NEWS REPORTS

Gold Spheres in Surficial Sediments

Support for an origin of some placer gold by chemical precipitation comes from a recent find of gold spherules (0.05 - 0.2 mm in diameter) in glacial till from the Abitibi Clay Belt of northeastern Ontario. Heavy mineral concentrates made from samples of a deeply-buried discontinuous horizon contain up to 1226 ppm Au and 87 ppm Ag. SEM studies of the spherical gold grains and accompanying dendrites (see cover photo) indicate a surface and internal structure composed of tightly packed lozenge-shaped units with a "cobble stone" appearance commonly referred to as microcrystallites by meteorite specialists.

The grains contain gold, silver, copper and selenium in varying amounts; some have Ag-rich rims (0.001-0.002 mm thick) and internal pockets of Ag-Se enrichment that may be eucairite, a Cu-Ag selenide. Some of the gold spheres were embedded in a soft dark-green matrix consisting of highly fractured amorphous material, which also contains 0.001-0.01 mm chromite euhedra and blades of clarkite. The amorphous material has a Si-Al-Ca-Na-Fe-U composition in which the sum of the oxides in electron microprobe analysis totals less than 75%, indicating significant contents of light elements such as carbon. In addition, SEM energy dispersive spectrometry shows a high background spectrum characteristic of organic materials.

Gold spheres in glacial sediments have now been found elsewhere in the Belt, and a search of placer gold samples in the National Mineral Collection in Ottawa has uncovered spheres in a sample of gold dust from the Naraguta tin mine in Nigeria. The only other locality known to the authors where gold spheres have been found is in the Lakekamu gold field of Papua New Guinea where spheres occur in an Fe-Mn oxide crust in fractures in weathered bedrock (P. Lowenstein, personal communication).

Metallic spheres with microcrystallite structures can be formed either by crystallization of droplets from a melt or by chemical precipitation. Although these gold spheres do resemble meteoritic metallic spherules and fire assay beads, a melt origin is rejected because of the unique composition, the worldwide distribution, and careful re-checking of the laboratory procedures involved. An in situ origin is favoured involving low-temperature precipitation, although bedrock sources and the processes of transport of the gold are unknown. Organic material and iron-manganese oxides are believed to be important in precipitating the gold, because they are powerful reducing agents and are present in most of the samples.

If the in situ origin is correct, then the classic concept of delineating glacial dispersal trains of gold in an up-ice direction must be modified where spheres are found in till. Where they are found in placers they should not be considered as detrital, and an understanding of the groundwater flow pattern should be sought so as to map the distribution of chemically precipitated gold or to find its bedrock source. The spheres may be related in origin to the large secondary nuggets found in lateritic terrains in Brazil and Australia. Indeed, they could be considered "proto-nuggets" for many gold grains in placer deposits.

R.N.W. DiLabio,
Geological Survey of Canada,
Ottawa,
J.W. Newsome and D.F. McIvor
Utah Mines Ltd.,
Timmins, Ontario

IUGS and Marine Geology

The structure and evolution of the shallow parts of the crust under oceans and along continental platforms were the focus of marine geosciences in the late 1960s and early 1970s. More recently, methods have been developed that study deep crustal structures and processes, as well as history of marine depositional environments. Brand new fields of marine geoscience such as paleoceanography have evolved recently, shifting some of the centers of activities for the marine sciences.

CMG has taken an active part in these developments for many years now, largely through the sponsorship of symposia, workshops and conferences. Many of its activities in 1984 were founded upon the recommendations of the Third International Workshop on Marine Geosciences held in 1983 under the title "Whither the Oceanic Geosciences?" (see Episodes 1983/2, p. 31-32). During this meeting, the entire field of non-living resources of the oceans was discussed at great length, and the Commission decided to establish its own subcommission on the topic. B. ul Haq (U.S.A.) is now in charge of this group and is presently formulating its membership.

Among the more active constituent bodies of IUGS is its Commission for Marine Geology. CMG is charged with the responsibility of promoting the advancement of knowledge in marine geoscience. This branch of geoscience has gone through a phase of specialization in the last decade, during which there has been rapid progress in our understanding of the geological history and structure of sediments and rock under ocean basins, continental margins and epicontinental seas.

Marine geosciences had been trailing the "continental geosciences" for many decades, but since the advent of sea-floor spreading and plate tectonics models some 20 years ago, the former have advanced much more rapidly than their continental counterparts. On the initiative of land geologists, marine geoscientists have developed into an independent group of researchers employed by academic institutions, government organizations, and industrial enterprises. These groups demand an increasing share of human and financial resources spent for the development of the Earth's mineral resources and for the protection of the global environment.

