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Record 1972/4

REPORT ON ATTENDANCE AT XV GENERAL ASSEMBLY OF THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS, MOSCOW, U.S.S.R.,

30 July - 18 August 1971

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SUMMARY

The writer attended symposia, and scientific and business meetings of the I.U.G.G. General Assembly on topics in gravity, seismology, geomagnetism, and geophysical investigations of the Earth's crust and upper mantle. Only a small fraction of the programmed papers of interest could be attended. Many projects of mutual interest were discussed informally with overseas scientists attending the meeting.

A Post-Congress tour to Novosibirsk in Siberia was undertaken, with a visit to the Institute of Geology and Geophysics at Akademgorodok, the University town. The work of the Institute in deep seismic sounding and other crustal investigations was of particular interest.

INTRODUCTION

The International Union of Geodesy and Geophysics (I.U.G.G.) is the co-ordinating body for geophysical investigations which require co-operative efforts from various nations. Membership before the XVth General Assembly included 69 countries; five extra countries were admitted during the Assembly, making a total of 74.

The I.A.G. comprises seven associations, namely:

I.A.G. - International Association of Geodesy.

I.A.S.P.E.I. - International Association of Seismology and Physics of the Earth's Interior.

I.A.M.A.P. - International Association of Meteorology and Atmospheric Physics.

I.A.G.A. - International Association of Geomagnetism and Aeronomy.

I.A.P.S.O. - International Association of Physical Sciences of the Ocean.

I.A.V.C.E.I. - International Association of Volcanology and Chemistry of the Earth's Interior.

I.A.S.H. - International Association of Scientific Hydrology.

General Assemblies are normally held at intervals of about 4 years. During these, business meetings of the above Associations and their Working Groups, Sections, and associated Committees are held. Symposia on scientific subjects, generally of interest to two or more associations, are also held; throughout the period of the assembly there are several such symposia running continuously.

B.M.R. has activities closely related to some aspects of the spheres of interest of all of the Associations except I.A.M.A.P. As I was the only delegate from B.M.R. it was impossible to cover all of these. I attempted to cover only the areas of vital concern to the work of my Section of B.M.R. - i.e. I.A.S.P.E.I., I.A.G. (Gravimetric aspects) and I.A.G.A. (Geomagnetic aspects). Even this proved to be far beyond the capabilities of one person.

I understand that the total number of delegates registered for the Assembly exceeded 4,000, including approximately 3,000 foreign visitors. Official languages of the Assembly were English, French and Russian. The Russians made a special gesture by delivering nearly all of their papers in English, and by providing translations of the remaining few.

SCIENTIFIC PROGRAM

A list is attached of the Symposia and meetings which I attended for part or all of their proceedings. The main symposium of interest to me consisted of the Upper Mantle Committee's invited review papers. This occupied the whole of the second week of the proceedings, and covered recent research on topics including the origin of the Earth and the continents, the materials and physical state of the interior, deductions from all types of geophysical measurements, geological studies of volcanism, metamorphism, and magmatism, and laboratory experiments of rock behaviour under high pressure and temperature conditions. A general acceptance of the ideas of the plate tectonics theory was evident, in which parts of the Earth's crust behave as rigid plates except at their boundaries; these plates move relatively to each other, spreading by addition of new crust at mid-ocean ridges, and being pushed down into the mantle under island arcs. Notable exceptions to the general support for this theory came from Prof. Beloussov of U.S.S.R. and Sir Harold Jeffreys.

Much progress has been made in Europe and U.S.S.R. in the use of deep seismic sounding methods. Most research workers are turning to magnetic tape and digital recording techniques, which permit more thorough analysis of the results. One result has been the detection of low velocity zones within the Earth's crust in some areas; these are difficult to detect with conventional seismic refraction techniques.

Remarkable progress has been made by Dr. Sukuma in Paris in the absolute measurement of gravity. He claims an accuracy of 3 microgal, whereas a few years ago one milligal was considered to be a desirable target. With this accuracy it should be possible to determine whether slow changes in the gravity field occur.

