produced for viewing by land-use planners, government officials, members of the building industry, students and teachers from intermediate through college levels, and the general public. Information about the film may be obtained from: *Modern Talking Picture Service, Inc.*, 5000 Park St., North, St. Petersburg, Florida 33709, U.S.A.

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Origins of Deserts Disputed

The widely held belief that today's deserts are largely the result of human activity is, according to the Director of the Center for Earth and Planetary Studies, Smithsonian Institution - **Dr. Farouk El-Baz**, a misconception that has led to misguided policies on the use of arid lands in many parts of the world.

The geological record reveals that the Earth experienced desert-like conditions in various regions and at different times during its evolution. "Deserts occur where they do, not because of human activities, but because of the total lack of rain.... desert growth is nothing new, as some people believe, but rather that the desert expands and shrinks under alternating dry and wet climatic periods, with or without human intervention," Dr. El Baz explained at the annual meeting of the American Geophysical Union in May.

Human activities can influence land degradation, especially along the fragile environment at the fringes of the desert. For example, in the Sahel - the bank of land between the Sahara and the "green" of Africa, human activities have resulted in land degradation, which could have been prevented through a better understanding of the desert terrain and the processes that act upon it.

"The popular notion is that nomads and Bedouin living in the deserts do not really understand the desert well.... the nomads let their animals overgraze the natural vegetation, thus exposing the land to soil erosion - and desert conditions set in. Using this overly simplistic model, well-intentioned government agencies and international organizations have tried to centralize services to nomadic people in times of drought. Nomads and their animals are crowded into urban communities where deep water wells are drilled. The overcrowding leads to overgrazing, and it is this effect that degrades the environment. The truth is, nomads and Bedouin have learned over thousands of years how to graze their herds, when to move on and how to live in harmony with their environment. The misguided policy of centralization has led to abuse of the edge of the desert," said Dr. El Baz.

He noted that the terms "desertification" and "desertization" have contributed to the problems of arid land management. They are used interchangeably to signify man-made as well as natural processes. More specific are words that describe the processes that lead to land degradation, such as soil erosion, water logging, salinization and dune encroachment.

A better understanding of the desert environments will prevent further misuse of arid lands. Photographs of the Earth taken by astronauts and by unmanned satellites have provided geologists with new tools to study the deserts. Space photographs are especially valuable in indicating the best possible areas for desert reclamation projects, since they clearly show up the areas of active sand movement - unsuitable for desert reclamation projects, and those areas where the soil is potentially arable.

In a recent issue of Smithsonian Magazine, Dr. El-Baz also noted that the pyramids of Egypt are still standing after thousands of years, because the ancient Egyptians built their monuments in the shapes of natural landforms that were resistant to wind erosion. In the thousands of years since their construction, other shapes would have been destroyed by severe wind erosion, but the pyramid-like hills and the sphinx-like yardangs are aerodynamically stable in the Egyptian desert. The ancient Egyptian builders may even have built their monuments around such existing landforms. The Great Pyramid, built by Pharaoh Khufu (Cheops) nearly 4 500 years ago, covers an area of 13 acres at its base, and is known to cover a rocky knoll. (At a height of 482 feet, this pyramid was the highest man-made structure in the world until 1889 when the Eiffel Tower was built). A big hill lies under the tomb of Queen Khent-Kawes at Giza, and El-Baz believes that a yardang may lie beneath the Sphinx.

GEOLOGIST

Editorial Section Head - Saudi Arabia

An experienced geologist with a suitably extensive field and research background is required by the Directorate General of Mineral Resources, Ministry of Petroleum and Mineral Resources, Jeddah, Saudi Arabia, to head their editorial section. This individual must possess organizational ability, tact, and superior skill with the English language. He will work closely with other section heads and with authors whose mother tongue is not English. Familiarity with geological review and/or publishing is desirable, as would be experience in geological instruction.

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