Sampling deep-sea cores (ODP photo)

CMG also has very close links with the ICSU Scientific Commission on Oceanic Resources (SCOR) and four new SCOR/CMG working groups have been established on 1) geological variations in carbon dioxide in the carbon cycle, 2) hydrothermal processes in the ocean crust 3) deep paleoceanography, and 4) polar deep sea paleoenvironments. Consideration is now being given to establishing new working groups under CMG on ocean paleodepth indicators and on high resolution event stratigraphy.

Another working group may be established on the feasibility of Arctic deep-sea drilling. This would investigate the technical requirements for drilling and coring operations in Arctic deep sea areas which are outside the coverage of the new ocean drilling program. This group would prepare a comprehensive document on the possibilities of Arctic drilling in pack ice-covered areas, with an evaluation of the financial requirements and the time frame for drilling operations.

CMG maintains close links with GEBCO, the organization responsible for the General Bathymetric Chart of the Oceans through its representative, R. Faulkner (New Zealand). There are also ties (through the CMG Chairman) to the ICSU panel on the evaluation of seabed dumping of atomic wastes, now preparing a report to be issued after its next meeting in 1985.

In 1984, the Commission sponsored several symposia at the Moscow Congress, and it is now involved in the 1985 meeting in West Germany on "Geology of the Oceans", and the second International Conference on Paleocceanography to be held in 1986 in the U.S.A.

COGEODATA Programs for Research and Regional Development

COGEODATA is the very active IUGS Commission on Storage, Automatic Processing and Retrieval of Geological Data. Much of its activity is carried out by four working groups linked together under its Research Program.

The Working Group on Resource Data and Resource Assessment (Chairman- R.B. McCammon, U.S.A.) concluded in early 1984 its four year review of petroleum data management in SE Asia, largely under the sponsorship of ASCOPE and CCOP (see Cook and Clark, Episodes 1981/1, p. 19-22). This work has played an important role in the establishment of regional petroleum data information systems now used as a base for assessing petroleum resources. A new trend for this working group is a project to evaluate various methods of assessing resources so as to formulate their "knowledge requirements", for use in the new "experts systems" like PROSPECTOR. This activity is linked with the new IUGS/Unesco program on deposit modelling.

The Working Group on Exploration Data and Interpretation (Chairman- P. L. Leymarie, France) has been involved in avant garde research into the use of computers for mineral exploration and interpretation. Its main objective is the assessment, improvement and dissemination of computer aided methods for gathering, analysing, integrating and presenting exploration data. The main effort is now on the adaptation of existing software and methodology involved in the development of "distributed systems" using micro and "pico" computers.

The Working Group on Information Technology (Chairman- G. Gabert, F.R.G.) will concentrate its activities during the next four years on a survey of current and future uses of information technology in geology. J. Hruska (Czechoslovakia)

chairs the fourth working group on a World Index of Geological Data Sources, which is now concentrating on updating and publishing indexes to computer-based geoscience information in Eastern Europe and elsewhere.

A second major effort of COGEODATA is its Regional Development Program, which has been extremely active in training computer specialists, resource analysts, geochemists, geophysicists, and data specialists in developing countries. This task is accomplished through workshops and short courses, "technology transfer", specialized consultancies, and special programs. Among the activities in 1984 were courses on factual data banks (Morocco), micro-computers and expert systems (Brazil), and courses are now being planned for 1985 in Burundi, Sudan, and Peru.

In South America, the development program is concentrating on deposit modelling and basin analysis, with a special project on Argentine basins. In Southeast Asia, sedimentary basin analysis is also being developed under a broad cooperative framework involving CCOP, CPMP, ASCOPE, ESCAP, IOC and IUGS itself. There are also regional development activities in eastern and western Europe and in North America.

In 1984 COGEODATA participated in two IUGS/Unesco programs on remote sensing and on mineral and energy deposit modelling (see Episodes vol. 7, no. 1, p. 53, 1984). The Commission also has links with several ICGP projects, many developed by its past chairman (and present Secretary General) of IUGS, R. Sinding-Larsen. A list of current officers is given elsewhere in this issue.

