# METALLOGENIC FEATURES OF THE MACKATICA ORE FIELD, SE SERBIA, YUGOSLAVIA

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**Abstract:** Significant quantities of molybdenum ore were found in Mackatica ore field, in SE Serbia, which was exploited up to 1952.,when the mine was closed down as uneconomic. Metallogeni of the margin of the orifield is connected to the processes of neo-alpine tectonomagmatic activity of Tertiary (Oligocene-Miocene) magmatism of granodiorite composition, featured by presence of Mo, Cu, W, Zn, Pb mineralizations with significant ore reserves, especially molybdenum. Concetrations of molybdenum regulary increase in hydrothermally altered schists and dacites, meaning that the altered rocks are the most favourable environment for deposition of molybdenum. The latest investigations have shown a new understanding of geological-structural composition and metallogenetic features, as wel as distribution and intesity of Mo mineralizations in the Mackatica ore field. In fact these investigations have shown that the reserves of Mo are much larger than earlier established, making this ore field interesting again.

**Key words**: Dacites, schists, hydrothermal alterations, Mo ore bodies, molybdenite, Mackatica, Borovik, Serbia, Yugoslavia.

The Mackatica ore field, as a part of the Surdulica granodioritic complex in SE Serbia, is an interesting district not only in Serbia and Europe, but all over the world as well, according to its metallogenic features and Mo-ore reserves respectively. It is geotectonically restricted to the Serbo-Macedonian mass and according to metallogenic territorial disposition it is a contitutional part of the Besna Kobila - Osogovo zone (Jankovic, 1967,1990; Jelenkovic at al., 1997; Simic, 2001.).

To the Mackatica ore field is confined a prominent molybdenum ore deposit of the same name in the Popova Dolina locality, but in the same area numerous other molybdenum mineralizations are evident. Among these the other sizeable Mo-deposits, such as Borovik, located in direct vicinity of the first one, then Kucišnjak, Groznatova Dolina, Troskacka Dolina, Cokanova Dolina, Pavlova and Meca Dolina,

are to be mentioned. All these occurrences are found in a wide range along eastern and southern margin of Mackatica deposit (Simic, 1993, 1994, 1995, 1996.).

Geological setting of the ore field is characterized by crystalline schists of the Vlasina complex, as a part of the Serbo-Macedonian mass, where the Ripheo-Cambrian muscovite and albite-muscovite schists are the most common rock types, then by Tertiary magmatic rocks, among them dacites being prevalent, locally accompanied by andesites, granodioriteporphyrites and quartzdioreiteporphyrites (Petrovic at al., 1973.), Fig. 1.

The whole rock sequence in the ore field, including both dacites and crystalline rocks, had been affected by intensive hydrothermal alteration reflected in silicification, sericitization, K-feldspatization, and piritization.

Molybdenum mineralization is of the stockwork-impregnational type, emplaced in various lithological environments, characterized by diverse mineral associations, closely related to silicification, K-feldspatization and partly sericitization. Mo-mineralization is also featured by low $Na_2O$ content and augmented $K_2O$ grade, as well as by the high $K_2O/Na_2O$ coefficient (Simic, 1993,2001.).

Molybdenum ore bodies are most commonly of lenticular shape, trending E-W do WNW-ESE, seldom of irregular or unclear outlines, exhibiting poorly expressed northerly and NNE dipping. Individual ore bodies are tracable at surface 100-350 m and more that 250 m down the dip and are maximum 250 m in thickness. The largest is ore body "C", where over 70% ore reserves in Mackatica deposit are concentrated (Fig.1,2).

Mo-mineralization in all ore bodies in the Mackatica ore field is featured in almost the same way, occuring as dense braided, wery thin quartz veins and veinlets with pyrite and molybdenite, conveyed through tectonical zones of nearly E-W trending. Mineralization intensity directly depends on the fracturing degree produced by the pre-ore tectonics.

Mineralization grades in various parts of ore bodies remarkably varies down the dip and strike. The largest molybdenite concentrations occur, as a rule, in central parts of ore bodies, gradually declining to the periphery, thus the limits of ore bodies being mostly defined according to the chemical analyses records. However it should be emphasized that it is, in some cases, extremely sharp, tectonic.

