Examples from the activity of ELGI abroad

*International Geological Expedition in Cuba**

The geological mapping on the scale of 1:50,000—started in the course of 1984 in the region of Holguin (southern part of Cuba)—as well as the complementary geophysical activities continued during 1985. Geological and geophysical prospecting for mineral resources to the scales of 1:10,000 and 1:25,000 was also performed by the Hungarian Geological–Geophysical Group (organized by MÁFI) on the areas becoming prospective in the course of the mapping. The geological mapping is being carried out on schedule.

The Coordination Team directing the international groups working on the basis of various bilateral agreements, besides controlling methodology in mapping and prospecting works carried out on different territories, collects and systematizes geological and geophysical materials of Cuba. Accordingly, the Hungarian chief geophysicist working in the team compiled the "geophysical prospecting" part of the report on geological mapping in the scale of 1:50,000, as well as took part in the finalization of the prospecting plans, evaluated the methodology of the geophysical crews and participated in setting up norms for the unification of geological interpretation of geophysical anomalies from the point of view of mining geophysics.

*International Geological Expedition in Mongolia**

In the course of 1985 the prospecting of the southern part of the Enderhan massif was continued by the Hungarian Geological–Geophysical Group which was organized by ELGI as main contractor. Prospecting in the scale of 1:10,000 and 1:5,000 was performed in the neighbourhood of the Ender Cagan Obo rare earths mineralization, on the Mengen Ender silver-polymetallic ore occurrence and on the Gotor Obo polymetallic and rare earths indication with self potential, various resistivity and induced polarization, geomagnetic and radiometric methods.

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Main results of the geophysical measurements:

— attention was drawn to the south-eastward continuation of the ore body on the Ender Cagan;
— the vein–lens type of mineralization became known and metalliferous zones could be separated on the Mengen Ender area;
— 3 IP anomalies of small size but high intensity were detected in the environment of the Gotor Obo. Their detailed investigation will be carried out in 1986.

*Results of electromagnetic frequency soundings in prospecting for ores in the Teerimäki area, Finland**

In August 1985 electromagnetic frequency soundings of high sampling rate were performed, by a four-member expedition of ELGI, with the Maxi-Probe system, on the Teerimäki area near the town of Keitele, in addition to the geophysical surveys carried out earlier by the Geological Survey of Finland with the purpose of prospecting for ore deposits (VES, AMT, VLF, Slingram profiling).

The aim of the geophysical survey was to trace the metalliferous zones connected with the contact zone of the gabbro intrusion. These metalliferous zones are supposed to exist between the north-western exposure of pyrite (borehole No. 382) and the south-eastern outcrop of sphalerite mineralization. Pyrite mineralization inside the gabbro intrusion is known only from two boreholes; EM soundings were tested on the area between them, above a thin ore sheet of ca 40° apparent dip (profile TE–B, between points 1–7 *Fig. 111*).

As a geoelectric model, it was supposed that the metalliferous zones are thin, conductive sheets, whereas the embedding medium consists of a quasi-*n*-layered formation with nearly horizontal or only slightly inclined irregular layer boundaries — or it consists of blocks of the above characteristics bounded by facture zones and faults. This model is a composition of the conventional ore models and the structural ones—used in the course of mapping. Another special feature of the geoelectric model is that the resistivities of the crystalline and volcanic rocks—mostly gneiss and gabbro—forming the subsurface are extremely high (4,000–60,000 Ωm) while the resisitivities of the weathered rocks of the fracture zones are low (100–800 Ωm) approximating that of the conductive metalliferous zones, therefore having similar inductive effects. Thus the fracture zones should be considered in the model as dipping conductive sheets.

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Results:

— The one-dimensional effects caused by the layering produce slowly changing patterns which can be correlated along the profile.
— Characteristic dents and quick local changes having no effect on the overall shape of the transformed curves are produced by the galvanic effects due to the dipping layers. By correlating these changes the dip conditions can be constructed (see Fig. 111, horizons *A*, *B*, *C*, *D*, *F*, *G*).
— A nearly 1-dimensional type effect is induced also by the thin ore sheet of 40° dip angle in the soundings above it. Such an effect is the ϱ_a decrease under horizon *H* in Fig. 111. The depth of the ore sheet can precisely be constructed also by 1-dimensional model hypothesis. Deviation between refraction points *H*, marked with circles, and the zone of mineralization are not significant.
— A 2-dimensional effect of a steeply dipping sheet can be recognized in Fig. 111 between points 9 and 12 by the characteristic fast change of the apparent resistivity pattern. As the cause a nearly vertical conductive sheet can be conceived perpendicularly to the profile with the upper head position under points 10–11. This can also be interpretated as a fault zone.