Formal Decisions on International Stratigraphic Standards

Formal stratigraphic standards for stratotype boundaries and for nomenclature of some of the geological systems are now being decided by the International Commission on Stratigraphy. Decisions are being made now for boundaries between the Precambrian and Cambrian, the Ordovician and Silurian, and the Pliocene and Pleistocene. Agreements on a working level are also being proposed for the Mid-Carboniferous and the Devonian-Carboniferous boundaries. Formal agreement is near for the chronostratigraphical subdivisions and nomenclature of the Silurian and Devonian Systems. Details regarding these decisions, will be published in the June 1985 issue of *Episodes*.

The International Commission on Stratigraphy, the largest scientific body within IUGS, comprises 33 Subcommissions, Regional Committees and Working Groups, which promote international standards and cooperation in stratigraphy. Members are specialists for the various established systems and are drawn from the international geological community. Perhaps the best known publication to emerge from the work of the Commission is the *International Stratigraphic Guide*, edited by Hollis Hedberg in 1976. In the last four years, IUGS has also published eleven authoritative monographs and stratigraphic charts for the Cambrian, Ordovician, Carboniferous, and Triassic of many regions of the world.

The concept of formal stratigraphic classification and terminology was initially discussed at the International Geological Congresses in Paris (1878) and Bologna (1881). A Commission for an International Lexicon of Stratigraphy was established at the Stockholm Congress of 1910, and this was reorganized in 1952 as the Commission on Stratigraphy, comprising Subcommissions on Stratigraphic Nomenclature and on the Lexicon. After the foundation of IUGS in 1961, the body was accepted as an IUGS commission.

In 1979 the International Commission on Stratigraphy began its work - still in progress - of formalizing the eons and eras as major units of the geological time scale. Field and laboratory studies are carried out world-wide to determine the most suitable boundary locations and type sections for stratigraphic standards. This work is assisted by several projects of the International Geological Correlation Programme (IGCP), a cooperative Unesco-IUGS enterprise.

Further details of the aims and activities of the Commission and its constituent bodies can be obtained from the Commission Chairman: Dr. J.W. Cowie, Department of Geology, University of Bristol, Bristol BS8 1TR, U.K.

Marine Science in China

China has some 4.7 million km² of sea territory, 18 thousand km of coastline and 5 thousand offshore islands. Its continental shelf is broad and shallow (<100m). The East China shelf, for example, is up to 600 km wide and was exposed above sea level during the last glaciation. These coastal areas are used extensively, and there is considerable exploration for hydrocarbons. It is not surprising, therefore, that the study of marine science in China is developing fast.

There are many organizations concerned with the study of marine science in China. These include the National Bureau of Oceanography (NBO), the Ministries of Geology and Resources, Transportation, Oil and Petroleum, and Mineral Resources, the Institution of Aquaculture, the Meteorology Bureau, various marine institutes organized under the Academia Sinica, and several universities, colleges and other institutes. Among the latter, Shandong College of Oceanology has 2,400 students, and there are plans to expand this number to 6,500 by 1988.

The NBO, established in 1964-65, is responsible for programs in all disciplines of oceanography. It consists of seven scientific institutes and several other sub-bureau, as well as 50 coastal monitoring stations, and it employs 10,000 people, of whom 4-5,000 are scientists or technicians. The work of the NBO is concentrated mainly on the Chinese continental shelf, but work is now beginning in the deep-sea areas and the Antarctic. The research institutes are geographically spread and work on local offshore areas such as the Gulf of Bohai, the Yellow Sea, and the East and South China Seas.

The NBO is involved in several joint programs with research institutions in other countries, concentrating on such areas as ecology (with Canada), marine biology and marine chemistry (France), and environmental pollution and the Kurashio Current (Japan). The annual input of sediment from the Yellow River to the continental shelf is 1.2 billion tonnes and that of the Yangtze River 0.4 billion tonnes. Over the last two thousand years the Yellow River has changed its course some 26 times, and this has influenced the input of sediment onto the shelf. Because of the importance of river-borne sediments, a joint program was initiated in 1979 between NBO, the U.S. Oceanic and Atmospheric Administration and Woods Hole Oceanographic Institution to study the Yangtze River estuary and its impact on shelf sediments from all aspects. A further cooperative program on the marine chemistry of the estuary, including the chemistry of particulate matter, is now underway with France.

Sand and gravel for construction and building materials in China are obtained from beaches, and as construction increases beach mining will undoubtedly increase in scope. This will have obvious environmental impact, but at present there is no law restricting beach mining. Another important offshore resource is calcium carbonate, which is recovered from shell beds at old strand lines, and is used extensively for lime production. Placer deposits of ilmenite, zircon and monazite are known along the southeast coastline of China, and although they are not now being mined, prospecting for these deposits is beginning.

