The outlines of geology and structural pattern

Complex base-metal mineralisation has been formed in relation to intrusive emplacements connected to Upper Eocene magmatism at Recsk (Fig. 1.). The mineralised complex consists of Cu-Mo porphyry ores in intrusive host rocks, Cu-Fe and Cu-Fe-Zn ores in the contact skarns, Cu-Pb-Zn-Fe metasomatic orebodies and veins in the altered Triassic limestones, several hundred meters from the intrusive contacts (3). Two-third of the total ore reserves is related to the porphyry-type ores, one-third is to skarn-ores, and to less extent, peripherial polymetallic ores (Fig. 2.).

The structure of the ore-bodies is characterised by steeply dipping post-mineralisation fault and shear systems and intense jointing, as a result of multiple phase compressive deformational forces. In the intrusive bodies and surrounding skarn zones the majority (80 %) of fractures and joints are infilled, while most of the faults, karst cavities, joints in the carbonate country rocks remained open. Detailed mapping and statistical analysis of the structural elements in the two 1200 m deep shafts and the 6 km long development drifts on two levels (-700 and -900 m. b.s.l.) has been carried out. The evaluation of the results and the hydrogeological observations during the mine development workings have led to the condusion that the water and gas hazards are mainly connected to NE-SW and ENE-WSW striking, NW dipping faults and breccia zones.

Hydrogeology

The mineralised intrusive has been emplaced into tectonically deformed, slightly karstic Middle Triassic country rocks, mostly limestones, and gave rise to the development of characteristic hydrogeological conditions:

- The intrusive emplacement has resulted in further fracturisation and faulting in the brittle aquiferous country rocks. On the other hand, these factures and joints were mostly filled by hydrothermal minerals (quartz, calcite, anhydrite), and a zoned aquifer system has thus developed. This aquifer is composed of three main rock types, which are characterised by markedly different transmissivity values (1,2):

- limestone	10^{-3} - 10^{-6}	m^2/sec
- skarn	10^{-6} - 10^{-8}	m^2/sec
- intrusive rocks	10^{-8} - 10^{-10}	m^2/sec

- The intrusive activity has altered the geothermical relationships in the area; the geothermical gradient is larger than 25 m/C° in the central zones, and smaller than 25 m/C° in the outer peripheries.

- The chemical character of the stored water fits well to the zonal pattern; the water stored in the intrusive rocks is characterised by Ca, K, Na cations, sulphate and chloride anions, the outer zones show dominantly Na-K-hydrocarbonate character. The dissolved salt content is dominantly above 10 g/l. The water stored in the intrusive body is slightly acidic, while it has neutral character in the peripherial zones.

- The volume and composition of the dissolved gas content is also zonally arranged; the G/W ratio is increasing outwards (exceeding 10 m^3/m^3 values at several places). The chemical composition of the gases show systematic variation. At 1 m^3/m^3 G/W ratio in the intrusive body the composition is characterised by 50-50 % CH_4 and CO_2, the CO_2 content increases above 95 percent in the outer zones, and the H_2S content is also increasing away from the central zone.

- The aquifer is a separate, interconnected system, supplied mainly from the Mátra Mts, and to a much less extent, from the surface.

The evaluation of underground mine-water drainage control

Since the commencement of copper-ore explorations the initial hydrogeological conditions have markedly changed in the area:

- A thermal water well has continuously produced water since 1967.

- Shaft sinking started at 1970 (No. 1. shaft) and 1975 (No. 2. shaft).

- Development drifting and underground explorations have started upon the completion of sinking the No. 1. shaft.

These activities have resulted in a considerable drawdown, and by the end of 1979 the piezometric surface was significantly changed (Fig. 4.).

By the evaluation of the intensities of water inflows and their temporal relationships with the resulted draw-downs, a characteristic drawdown vs. piezometric level correlation can be established. Thus the following relationship can be given concerning the water discharge and the level of drawdown:

$$h = 160 - (13q^2 + 25q) \quad \text{(in meters a.s.l.)}$$

where q = discharge (m^3/min)
h = piezometric level (m. a.s.l.)

The above equation refers to the area of the two main haulage levels between the two shafts and the northern and southern exploration drifts.