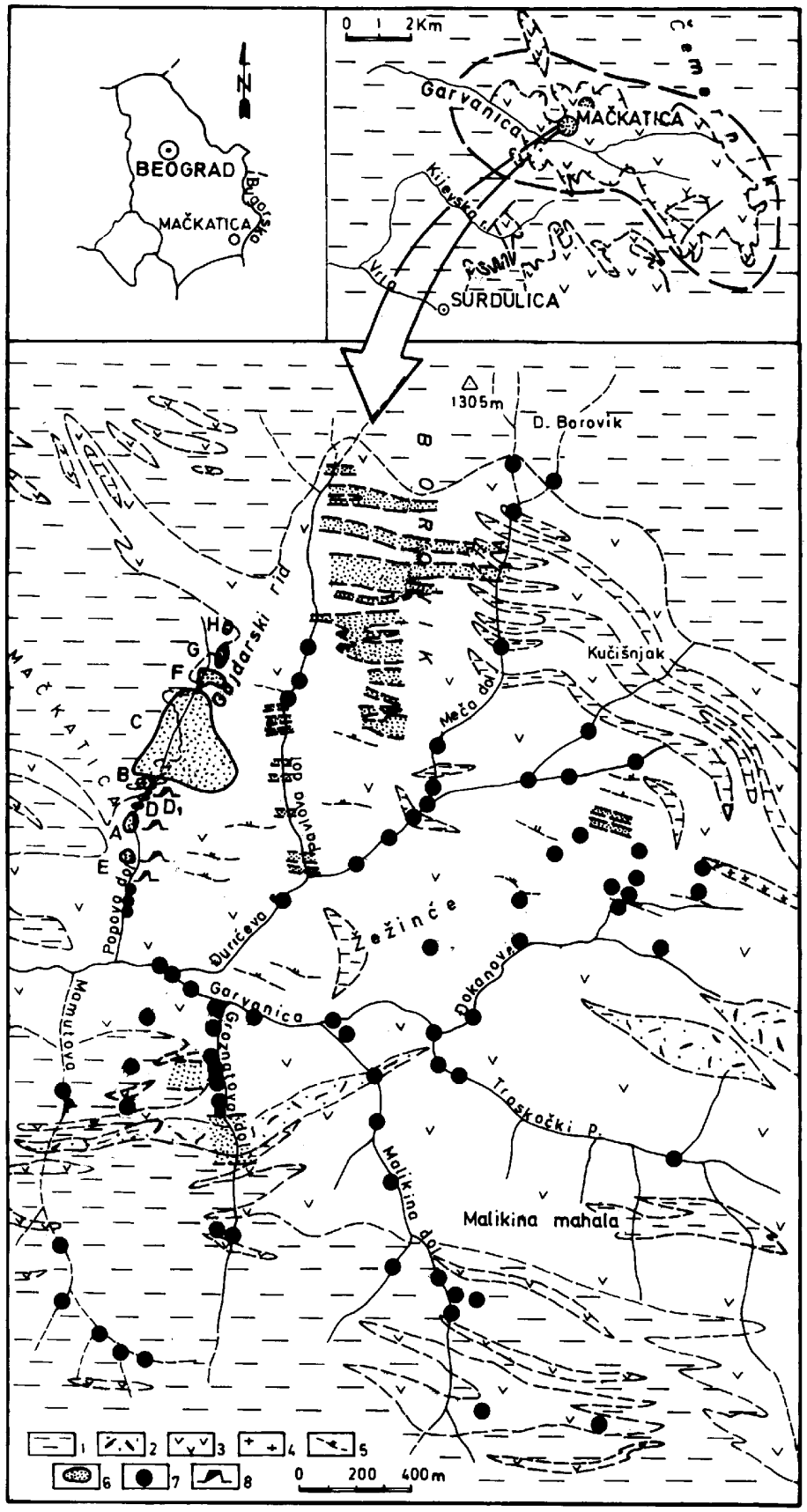


**Fig 1.** Geological sketch map of the Mackatica ore field

1. Schists, 2. Qurtzites, 3. Dacites, 4. Granodiorite-porphyrites, 5. Fissures, 6. Mo-ore bodies, 7. Mo-occurrences, 8. Adit,