NEW from the **GEOLOGICAL ASSOCIATION OF CANADA**

RECENTLY PUBLISHED

Geoscience Canada Reprint Series 1

FACIES MODELS

2nd Revised Edition

Edited by Roger W. Walker, 1984

GAC's best-selling collection of reviews reprinted from Geoscience Canada on sedimentary facies, facies sequences and facies models. There are five new chapters, additional text and many new illustrations. Ideal for use as a university text. Over 15,000 copies of the first edition sold since 1979!

317 pages

\$12.00

GAC SPECIAL PAPER 27

JURASSIC-CRETACEOUS BIOCHRONOLOGY AND PALEOGEOGRAPHY OF NORTH AMERICA

Edited by G.E.G. Westermann, 1984

New data and theories on Mesozoic marine life and history of North America and adjoining oceans. Includes: Atlantic opening, paleogeography of Gulf of Mexico, ammonite biogeography and allochthonous terrains of NE Pacific, ammonite zonations and the Jurassic-Cretaceous boundary, paleo-oceanography of the Cretaceous Seaway of Western Interior North America.

315 pages. \$30 (GAC Members) \$36 (Non-members)

IN PRESS

GAC SPECIAL PAPER 28

EVOLUTION OF ARCHEAN SUPRACRUSTAL SEQUENCES

Edited by L.D. Ayres, P.C. Thurston, K.D. Card and W. Weber

A review of volcanic-sedimentary sequences of the Superior and Slave Provinces and their mineral deposits, Archean crustal development and Proterozoic reworking, plus papers on the Archean of Australia and South Africa. Includes a coloured lithostratigraphic map (1:500,000) of the Abitibi greenstone belt.

App. 400p \$35 (GAC Members) \$42 (Non-Members)

GAC SPECIAL PAPER 29

THE CARSWELL STRUCTURE URANIUM DEPOSITS (SASKATCHEWAN)

Edited by R. Lainé, D. Alonso and M. Svab

A synthesis of the voluminous unpublished material on one of the best uranium deposits in North America. Reviews the geology, mineralogy, geochronology, geochemistry, stratigraphy, geophysics and metallogeny of this conspicuous ring-type structure.

App. 300p. \$35 (GAC Members) \$42 (Non-Members)

GEOSCIENCE CANADA REPRINT SERIES 2

DATING METHODS OF PLEISTOCENE DEPOSITS AND THEIR PROBLEMS

Edited by N.W. Rutter

A collection of reviews on uranium-series disequilibrium dating, counting C^{14} atoms, amino acid racemization, thermoluminescence, tephrochronology and fission-track dating, electron spin resonance, paleomagnetism, and the use of paleosols and weathering features. Ideal as a university text.

Approximately 96 pages.

\$12

GAC SHORT COURSE NOTES Volume 3

COAL PETROLOGY: ITS PRINCIPLES, METHODS AND APPLICATIONS

-R.M. Bustin, A.R. Cameron, D.A. Grieve, and W.D. Kalkreuth. 2nd Revised Edition.

An introduction and synthesis. Relates coal composition to variations in depositional environments and to subsequent geological history. Emphasizes microscopic and macroscopic techniques and applications to geological interpretation, coal utilization and hydrocarbon exploration. Includes many practical examples.

Approximately 210 pages.

\$20

ORDER FROM GAC Publications
Business and Economic Services
111 Peter Street, Suite 509
Toronto, Ontario
CANADA M5V 2H1

(All prices in Canadian dollars)

Add \$3.00 postage (BOOK RATE) and handling for each publication ordered. Payment must accompany orders. Make cheques payable to Geological Association of Canada. If paying by VISA or MASTERCARD give full card number, expiry date and signature.

News Reports

Chinese oceanographers are now beginning to search for manganese nodules in the Western Pacific, though this work is still of a reconnaissance nature. China seems to be reserving its position on whether to initiate a full program for nodule prospecting as a potential economic resource.

In recent years China has been on the brink of a major off-shore oil boom involving considerable foreign participation. The country has a mature continental margin, which is considered one of the best prospects for large new petroleum deposits.