The I.A.G. has adopted a series of gravity values for base stations of the First Order World Gravity Net, based on international measurements over many years. Several Australian stations are included in this, and with the internal measurements carried out in this country in recent years, all local gravity values can readily be adjusted to conform to the new standards.

Some progress is being made towards a theory of earthquake occurrence that will enable predictions to be made of damaging events, but there is much work yet to be done on this. One interesting sidelight on this was a paper describing lightning which sometimes accompanies earthquakes; the explanation given was that this was a ground to ground discharge resulting from piezo-electric behaviour of the surface rocks in response to vibrations.

Many elaborate mathematical methods have been developed for extracting more information out of geophysical data; this is particularly true for seismic data, where the trend is towards analysis of the whole seismogram of an earthquake or explosion, instead of noting only the times of arrival of the main energy pulses.

INFORMAL DISCUSSIONS

This Congress afforded a unique opportunity to discuss various projects of mutual interest with overseas collaborators. Some of the more important items discussed, i.e. those having a direct bearing on our activities, are mentioned below.

(a) Gravity ties to Russia. Prof. Y.D. Boulanger and Dr. M. Kogan, of the Institute of Physics of the Earth, Moscow, were very anxious to pursue a proposal to make a pendulum gravity tie between Moscow and Sydney, with local assistance from B.M.R.; in addition they invited us to make a return visit to Moscow with our pendulum equipment (which is still under development). Further, they wish to propose sending 10 or more Russian gravity meters, with 6 or 7 observers, to make measurements along the Australian Gravity Calibration Line. This would involve B.M.R. in charter of an aircraft for about 10 days, and local accommodation expenses for the visitors. A letter formally suggesting this project will follow.

(b) Magnetic Conjugate Point Experiments. A team of Russian scientists, headed by Prof. V.A. Troitskaya of the Interdepartmental Geophysical Committee, and including scientists from Izmiran, Leningrad University, Yakutsk Cosmological Research Institute, and Khabarovsk Complex Institute, held two meetings with Dr. E.M. Lilley of A.N.U. and myself, to discuss a proposed joint project for measuring magnetic field variations at conjugate points of the geomagnetic field. Petropavlovsk is approximately conjugate to Canberra. Because of the distribution of land and sea there are not many places in the world where such measurements can be undertaken. B.M.R. has agreed to record medium speed variations at Canberra, and Ionospheric Prediction Service is already making special recordings with their vertical ionosondes. Other Australian institutions, such as A.N.U. and the Universities of Queensland, New England, Newcastle, and Hobart may be prepared to co-operate in this project by recording electrical and/or magnetic variations at various frequencies.

(c) Special Committee for Antarctic Research. The Solid Earth Geophysics Working Group, of which I am a member, held an informal meeting, which was attended by more members than most formal meetings. Matters discussed included exchange of data, a U.S. project to drill a deep hole off the Ross Ice Shelf, indices of geomagnetic activity, and a proposed Southern Oceans International Project.

(d) 10-Ton Explosion Project. It has been established that the time of collapse of the bubble generated by an explosion under water depends on the charge size and depth; with 10 tons of 200 metres depth the seismic waves are generated at the optimum frequency for teleseismic transmission and experimentally have been recorded up to 90° angular distance from the explosion.

A meeting was convened by Dr. P.L. Willmore, of U.K. Institute of Geological Sciences, to discuss an international project for detonating such explosions at various sites around the world. The resulting seismic waves will be recorded by permanent and temporary stations within range. Such a project will greatly improve our knowledge of the structure of the upper mantle, and improve the accuracy of location of earthquakes.

A Working Group was formed under the auspices of I.A.S.P.E.I. to organize this project, possibly in late 1972, and I was appointed a member of this. With the recent donation of explosives to BMR by WAPET, we should be in a good position to participate.

