

Earth Sciences Converge in Moscow

from a Correspondent

At the fifteenth general assembly of the International Union of Geodesy and Geophysics (IUGG) held in Moscow during the first fortnight of August it was clear that at long last, and very belatedly, Earth scientists of various disciplines are beginning to talk each other's language. All interests were catered for at the specialized symposia organized by the various member associations within the union. What follows is a selection of items from some of these symposia; a further report will appear in the forthcoming issue of *Nature Physical Science*.

East Africa, and particularly its rift system, has been the site of major British scientific endeavour for many years and this was evident at the East African Rift symposium where eleven of the contributions were by scientists from the United Kingdom. Eight other countries were also represented and this was the first time so many scientists working in East Africa have gathered together.

Seven speakers dealt with the Afar triangle (the junction of the East African rifts with the Red Sea and Gulf of Aden). The structure of the region was ably reviewed by Mohr (Smithsonian Institution) and the volcanology was discussed by Tazieff (CNRS). On display were two maps of the region, a preliminary Bouguer gravity map by Makris (Hamburg) and a very impressive aeromagnetic map by Hall (Newcastle upon Tyne). Hall's map was coloured in such a way that the quiet zones could be readily distinguished from the regions of large magnetic anomalies similar to those found over the seafloor spreading zones of the Gulf of Aden and the Red Sea. Geologists and geophysicists all agreed that sialic crust must be absent beneath much of this region. This view was confirmed by Jobert (Paris) who described some seismic refraction experiments carried out by dropping bombs in the sea and recording on land in the French territory of Afar and Issas. All his profiles showed the presence of oceanic crust. Only the exact proportion of oceanic to continental crust remains uncertain.

From Afar, the theme of the meeting moved to East Africa. A general review of continental rift zones was given by Milanovsky (Moscow). Knopoff (Los Angeles) then presented evidence which convincingly demonstrated the presence of low seismic velocities beneath the East African rift on the basis of surface wave phase velocities at the Addis Ababa and

Nairobi stations. There then followed two geological contributions on the rift volcanics in Kenya; Williams (Nairobi) reviewed the distribution in space and time of the various volcanic rocks, contrasting those occurring on the rift floor and shoulders, and McCall (Victoria) described a special field-geochemical study of the Silali volcano. McCall took the view that the eastern rift is an "aborted" ocean which has never opened up; the rocks are from primary mantle derived material and the magma chambers probably reached to within a kilometre or so of the rift valley floor. Such a view is consistent with the mapping and interpretation of the positive gravity anomaly along the rift axis by Searle (now at Addis Ababa) to which many contributors made reference.

The afternoon session opened with an account by Logachev (Irkutsk) of Soviet expeditions between 1967 and 1969. Soviet scientists have an impressive collection of geological data and have made more than 250 potassium-argon age determinations for 170 different localities in Kenya, Tanzania and Uganda. On the basis of this work, it is thought the process of rifting can be divided into six stages—23–16; 23.5–12; 10–5; 5–2; 2–0.7; and 0.7–0 million years—and each of these represents definite stages of magmatism and structural development. Rykounov (Moscow) described Soviet microearthquake studies in the southern part of the Gregory rift and the northern part of the western rift. In northern Tanzania, he and his colleagues have obtained a crustal structure consisting of 18 km with a P-wave velocity of 5.8 km s⁻¹ underlain by 19 km with a P-wave velocity of 6.5 km s⁻¹.

Fairhead and Girdler (Newcastle upon Tyne) discussed the relocation of epicentres using the joint epicentre technique. Their plots of epicentres on new fault maps prepared by Baker showed a remarkable correlation between earthquakes and recent geological features. They have also calculated travel time corrections for fifteen seismic recording stations throughout Africa and have tentatively mapped regions in which P-waves are slowing down beneath the rift system north of the equator. From a study of all available fault plane solutions they suggest that this region is associated with a W.N.W.–E.S.E. stress pattern and with a consequent thinning of the lithosphere.

A notable feature of this meeting on the East African Rift was a consensus of opinion that there must be some

separation of the lithospheric plates beneath Afar but none beneath East Africa. It seems that the lithosphere in East Africa has thinned but not broken apart.

At first sight, the choice of ocean floor spreading as a major topic for discussion in an international symposium seems somewhat outmoded, for the major impact of this all-embracing theory came 3–4 years ago and is accepted, in varying degrees, by most Earth scientists. Several speakers dealt with the internal processes that cause the seafloor to spread and the plates to move. Models presented by Turcotte (Cornell) and McKenzie (Cambridge) involved the evaluation of solid state thermal convection as the major driving mechanism. Both suggested that the convective process extends deeper into the Earth than the low velocity layer and that total mantle convection could not be ruled out.

Although much of the ocean floor has been investigated by geophysical methods (one eminent US oceanographic geophysicist bemoaned the fact that there was little of the ocean floor left to study), a group of speakers presented the results of regional studies in localized areas; for example, Talwanie and Pitman (Lamont-Doherty Observatory) discussed the Norwegian-Greenland Sea, Krause and Shilling (Rhode Island) gave an account of the Azores area and Barker (Birmingham) described the active spreading centre in the Scotia Sea.

Although there is now a vast amount of data on the physics, chemistry and shape of the Moon, the "vulcanists" and "impactors" at the symposium on this subject seem to be as widely divided as ever. Those selenologists who proposed an internal origin for the Moon's physical phenomena seemed to be dominant, if only because they were thicker on the ground than their opponents.

Because it is to be replaced by the Inter-Union Commission for Geodynamics, the Upper Mantle Project made its last international appearance in a 4½ day symposium.

The lasting impression of the IUGG assembly is that the next decade should be one of great stimulation and interest as continental geological and geophysical data are reappraised in the light of the seafloor-spreading-plate tectonics concept. It is to be hoped that the newly formed Inter-Union Commission for Geodynamics will make a major contribution by guiding these studies.