China is also becoming increasingly interested in Antarctica, having acceded to the Antarctic Treaty in 1983. Prior to 1984, China had sent five groups of scientists to Antarctica at the invitation of Australia, New Zealand, Chile and Argentina. One feature of China's polar research program is the desire for international cooperation, and most of the projects undertaken so far have been on this basis.

Marine pollution has been recognized as a major problem in coastal areas of China, particularly in industrially developed estuaries. The seriousness of the problem is now appreciated and attempts are being made to develop control mechanisms. China's first law relating to protection of the marine environment came into effect in early 1983, and large amounts

are now spent in combating pollution. To give some idea of the scale of the problem, about six million tonnes of domestic and industrial waste are introduced annually into Chinese coastal waters. Among the principal pollutants, an average of seven million tonnes of organic matter and 100,000 tonnes of oil is discharged into the sea annually. Mercury, cadmium, lead, zinc, arsenic, chromium and phenol are also discharged into the sea, and in heavily polluted areas red tides and dead fish have been found.

Particularly important problems for the future appear to be hydrocarbon resources, biological resources and the question of marine pollution. The standard of marine science in China is fast improving. The strong numerical base, the enthusiasm of its scientists, and the extent of the resources being put into this area suggest that the gap in standards will narrow over the coming decade and that China will play an increasingly important role in the study of marine science and the use of the oceans.

G.P. Glasby
New Zealand Oceanographic Institute
Box 12-346, Wellington
New Zealand

IGCP Progresses Despite Unesco Crisis

The International Geological Correlation Programme (IGCP) continues to be a bright star in the international geoscientific world and especially in the firmament of Unesco. Its contributions to scientific knowledge, to international cooperation in science and to building geoscience communities in developing countries have been formally acknowledged by Unesco member countries.

Despite this activity, both the Board and Scientific Committees of IGCP have stressed again that funding now available to IGCP projects has reached the "lowest possible level to retain credibility" and that further reduction would be "inconceivable." Pointing out the large number of important regional projects in Africa, Latin America and Southeast Asia and the thousands of geoscientists involved, the Board stresses the fact that IGCP funding is "trivial compared with that allocated to, for example, the Geology for Development project in Africa, which is of limited scope both scientifically and geographically."

The good news for IGCP is that, despite the U.S. withdrawal from UNESCO, the funding for the program in 1985 is substantially the same as that for 1984 and the outlook for 1986-87 "seemed hopeful." The bad news is that, because of its severe budgetary situation, Unesco cannot afford to increase the funding as much as it would wish.

E. von Braun, Secretary of IGCP, reminded Board members that Unesco support is only for arranging meetings between scientists from different countries participating in the same projects, for regional meetings, and to ensure the proper "international administration and nature" of the program. This is only a fraction of the total cost of the projects which must be covered by participating nations themselves. In this connection, as R. Rutland, Chairman of the Scientific Committee, emphasized the "basic problem of the ratio between

overheads and operating funds cannot be ignored." Only limited funds are available for new projects - much less than they need for "reasonable encouragement."

In 1984, there were 48 on-going projects, including 7 that had completed their work. The trend since 1973 has been away from projects on precision of time scales (34% of projects in 1973 compared to 12% in 1984) towards those on events and processes (17% to 29%), methods (7% to 12%), and regional correlation (24% to 31%). The proportion concentrating on resources has remained virtually constant (17% to 16%).

Out of the 17 new project proposals received 6 were approved by the Board as follows:

- Project 224. Pre-Jurassic Evolution of Eastern Asia. Project leader - K. Ichikawa (Dept. of Geoscience, Faculty of Science, Osaka City University, Sugimoto, Sumiyoshi-ku, Osaka 558, Japan). This project aims at the correlation and better understanding of pre-Jurassic processes involving various geotectonic units that form the present day eastern margin of the Asian continent but which were not contiguous in Paleozoic time. The project will study tectonism, biotic distribution, sedimentation, igneous activity, metamorphism and distribution of resources.

Project 227. Magmatic Evolution of a Rift. Project leaders - A.B. Kapumzu and R.T. Rubala, (Lab. de Petrologie, Université de Lubumbashi, BP 1825, Lubumbashi, Zaire). This project will use structural petrological and geophysical approaches to a study of the magmatism and evolution of rift zones of the African plate and their comparison with analogous magmatic situations throughout the world.