I also discussed with Dr. Willmore the possibility of transferring a network of seismographs, at present in Solomon Islands region, to East Papua next year, when our crustal investigation in that area is proposed. This will be considered when the future of the network is decided in the near future.

(e) Meeting with Dr. P. Molnar of Lamont Geological Observatory, University of Columbia, New York, to discuss earthquake focal mechanisms in the New Guinea - Solomon Islands region. He gave me a draft of a paper by T. Johnson and himself, which is very relevant to our own work in this area.

(f) Prof. N.P. Grushinsky, of Sternberg Astronomical Institute, discussed gravity measurements in Antarctica, and the possibility of further co-operative work using Australian gravity data for determination of the shape of the geoid.

POST-CONGRESS TOUR TO NOVOSIBIRSK

I had enrolled for a tour to Irkutsk, but this was cancelled owing to floods, and I changed to the Novosibirsk visit. This was probably more interesting scientifically than the Irkutsk trip as it turned out.

The main feature was a visit to the Institute of the Earth's Crust at Akademgorodok, about 15 km from Novosibirsk. This institute has a staff of about 1 000 - 800 scientific and technical, and 200 administrative. It comprises three large Sections - Mineralogy and Petrography and Ore Deposits, under Prof. Sobolev; Stratigraphy, Tectonics, and Sedimentary Rocks, under Prof. Luchitzky; and Geophysics, under Prof. Puzyrev. The excursion was mainly concerned with the latter, which includes Divisions of Geochemistry, Spectrochemistry and Physics and Chemistry of Rock Properties, and a Geophysical Department. This latter is again divided into three subdivisions -

(a) Central Geophysical Observatory (seismology, geomagnetism, ionospheric sounding, earth tide measurements).

(b) Potential fields - gravity, magnetic, electromagnetic, and (a recent addition) direct measurement of recent crustal movements.

(c) Seismology, including deep crustal sounding, improvements in prospecting techniques, use of transverse waves; also magnetotelluric, heat flow, and nuclear bore-hole logging techniques.

We visited their high pressure laboratory for determining rock properties, the geological museum, and the computer centre, and had a series of talks followed by discussion on other aspects of their work. I was particularly interested in their equipment, field techniques, and methods of interpretation for deep seismic sounding, and the use of transverse waves in seismic exploration to improve signal to noise ratio.

CONCLUDING REMARKS

On the whole I found the Russian scientists very friendly and open, and prepared to discuss any aspect of their work with visitors.

I strongly recommend that for future I.U.G.G. General Assemblies, about 6 delegates should attend from BMR in order to represent fully our interests. These should include 3 from the Geophysical Branch to cover

I.A.G., I.A.G.A., and I.A.S.P.E.I., 2 Geologists to cover I.A.S.H., and I.A.V.C.E.I., and either a Geologist or Geophysicist for I.A.P.S.O.

The next Assembly will be held in Paris in 1975.

APPENDIX

Symposia Attended

Crustal structure based on seismic data

Geophysical theory and computers

Ocean floor spreading

Automatic acquisition of data and time series analysis

State of substances in the Earth's Interior

Forerunners of strong earthquakes

East African rift system

Earth tides

Upper Mantle Project invited reviews

Scientific Sessions of Associations

I.A.G. Section IV - Gravimetry

Measurement of gravity at sea

Absolute gravity determinations

Establishment of World Gravity Network

Gravity measurement techniques

I.A.G. Section V - Geoid

Physical geodesy

Determination of geoid from gravity and satellite orbit data

I.A.G.A. - Commission I - Observatories and Instruments

Magnetic observatory instrumentation

I.A.G.A. Working Group meetings

I 1 Magnetic observatories

I 2 Geomagnetic and telluric instrumentation

II 1 Land and airborne surveys

II 2 Shipborne surveys

II 6 Data interchange

IV 1 Morphology and indices

IV 4 Special disturbance events

Business meetings

Opening Plenary Session of the General Assembly

Closing Plenary Session of the General Assembly

Opening Plenary Session of I.A.G.

Closing Plenary Session of I.A.G.