The impact of the water hazard on underground workings (shaft sinking, drifting, exploration drilling) is not large as far as the volumes are concerned. The largest inrush, which has been experienced so far, was 2,5 m^3/min. The high dissolved salt content (about 10000 mg/l) and gas content (about 10 m^3/m^3, CO_2, CH_4, H_2S etc.) sause difficulties in pumping and ventilation.

The alternatives of prevention methods

In the development stage preventive drainage control methods are used. Pre-draining holes are drilled during shaft sinking and drifting, and grouting is applied, when necessary. The final method for drainage control will be systematic underground pre-draining.

A pre-draining system is suggested, where the drawdown is carried out from underground drill-holes, which are equipped with valves and pressure-meters.

The whole production area can be dewatered with a 10 m^3/min capacity system. In this way the technical difficulties arising from accidental water tappings can be largely reduced, the climatic conditions can be improved by the decrease of humidity, and the rate of carbonate precipitation will also be smaller.

The water obtained by systematic dewatering and transported in closed drainage system has larger economic value, since the possibility of underground pollution is significantly reduced, therefore the possible modes of the underground or surface utilisation of such waters are increased.

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Ábrák jegyzéke

Fig. 1. The areal extension of the intrusive formations

1./ Central intrusive body; 2./ Skarn zone; 3./ Intrusive dike extensive; 4./ Intrusive dike; 5./ Maximum of skarns; 6./ Maximum of dikes.

