1 GEOPHYSICAL PROSPECTING

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Location of the field works of ELGI in 1977 is presented on Fig. 1.

The geophysical investigation of the Transdanubian Central Range continued according to the co-ordinated plans of the Bauxite Prospecting Enterprise and the Hungarian Geological Institute. The bulk of the work consisted of *reconnaissance mapping* near Keszthely, in the western foreground of the Bakony Mountains and in the environs of the Velence Mountains. *Regional mapping* was carried out in the Bakony Mountains and in the SE and NW margins of the Gerecse Mountains. *Detailed* surveys were performed for quartz-sand, lignite, oil shale and bauxite exploration.

Some of the more interesting results are summarized as follows. In the *western foreground* of the *Keszthely Mountains* new bore-holes and karst water observations were needed to study the water supply problems of Lake Hévíz. The bore-holes have been located on the base of integrated geophysical investigations. On the contour map of the upper Triassic dolomite (Fig. 2) determined by gravity, magnetic and seismic refraction measurements several fault zones can be traced which may have an important role in the flow of the karst water. Depressions of the Triassic basement are filled by marl. On Fig. 3 at the place marked H-VI the bore-hole reached marl at the depth predicted by geophysics and yielded 100 l/min 38 °C water.

In the *western foreground of the Bakony Mountains* the Preaustrian basement was mapped, but upper Cretaceous horizons were determined as well. The project was based on the possible coal reserves of the area. In the geophysical complex gravity, geoelectrics, seismic refraction and VIBROSEIS reflection were involved. The resulting map is presented on Fig. 4.

The regional mapping in the *Bakony Mountains* served bauxite exploration. On Fig. 5 two characteristic cross sections are presented. East of the ridge geophysical parameters suggest the presence of Cretaceous and Eocene formations. These, as overlying layers could prevent the Oligocene denudation of the bauxite accumulated in tectonic troughs. To clear these problems bore-holes were proposed (locations marked by F).

Thet target of geophysical survey of the *basin between Tatabánya and Szárújtelep* was coal and bauxite exploration. For drilling project the southern part of the area was submitted for consideration which—according to cross section Sze-9 (Fig. 7)—has favourable structural position.

Basaltic ring structures, as possible oil shale sites were prospected by helicopter borne magnetic survey. The ΔT map is shown on Fig. 8 a, and a geologic cross section on Fig. 8 b. Interpretation of the map was done by model computations; it was concluded that towards NW, W and SW of the discovery site, other crater rings were presumable as well.

As contract work for the Bauxite Prospecting Enterprise an integrated geophysical survey has been carried out *around the Iharkút mining area* since 1974. The summarized results are shown on Fig. 9. Perspective areas were separated and the relief of the Triassic basement determined. The geophysical model has been updated continuously using the latest bore-hole data.

The exploration of the *Börzsöny Mountains* was concentrated around two subjects: 1) regional structure and evolution; 2) localization conditions of mineralization.

Reinterpretation of former geological-geophysical data played the prominent part in the first point (Fig. 14). The dislocation zone on the boundary of the Transdanubian–Gömörid Permian–Mesozoic and the Veporid crystalline structural formations (Fig. 10) near Diósjenő, was detected by seismic refraction survey (Fig. 11) and gravity-magnetic modeling (Fig. 12). In the volcanic structure the character of the marginal ridge was specified, the set-up of the depression of Szob–Szokolya and the position of the sedimentary series of Márianosztra were detailed. The marginal ridge consists of several small volcanoes (Fig. 13), remnants of an earlier large size strato-volcano could not be detected. The volcanic series of the depression of Szob–Szokolya are thin and consist of the formations of the marginal ridge (Fig. 16). The sedimentary series of Márianosztra proved to be the same as the underlying sediments. It means that the vicinity of bore-hole Nb-7 is in depressed position (Fig. 15). The most prominent elements of the post-volcanic structure are the young, mainly thrust faults of NW-SE strike.

The *localization conditions of mineralization were* studied according to the following classification: ore district, separated areas of the ore district, locality and local mineralization (Fig. 17). The location and parameters of each unit are governed by two effects: the origin and thermodynamical conditions and the structural set-up controlling the migration routes and condensation of the fluids. The ore district lies where the Oligocene main structural line and the deep magma chamber coincides. The northern locality (Fig. 18) is in connection with a shallower magma chamber (hypabissal intrusion?), and the radial fracture system of the central dome (Fig. 19).

Three types of mineral deposits are known in the area: veins of sulfides and clay minerals, columnar bodies of nested, brecciated, banded texture and zones of disseminated mineralization. The target of the present exploration by the IP method (Fig. 20) is the disseminated mineralization.

The *geophysical exploration of the Darno structural zone* in 1977 aimed at the investigation of deep structure and mineralization of the Bükk and Uppony Mountains. Three reflection seismic profiles traversed the Darno-line; one of them, shot by the VIBROSEIS system crossed both mountains. Additional gravimetric surveys and geoelectric (IP, SP, VES) measurements along profiles continued as in former years. In the southern foreground of the Bükk Mountains the basement relief was contoured by telluric survey and DE soundings (Fig. 21).