- Project 233. Terrains in the Circum-Atlantic Paleozoic Orogens. Project leaders - J.D. Keppie (Dept. of Mines and Energy, Box 1087, Halifax, Nova Scotia, Canada E3J 2X1) and R.D. Dallmeyer (Dept. of Geology, University of Georgia, Athens, Georgia 30602, U.S.A.). The objectives of this project are to identify and define terrains and terrain boundaries, constrain the times of their amalgamation, determine the nature extent and age of pre-, syn- and post-accretionary movements, and interpret the tectonic elements and metallogenesis within each terrain and the overstepping sequences.
- Project 235. Metamorphism and Geodynamics. Project leaders - L.L. Perchuk (Inst. of Experimental Mineralogy and Academy of Sciences, 142432 Chernogolovka, Moscow District, U.S.S.R.) and M. Brown (Dept. of Geology, Kingston Polytechnic, Penrhyn Rd., Kingston-upon-Thames KT1 2EE, U.K.). This project aims to reconstruct the pressure-temperature-time paths of portions of metamorphic belts, especially those of Precambrian age. It will investigate the evolution of the gas phase with time throughout metamorphism and will correlate points in the metamorphic history with specific structural events.
- Project 236. Precambrian Events in the Southern Continents. Project leader - D.J. Ellis (Dept. of Geology, University of Tasmania, GPO Box 252C, Hobart, Tasmania 70001, Australia). This project will provide the basis for correlating the major plutonic, metamorphic and tectonic events in the Precambrian land mass of Gondwana now represented by shield areas in Sri Lanka, India, Australia, Africa, and Antarctica.

Project 239. Exploitation of IGBADAT, The World Base for Igneous Petrology. Project leader - F. Chayes (Geophysical Lab., 2801 Upton St. NW, Washington D.C. 20008, USA). This project, which succeeds number 163 that built a world data base for igneous petrology will encourage and facilitate use of the base, which is now deposited with the World Data Center A. The base is unique in that its structure facilitates machine sorting of petrographic, mineralogical, stratigraphic, radiochemical and trace element information, in addition to the usual major component or "essential oxide" data.

Following the vote by the IUGS Council in Moscow last year against the change of name from "Correlation" to "Cooperation," approved earlier by both IGCP and Unesco, the Board considers the matter closed. There were several changes in the membership of the Scientific Committee, with R. Rutland (Australia) retiring as its Chairman. J. Lovering (Australia) replaces G.O. Kesse (Ghana) as new Board Chairman, with J. Tater (Nepal) as Vice-chairman and K. Heier (Norway) as Rapporteur. Both the Board and the Committee expressed very strong support for the Secretary, E. von Braun, and his secretariat and urged Unesco to ensure the continuity of their operations.

It was also recommended that "great attention" be paid to the INQUA Symposium on Global Change in Africa now being planned for Dakar, Senegal, in 1986. IGCP will co-sponsor this meeting, and members pointed out that it would be a good opportunity for "consideration and elaboration" of the Unesco inter-regional project recommended in 1983 on Quaternary - Geology for Survival.

New Officers for IUGS Commissions and Affiliates

Several more of the IUGS Commissions and Affiliates have now reported the election of new officers as follows:

INTERNATIONAL ASSOCIATION OF GEOCHEMISTRY AND COSMOCHEMISTRY (1984-1989)

President	- M. Grunefelder (Switzerland)
Vice-President	- H. Wanke (F.R.G.)
Treasurer	- E.C. Angino (U.S.A.)
Secretary	- B. Hitchen (Canada)
Past President	- V.L. Barsukov (U.S.S.R.)
Council Members	- I. Barnes (U.S.A.)
	- M. Carapezza (Italy)
	- K. Kigoshi (Japan)
	- L.N. Kogarko (U.S.S.R.)
	- D. Lař (India)
	- S. Moorbath (U.K.)
	- F. Mrna (Czechoslovakia)
	- H. Sorensen (Denmark).

INTERNATIONAL ASSOCIATION OF MATHEMATICAL GEOLOGY (1984-1989)

President	- J.C. Davis (U.S.A.)
Vice-President	- P. Switzer (U.S.A.)
Past President	- E.H.T. Whitten (U.S.A.)
Secretary General	- R.B. McCammon (U.S.A.)
Eastern Treasurer	- V. Nemec (Czechoslovakia)
Western Treasurer	- M.E. Hohn (U.S.A.)
Council Members	- I. Clark (U.K.)
	- D. Gill (Israel)

- R. Sinding-Larsen (Norway)
- J.M. Cubitt (U.K.)
- A. Marechal (France)
- G.D. Williams (Canada)
- H.M. Parker (U.S.A.)
- A.N. Bugaets (U.S.S.R.)

