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THE RELATIONSHIP OF THE STRUCTURE AND METALLOGENY OF THE NORTHERN HUNGARY

(Figs. 2)

Abstract: The heterogeneity of geology and structure in the northern parts of Hungary is also reflected in the diversity of ore occurrences, different both in age and genetic type. Recent advancements of the structural interpretation of the different structural units (i. e. the Darnó zone; the Börzsöny, Mátra, Bükk and Rudabánya Mts.) have revealed a number of previously unknown genetic and structural relationships. These concepts are converted into the language of metallogeny in the present study.

Резюме: Неоднородность геологического строения и структур северной части Венгрии определяет и разнообразие рудопроявлений, отличающихся как по возрасту, так и генетически. Недавние достижения структурной интерпретации различных структурных единиц (таких как зона Дарно, горы Бёржёнь, Матра, Бюкк, Рудабаня) выявили некоторые ранее неизвестные генетические и структурные взаимоотношения. Эти концепции рассмотрены с точки зрения металлогении в данной работе.

Several megascopic structural units are known in the Northern Hungary. These incorporate both pre-Tertiary and Tertiary formations and are characterized by distinct geological features. The mineralizations, which are associated with these formations, differ in the time and mode of their genesis. These different metallogenic units were interpreted in the earlier non-mobilistic evolution models in the context of subsequent tectono-magmatic activations.

The intense geological and geophysical research in the last decade has resulted in the better understanding of the regional structural characteristics. It has been revealed that the so-called "Pannonian median-mass" was formed as late as the Upper Miocene period, and its Paleo-Mesozoic and Tertiary sequences are composed of mixtures of oceanic and continental plate-fragments, thus making the stratigraphical and tectonic interpretations rather difficult. Using the recent structural interpretations we have attempted to reevaluate the characters of metallogeny and mineralizations in the Northern Hungary.

The main geographical feature of this area is the so-called Northern Mountain Range, which incorporates Neogene calcalkaline volcanic units (Börzsöny, Cserhát, Mátra, Tokaj), and Paleo-Mesozoic units (Rudabánya, Aggtelek, Uppony, Szendrö). The surrounded basins are filled by Paleogene and Neogene mo-

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lasse sediments (clays, silts, sandstones). The Uppony and Szendrö as well as the eastern edge of the Tokaj consist of platform-type Paleozoic formations. The Bükk and Rudabánya units are built up from Mesozoic carbonate, evaporite platform-type sequences, overlain by an overthrusted nappe consisting of oceanic formations, i. e. shales, cherts, limestone and basic volcanics.

The Range is intersected by well-identified fault zones, which separate these units from each other. The most characteristic ones of these are the Darnó-zone and the Hernád-fault as well as the Szamos, Sajó, Tarna and Zagyva transverse-faults (Fig. 1).

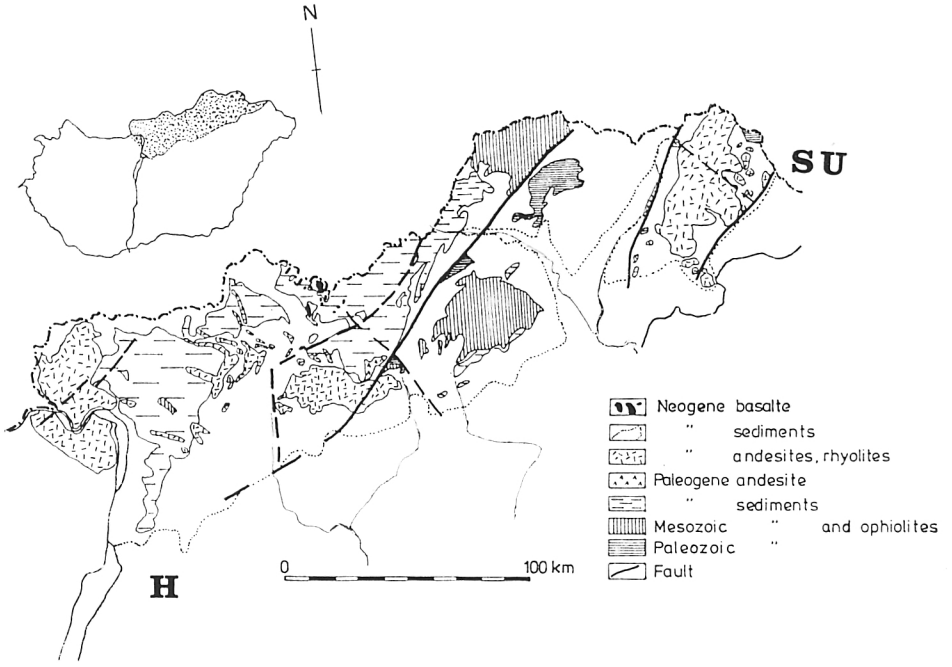

Fig. 1. Geological and structural map of N. Hungary.