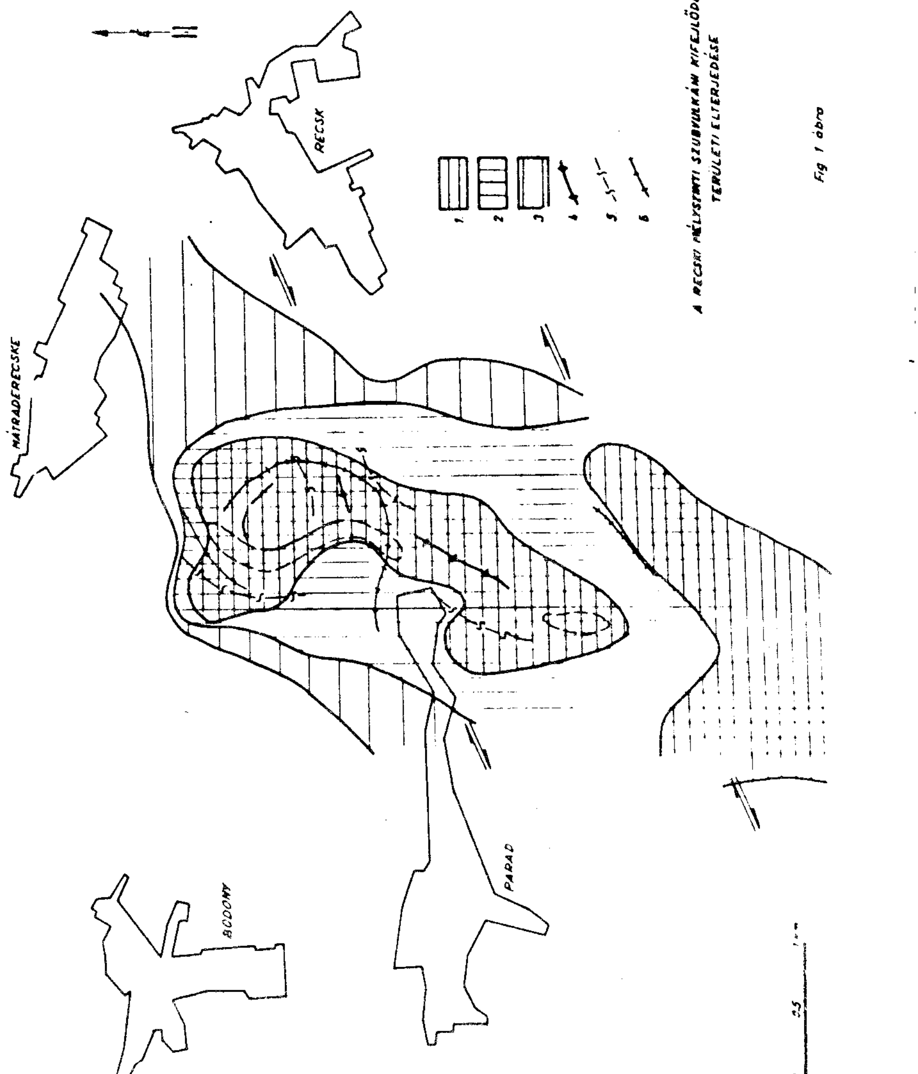
Fig. 2. The arrangement of ore types

1./ Skarn copper ore; 2./ Low-grade skarn copper ore; 3./ Polymetallic skarn ore (Pb-Zn-Cu); 4./ Disseminated (porphyry) copper ore; 5./ Low-grade porphyry ore; 6./ Polymetallic ore (Pb-Zn-Cu); 7./ Low-grade polymetallic ore; 8./ Vein-type polymetallic ore; 9./ Enargite-bearing massive copper ore; 10./ Barren area.

Fig. 3. The relief of the basement.

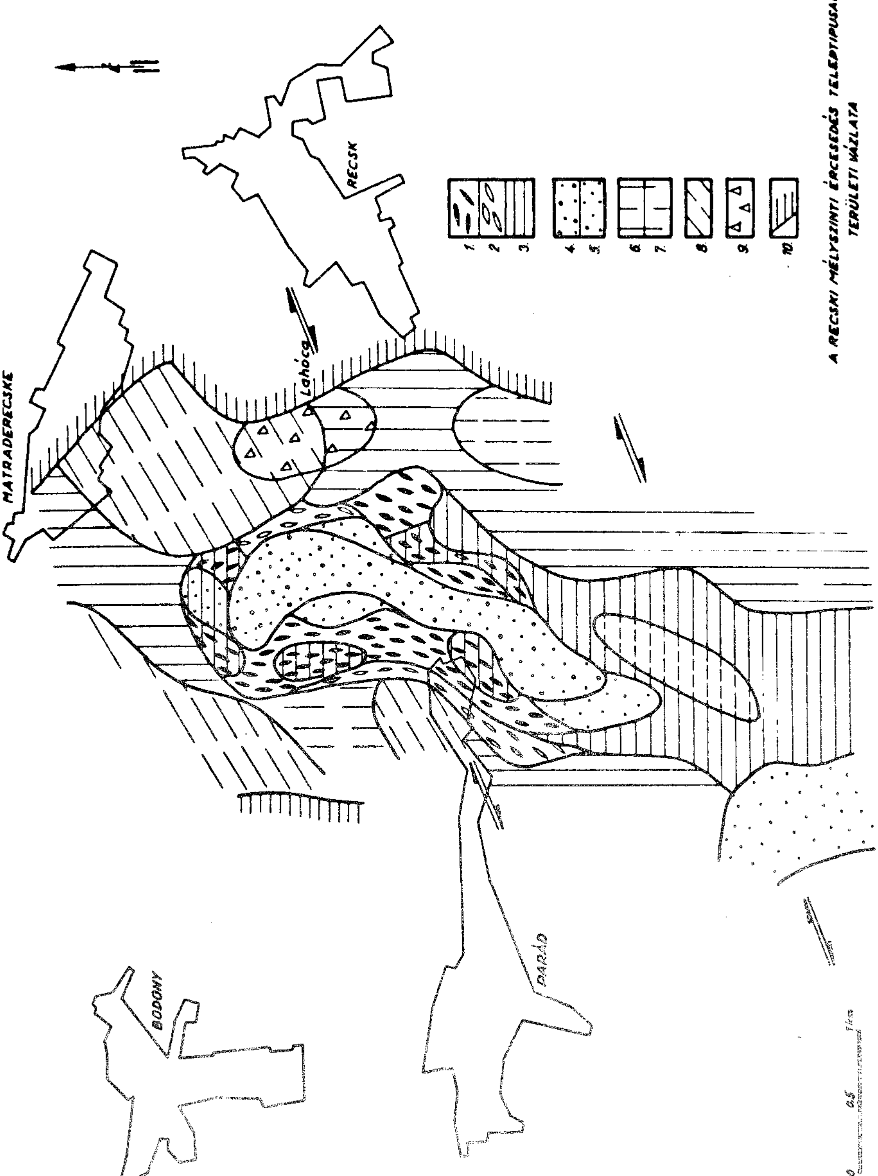
Fig. 4. Geological section between the two shafts:

1./ Andesite effusives (E_3); 2./ Limestone (E_3); 3./ Basement sediments (T_2); 4./ Intrusives (E_3); 5./ Skarn (E_3);



A RECSKI MÉLYSZINTI SZUBVULKÁNI KIFEJLŐDÉSEK TERÜLETI ELTERJEDÉSE

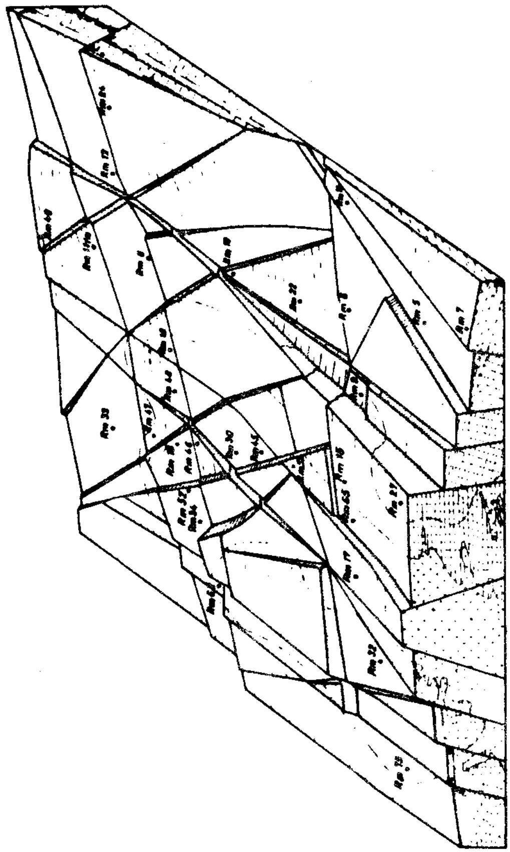
Fig 1 ábra



A RECSKI MÉLYSZINTI ÉRCESEDÉS TELEPTIPUSAINAK
TERÜLETI VÁZLATA

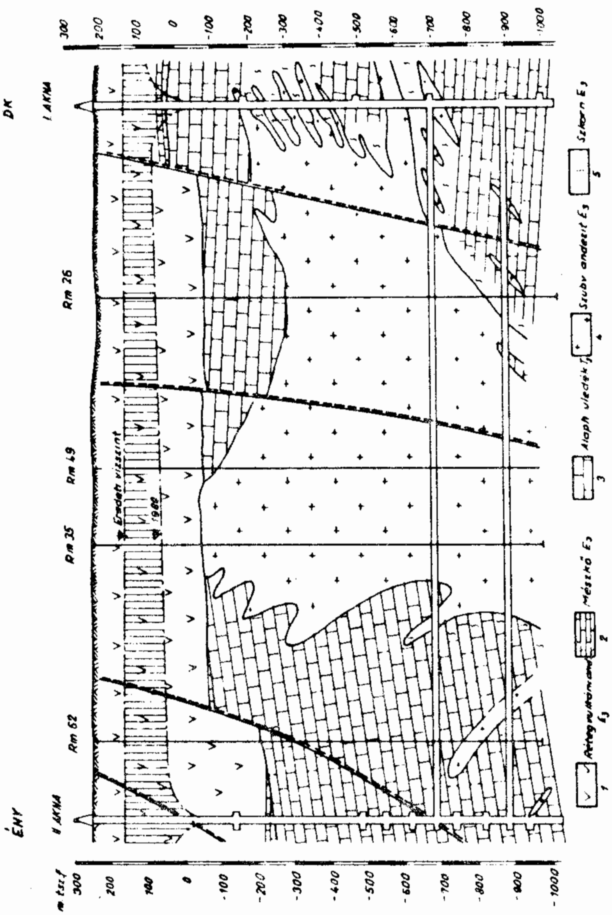
2. ábra

A RECSK MÉLYSZINT ALAPHEGYSÉGI FELSZÍNE (TÖMBSZELVÉNY)



3. ábra

FÖLDTANI SZELVÉNY A KÉT RECSKI MÉLYSZINTI AKNA KÖZÖTT



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