Electromagnetic frequency soundings near Ranua in Finland connected to the Suhanko-project

As another task of the expedition Maxi-Probe type EM frequency soundings were carried out at every 100 m along a 1.7 km long profile on the area of the Suhanko gabbro intrusion, on the comission of the Oulu University. The aim of the investigations was to verify the existence of the ore body. At one part of the profile the existence of it can be excluded. The ϱ_a decreases of the other soundings refer to a conductive zone at a depth of 700–800 m according to 1-dimensional evaluation. This result agrees with that of the 1-dimensional evaluation of the AMT soundings. On the profile, however, there is a strong 2-dimensional effect similar to that of Fig. 111. This effect may also be due to a fault.

*EM frequency soundings in the vicinity of the iron occurrence at Marquesado, Spain**

From 21st November till 14th December 1984 on the comission of Compañia Andaluza de Minas S. A. (C. A. M.) electromagnetic frequency soundings (MFS) were carried out with the Maxi-Probe EMR–16 instrument.

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Haematitic iron ore is the main production of C. A. M. in open pit mines on the northern slope of the Sierra Nevada at the rim of the Marquesado basin.

The aim of the measurements was:

— to determine the geoelectric resistivity conditions on the basis of MFS measurements on an area known by drillings *(Figs. 112 and 113)*;
— to investigate the geoelectric model of the basin along some regional profiles by experimental measurements *(Fig. 114)*.

The zone of mineralization can be found in the top unit of a complex nappe system consisting of Triassic shale, calc schist and limestone but it is mostly connected with the limestone. The shapes of the ore bodies are capriciously changing. The size of the largest ore body is 350 m×100 m×60 m. In the basin, above the nappe system alluvial formations are deposited ranging in thickness up to 200 m.

In Fig. 112 two apparent resistivity vs depth curves are presented. The measurements were carried out at a distance of several 100 meters from the pit, over boreholes. It can be seen from the geological column that the iron ore (marked by black) may be situated, at different levels of the Triassic formations. Four horizons were determined on the MFS curves. The surface of the conductive mica schist was marked by *A*. The most useful information of the measurements is the correlation of this break point along the profile. The surface of the Triassic nappe system including also the iron ore is indicated by horizon *B*. It often cannot be accurately determined because of the overlapping resistivity intervals of the formations above and underneath. Horizons *C* and *D* are the lower and upper boundaries of a high resistivity sequence which can be correlated within the alluvium. On the basis of Fig. 112 one could say that iron ore can be detected as a "layer" of high resistivity compared to its environment. Other measurements, however, prove that this statement cannot be generalized because ore bodies do not behave as "layers", even not for MFS measurements. The ore bodies penetrated by a borehole at point 2 of Fig. 113, for example, showes better correlation with the high resistivity parts of the MFS curve of point 3 than with that of point 2 (do the ore bodies thicken in the direction of point 3?). The MFS curves of Fig. 113 draw the attention to further high resistivity formations under horizon *A*. In the lack of borehole data it can only be assumed that these can be interpreted as gneiss, carbonates or, perhaps ore.

In Fig. 114 a regional profile can be seen with 200–500m point intervals on an area of the basin where there are practically no boreholes. Horizon *A* follows the surface of the mica schist. Relatively reliable correlation can be performed between the MFS curves for even such a great point interval. From this the conclusion can be drawn that the geological build-up is undisturbed compared to the environment of the known ore occurrence. It deserves attention, however, that under horizon *A* capriciously changing bodies of high resistivity can be detected here too. The regional profiles enables us to divide the basin into parts with different structure and different prognostic value.

We got acquainted with the geology of the area by the assistance of Srs Gonzales, Serrano and Zubiaur members of the Geology Branch of C. A. M. whereas the geophysical measurements were carried out with the help of Srs Fernandes, Ovejero and Santiago members of Sociedad Minera y Metalurgica de Peñarroya España S. A. We should like to thank for their priceless help.

Library

The present stock of our *Library* amounts to 27,233 volumes of books and periodicals as well as 10,823 miscellaneous items. In 1985 our stock was increased by 615 books, 382 volumes of periodicals, 845 documentary publications and 300 brochures on instruments. Our collection of periodicals has been enlarged by 6 new ones. As a result of international exchange we received 352 publications and dispatched 1,474 publications to 512 addresses in 59 countries. In 1985 the services of our Library were utilized by 5,161 readers/borrowers.

Publications

In 1985 the following publications were issued:

— Annual Report of the Eötvös Loránd Geophysical Institute of Hungary for 1984.
— Geophysical Transactions, vol. 31. Nos. 1, 2, 3, 4.
— Study of the Earth Tides (Bulletin of KAPG, No. 6., No. 7.)