INTERNATIONAL COMMISSION ON STRATIGRAPHY

COMMISSION BUREAU

Chairman	- J.W. Cowie (U.K.)
1st Vice-Chairman	- W. Ziegler (F.R.G.)
2nd Vice-Chairman	- E.G. Kauffman (U.S.A.)
Secretary General	- J. Remane (Switzerland)
Past Acting Chairman	- M.G. Bassett (U.K.)

SUBCOMMISSION ON PRECAMBRIAN STRATIGRAPHY

Chairman	- K. Plum (Australia)
Secretary	- D. Gee (Australia)

SUBCOMMISSION ON CAMBRIAN STRATIGRAPHY

Chairman	- A.Yu. Rozanov (U.S.S.R.)
Secretary	- J.W. Cowie (U.K.)

Working Group on Precambrian/Cambrian Boundary

Chairman	- J.W. Cowie (U.K.)
----------	---------------------

Working Group on the Cambrian/Ordovician Boundary:

Secretary	- B.S. Norford (Canada)
	- J.F. Miller (U.S.A.)

News Reports

SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY:

Chairman - C.R. Barnes (Canada)
Secretary - B.D. Webby (Australia)

Working Group on the Ordovician/Silurian Boundary

Chairmen - R.J. Ross (U.S.A.)
- C.H. Holland (Ireland)
Secretary - L.R.M. Cocks (U.K.)

SUBCOMMISSION ON SILURIAN STRATIGRAPHY

Chairman - D.J. Kaljo (U.S.S.R.)
Secretary - T.N. Koren (U.S.S.R.)

SUBCOMMISSION ON DEVONIAN STRATIGRAPHY:

Chairman - W.A. Oliver (U.S.A.)
Secretary - D.L. Dineley (U.K.)

Working Group on Devonian/Carboniferous Boundary

Chairman - E. Paproth (F.R.G.)
Secretary - M. Streeel (Belgium)

SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY

Chairman 1984-1986 - R.H. Wagner (Spain)
1986-1989 - W.H.C. Ramsbottom (U.K.)
Secretary - W.L. Manger (U.S.A.)

Working Group on Carboniferous/Permian Boundary

Chairman - C.A. Ross (U.S.A.)

SUBCOMMISSION ON GONDWANA STRATIGRAPHY

Chairman - J.M. Dickins (Australia)
Secretary - R.E. Wass (Australia)

SUBCOMMISSION ON PERMIAN STRATIGRAPHY

Chairman - Shen Jin-Zhang (China)
Secretary - Jin Yu-Gan (China)

Working Group on the Permian/Triassic Boundary

Chairman - E.T. Tozer (Canada)

SUBCOMMISSION ON TRIASSIC STRATIGRAPHY

Chairman - C. Virgili (Spain)
Secretary - H. Visscher (Netherlands)

Working Group on Triassic/Jurassic Boundary

Chairman - R. Moutarde (France)

SUBCOMMISSION ON JURASSIC STRATIGRAPHY

Chairman - A. Zeiss (F.R.G.)
Secretary - O. Michelsen (Denmark)

Working Group on the Jurassic/Cretaceous Boundary

Chairman - J. Remane Switzerland
Secretary - V.A. Zakharov (U.S.S.R.)

SUBCOMMISSION ON CRETACEOUS STRATIGRAPHY

Chairman - J.M. Hancock (U.K.)

Working Group on the Cretaceous/Palaeogene Boundary

Chairman - K. Perch-Nielsen (Switzerland)
Secretary - J. Smit (Netherlands)

SUBCOMMISSION ON PALAEOGENE STRATIGRAPHY

Chairman - I. Premoli-Silva (Italy)
Secretary - D.G. Jenkins (U.K.)

Working Group on the Palaeogene/Neogene Boundary

Chairman - F.F. Steininger (Austria)
Secretary - F. Rögl (Austria)

SUBCOMMISSION ON NEOGENE STRATIGRAPHY

Chairman - J. Senes (Czechoslovakia)

Working Group on the Pliocene/Pleistocene Boundary

Chairman - E. Aguirre (Spain)

Regional Committee on Mediterranean Neogene Stratigraphy

Chairman - J.E. Meulenkaamp (Netherlands)
Secretary - F. Rögl (Austria)

Regional Committee on Pacific Neogene Stratigraphy

Chairman - J.P. Kennett (U.S.A.)