The structures and the ore-deposits

In the Northern Hungary several ore-occurrences have been known for centuries. These were long considered as isolated and unique spots because of their uncertain regional connections. The metallogenetic relationships were largely obscured by the heterogenous characteristics of ore-deposition and paragenesis. Analogies were sought with remote occurrences (i. e. Gyöngyösoroszi—Banská Štiavnica, Recsk—Bor, Rudabánya—Eisenerz).

At Rudabánya metasomatic ores are known in Perm—Triassic shales and carbonates. A three-phase ore deposition is encountered here: a) hematite-siderite-chalcopyrite; b) siderite; c) barite-chalcopyrite-galena (with Ag and Hg). The late stage mineralizations were superponed on the earlier ones. The mine-

ralization is controlled by earlier tectonic elements. The deposit was evaluated as of metasomatic origin related to the Triassic Kimmerian orogeny but its magmatic source was not known. Early—Triassic quartz-porphyry volcanics were known for a long time in the area. These show slight Fe, Mn, Cu enrichments. Syngenetic stratiform siderite mineralization was found in the Seizian sandstone. The association of quartz-porphyries and these Permian--Triassic detrital sediments and evaporites has been proved, reflecting a continental platform-type environment for the deposition of this series. It is therefore suggested, that the metasomatism was a late secondary alteration process. The mineralization had been formed by volcanogenic processes related to the quartz-porphyry, resulting volcanogenic stratiform ores in the associated sediments. A close analogy of this occurrence is found in Slovakia, Šankovce (I l a v s k ý, 1976).

Similar occurrences are known in the Bükk. This structural unit is composed of a lower, Permian-Triassic platform facies, probably of Gemerid-type, and an upper nappe-structure with tholeiitic igneous rocks, flysh-like sediments and oceanic sedimentary formations (B a l l a et al., 1981). The stratiform ore indications are connected with the lower, platform facies. At the Darnó-hegy black-shales are associated with siltstones and evaporites. These contain syngenetic sulfide enrichments (chalcopyrite and pyrite), there lithology and ore mineralogy suggest a similar origin to that of the Kupferschiefer (B a k s a et al., 1980). Different mineralizations are connected with the upper nappe-structure. The tholeiitic igneous rocks (spilite, diabase, gabbro and ultrabasic differenciates) indicate progressive continental rifting and spreading from the Triassic, and reflect ophiolitic character (O n o u h a, 1977). Low-grade Cu enrichments and local Fe-Mn exhalative ores are associated with the diabases and spilites. Native copper ores are found in the supergene zone of these Cu-enrichments (Darnó-hegy) (Fig. 2). A special differentiated variety of the gabbro intrusives at Szarvaskö is the wehrlite, with subeconomic Fe-Ti-V content.

The closure of the oceanic basin, the subduction of the oceanic plate and the collision of isolated microplates is connected with the Paleogene andesitic island arc. This forms a volcanic range in SW-NE direction across the Carpathian basin. Several occurrences are known in this range, the Recsk porphyry Cu-Mo skarn Cu-Fe-Zn and hydrothermal Cu-Pb-Zn-As-Au-Ag ores represent the most significant mineralized complex (B a k s a et al., 1980). The chemistry of the igneous rocks indicate 120 km depth for the partial melting, though the rate and direction of the subduction is not accurately known since several features of this volcanic range is obscured by later tectonic and magmatic effects.

In the Northern Hungary the youngest mineralizations are related to the Inner Carpathian Neogene volcanic arc (Börzsöny, Mátra, Tokaj). The age of the volcanism and mineralization is gradually younger in eastward direction. Andesites are dominant in the Börzsöny and Mátra Mts., rhyolites in the Tokaj. No mineralization has been recorded yet in connection with the andesite dykes of the Cserhát between the Börzsöny and the Mátra.