From the interpretation of the data obtained in 1976 the magnetic model computations and reflection seismic profile ÉK-2/A are reviewed.

The complex magnetic anomalies of the Bükkszék area were interpreted by separating them graphically—generally into three separate anomalies, already suitable for model computations. The biased errors of separation influence mainly the width of the causing body. It can be seen on Fig. 22 that three bands of magnetic bodies (probably diabase) were determined. The results of model computations are in agreement with the data of bore-hole Bs-4, located on band A.

Reflection profile ÉK-2/A is located in the North Hungarian Paleogene Basin (Fig. 23). Two variations of the processed section are presented: on Fig. 24 the low frequency time section up to 10 sec, on Fig. 25 the result of migration stacking coloured by 12 dB amplitude steps. Geological interpretation is given on the overlay.

The *regional study* of the tectonics of Transdanubia was continued in two directions: 1) magneto-telluric soundings on former seismic profile MK-2 to investigate conducting layers in the Paleozoic basement and 2) seismic profiling across the Transdanubian Central Range (MK-3/77).

The MT sounding were preceded by telluric and VES surveys. On Fig. 26 the telluric isoarea map is presented: the two minima may be in connection with Paleozoic conductors. The MT soundings were oriented according to the izoarea map. The cross section (Fig. 27) shows at the southern end a more than 1000 m thick conducting layer (3.5 ohmm resistivity) under the $\varrho > 100$ ohmm Triassic limestone. Probably this conductor between the Triassic and the crystalline basement is of Carboniferous age.

The location map of the seismic profile is shown on Fig. 28. The time section of the northern part (MK-3/77 É) is presented on Fig. 29, while its migrated version on Fig. 30. As a result of the signal to noise ratio improvement due to migration stacking a relection horizon can be traced in the basement. On Fig. 31 a portion of the southern section (MK-3/77 D) can be seen. In the Mór basin a deep horizon appears forming a local high, and near point 420^{00} is terminated by a structural line. Southward the character of the cross section changes absolutely: before further signal to noise ratio improvement it can not be interpreted.

The civil engineering mapping of the Balaton area has been continued. On Fig. 32 a characteristic cross section is presented. By integrated interpretation of the physical parameter logs different formations could be separated.

Several *water supply and engineering geophysical* projects were carried out for different companies. The results of the geophysical investigations for the Danube Water Conservancy Project are reviewed on Fig. 33. It can be seen that not only the dam site was investigated but the whole river bed down to Budapest to explore the transport of detritus and the prospect of building material production.

Similar preliminary investigations were carried out for the water reservoir on the Drava River near Barcs, and for a reservoir near Chalmová, Czechoslovakia.

A geophysical project was completed on the Mohács island (Danube) to help to solve the water supply problems of Pécs. Two aquifers: the Mesozoic basement and the alluvial cone were explored.

The *geophysical survey of the Great Hungarian Plain* was continued. The net of reflection profiles was completed by both dynamite and VIBROSEIS systems; the latter was used in the inhabited areas of Debrecen. On Fig. 34 the location map and the isochrones of the Pannonian basin floor are given. On Figs. 35 and 36 a time section and its migrated version are presented. Migration stacking helps to interpret the deep structure of the section.

A project of national *regional seismic network* for CH prognosis was initiated in 1976. ELGI started to work on profile A-12 and completed in 1977 a total sum of 84.3 km, partly by 12 fold and partly by 24 fold coverage. The profile (see Fig. 37) lies mainly in the North Hungarian Paleogene Basin. The task was the delineation of the Paleogene and older structure. From the collected data the time section of profile A-12α is presented; on Fig. 38 coloured by 12 dB amplitude steps, on Fig. 39

according to frequency content. On the overlays two versions of geological interpretation are given.

In the *Mecsek Mountains* two areas were under exploration. For the coal mines the refraction seismic survey of former years was extended, and in the western part of the mountains reflection seismic profiles were shot for the investigation of the Paleozoic formations. Fig. 40 shows time section Gö-5 coloured according to frequency content. On the northern part of the profile the surface of the granite appears around 2 sec. Its slope towards the south can be followed till point 90°°.

Karst and thermal-water exploration projects were carried out at different localities. For the drink and thermal water supply of Sopron combined reflection seismic and geoelectric survey was initiated. Fig. 41 shows reflection time section So-2/77 coloured according to reflection amplitudes. The combination of reflection profiling and geoelectric soundings has the adventage of yielding both structural and resistivity (porosity) informations. The fracture zone, terminating the updip of the basement is favourable for thermal water, while in the eastern part the thickening of the Upper Pannonian sediments and their increasing resistivity suggest a good water-bearing area.

For the preparation of a thermal water drilling project refraction seismic and gravity survey was carried out at Diósgyőr (Miskolc). Fig. 42 shows the obtained basement contour map. Because of industrial noise no geoelectric method could be employed. Different basement formations were separated by their head wave velocities (zones A, B, C and D).

In 1976 the refraction seismic profile near Gárdony revealed a fraction zone (see Fig. 43). The bore-hole, drilled later discovered Permo-Triassic limestone in the predicted depth and yielded 700 l/min 51 °C thermal water.