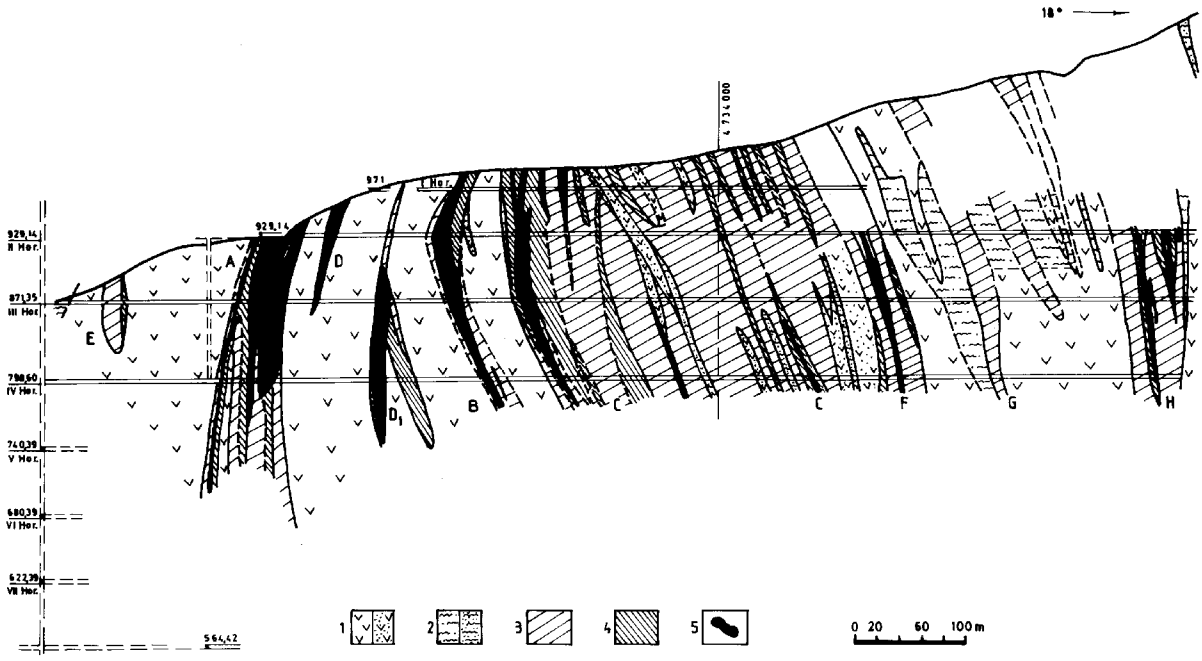


**Fig. 2.** Cross section – Mackatica

1. Fresh, locally slightly mineralized dacite (< 0.04% Mo), 2. Fresh, locally poorly mineralized micaschists (< 0.04% Mo), 3. Ore with Mo contents less than 0.08%, 4. Ore with Mo contents less than 0.14%, 5. Ore with Mo contents more than 0.14%.

Mineral composition of Mo-ore is very uniform: quartz, pyrite and molybdenite are the basic mineral costituents, forming either compound or monomineral veins.Pure molibdenite veins are extremely rare, and these with quartz are the commonest. All of these veins are accompanied by sporadic chalcopyrite, hematite, scheelite, sphalerite, galena, and traces of wolframite.

Molybdenum content in ore ranges from one deposit and occurrences to the others. In the Mackatica deposit molybdenum averages 0.091%, amounting 25,000.000 t of ore, and at Borovik deposit the mean Mo grade is 0.05% in 70,000.000 t of ore. At other localities Mo ranges from 0.03-0.1%, very rarely reaching over 0.4%. The Mackatica molybdenite concentrate shows about 150 g/t rhenium (Vujanovic, 1959.).

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