Two mineralized centres were recognized in the Börzsöny. Here diorite-porphyries and subvolcanic andesite bodies are the host rocks of the disseminated Cu-Fe mineralization, stratovolcanic andesites of the Cu-Fe-As-Bi-Au-Ag hydro-

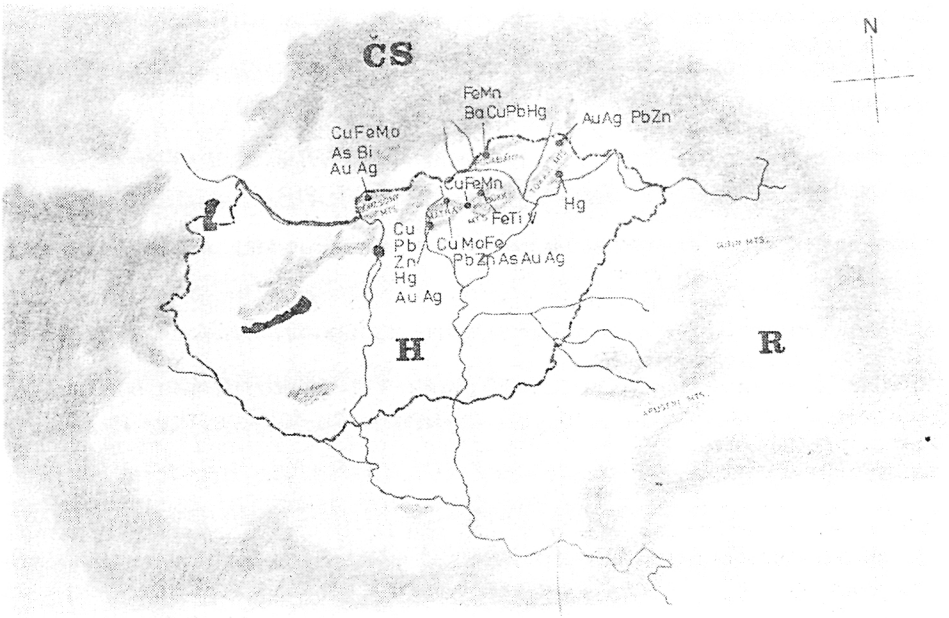

Fig. 2. Location map of ore deposits of N. Hungary.

thermal veins and stockworks. Molybdenum is also found in traces (G a t t e r, 1979).

Gyöngyösoroszi is a well-known occurrence of the mesothermal basemental vein-type mineralization in the Badenian volcanics of the Mátra. Parádsasvár is a similar though smaller occurrence. Copper, lead and zinc are the main components, with Au, Ag, Cd, Sb, Hg accessories, forming a very rich mineral paragenesis. Baryte, Sb- and Hg ores are associated with intense epithermal silicification at Asztagkö, providing further perspectives for exploration (Fig. 2). Deeper intrusive diorite-porphyry bodies and dykes were found at Gyöngyösoroszi by several drill-holes, indicating a possibility of search for porphyry mineralization.

A poorly-known region of the Neogene volcanic range is the Tokaj. Here Badenian-Sarmatian andesites are associated with Au-quartz veins and Pb-Zn stockwork ores. Hg traces are known in epithermal quartzites at Sárospatak. The deeper parts of these mineralizations are not yet known, and a more accurate knowledge of their chronology and genesis is necessary (Fig. 2.).

Conclusions

The heterogeneity of the geology of the North Hungary reflects a complexity of plate movements in the subsequent geological epochs from the Paleozoic. The majority of the pre-Pliocene structural units is in allochthonous position, the present structural relationships were formed only at the end of the Miocene. The mineralizations are connected to certain parts and certain lithological types of the formations comprising these structural units. Their characteristics reflect

the original environment of formation. Thus, in places where different structural units are in contact with each other several types of mineralization might occur, which are not necessarily related to each other in time or genesis.

The following metallogenic types can thus be encountered in the Northern Hungary:

— Perm-Triassic platform, with Kupferschiefer type mineralization;

— Perm-Triassic quartz-porphyry volcanism with volcanogenic-sedimentary and stockwork Fe, Cu, Pb, Hg, Ba ores;

— Triassic continental rifting with tholeiitic igneous rocks, Cu-Fe mineralization, Fe-Ti-V enrichment in gabbros;

— Paleogene plate collisions, subduction and andesitic island arc volcanism with porphyry and skarn copper, Cu-Zn ores, metasomatic Pb-Zn, volcanogenic stockwork and exhalative Cu-Au-Ag ores;

— Neogene volcanics are of andesite, dacite,, rhyolite composition with porphyric ore indications, Cu-Pb-Zn, As-Bi-Hg, Au, Ag hydrothermal veins and stockworks (Fig. 1).

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