SUBCOMMISSION ON QUATERNARY STRATIGRAPHY

Chairman - R.P. Suggate (New Zealand)
Secretary - H.J. Schneider (F.R.G.)

SUBCOMMISSION ON STRATIGRAPHIC CLASSIFICATION

Chairman - A. Salvador (U.S.A.)
Secretary - P.F. Burolet (France)

SUBCOMMISSION ON GEOCHRONOLOGY

Chairman - N.J. Snelling (U.K.)
Secretary - A.J. Hurford

SUBCOMMISSION ON THE MAGNETIC POLARITY TIME SCALE

Chairman - N.D. Opdyke (U.S.A.)

COMMITTEE ON STORAGE, AUTOMATIC PROCESSING, AND RETRIEVAL OF GEOLOGICAL DATA (1984-1989)

Chairman - G. Gall (Finland)
Vice-Chairman - D.A. Rodionov (U.S.S.R.)
Secretary Treasurer - R.G. Garrett (Canada)
Past Chairman - R. Sinding-Larsen (Norway)
Executive Members - J. Hruska (Czechoslovakia)
- G. Gabert (F.R.G.)
- P. Leymaire (France)
- R.B. McCammon (U.S.A.)
Members - N. Nishiwaki (Japan)
- Zhao Pengda (China)
- H. de la Roche (France)
- J.F. Landers (U.S.A.)

Chairman for the Regional Committee for Latin America

- H.A.F. Chaves (Brazil)

COMMISSION ON MARINE GEOLOGY

Chairman - K. Hsü (Switzerland)
Secretary - J. Thiede (F.R.G.)
Members - E.M. Davin (U.S.A.)
- J. Francheteau (France)
- T.F. Gaskell (U.K.)
- G.R. Heath (U.S.A.)
- T.H. Gordon (U.S.A.)
- J.A. Katili (Indonesia)
- C.E. Keen (Canada)
- J.P. Kennett (U.S.A.)
- L.P. Lisitzin (U.S.S.R.)
- Mei-E Ren (China)
- R.A. Scrutton (U.K.)
- S. Uyeda (Japan)
- C.C. von der Borch (Australia)
- R. von Huenen (U.S.A.)
- R. Whitmarsh (U.K.)

A new GSA Special Paper by A.M.C. Şengör, the product of his long-standing interest in Tethyan problems.

With this work, Şengör hoped to fill an important gap he saw in the regional tectonic literature of Eurasia, namely a synthetic overview of the early history of the Alpine-Himalayan mountain ranges and its expected implications for the "Tethyan paradox," first brought into focus by Alan Smith of Cambridge.

GSA Special Paper 195: **The Cimmeride Orogenic System and the Tectonics of Eurasia**, by A.M. Celâl Şengör, 8½" × 11", paperback, 91 pages, illustrated, with subject & author indexes and one folded map insert. ISBN 0-8137-2195-4, CIP, paperback . . . \$17.00.

The CIMMERIDE OROGENIC SYSTEM and the TECTONICS of EURASIA

A. M. Celâl Şengör

**SPECIAL PAPER
195**

Check, money order (in U.S. funds), or credit cards below accepted. Credit card users must provide their full name, card name, card number, and expiration date. Colorado residents add sales tax. We pay surface postage on prepaid orders.

MasterCard * VISA * American Express * CHOICE
Carte Bleue * Barclay Card * Access
EuroCard * Standard Bank Card

Order today from:

GSA Publication Sales

P.O. Box 9140

Boulder, CO 80301 • (303) 447-2020

THE GEOLOGICAL SOCIETY OF AMERICA

Geology down under . . .

AUSTRALIA
from the bottom up!

read the . . .

AUSTRALIAN JOURNAL OF EARTH SCIENCES

The *Australian Journal of Earth Sciences* is the official journal of the Geological Society of Australia Incorporated and publishes research papers and significant review articles on a wide variety of topics ranging from those of a purely theoretical and experimental nature to those of more general interest to geoscientists working on problems in and around the Southern Continents. In addition it publishes papers, critical discussions of published papers and abstracts of Australian theses.

The Journal is issued quarterly to members of the Society. For details of membership contact:

Geological Society of Australia Inc.
10 Martin Place,
Sydney, N.S.W. 2000 Australia

Library and other non-member subscription enquiries and orders should be directed to the publisher:

Blackwell Scientific Publications (Aust)
Pty. Ltd.
99 Barry Street,
Carlton, Vic 3053 Australia