Using 3D/4D modeling tools in exploration for gold-polymetallic potential areas in Greece

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Abstract

Greece's geology favours a potent and dynamic use of mineral resources, which became a major incentive of the country's mining business, and economic and social growth. Among the Non-Energy Metallic Minerals commodities, base and precious metals, in particular zinc, lead, copper gold, and silver are becoming an increasingly important and rapidly growing target of the mining industry. In NE Greece, where most of the potential resources and feasible deposits are hosted, gold-polymetallic mineralizations occur in a wide range of genetic types comprising magmatic, hypothermal / mesothermal, epithermal and supergene mineralization types. The magmatic porphyry copper type deposits and mineralizations show economic gold grades (e.g. Skouries, Fisoka, Pontokerasia), the hypothermal / mesothermal manto-type polymetallic sulphides form high-grade gold ores (e.g. Olympias, Mavres Petres, Piavitsa, Thermes, Pangeo, Farasino) and the epithermal gold systems lead to potential high-sulphidation mineralizations (e.g. Aghios Demetrios, Viper, Perama, Kirki, Pefka) (Fig.1).
The genetic link between porphyry coppers and large polymetallic manto style sulphide deposits can be incorporated into regional exploration strategies in a complex metamorphic terrain of schists, gneisses and marbles, whereas the epithermal type deposits were emplaced within a broad volcanic belt, which developed first in Bulgaria and then moved south through northern Greece to the region of Thrace. The epithermal gold mineralization occurs in hydrothermal breccia zones, related to volcanic rocks of andesitic, dacitic or shoshonitic composition as well as hosted by sedimentary rocks. All previous types of sulphide minerals (particularly those hosted by Rhodope and Serbo-Macedonian marbles) were overimposed by post-Pliocene co-active supergene oxidation and karstification processes (e.g. Angistro, Menikio). All the main types of gold mineralization are linked to plate tectonic movements during the Tertiary. From the global metallogenetic point of view the post-Alpine Tertiary geodynamic systems in SE Europe are potential in producing high-grade ore deposits of base and precious metal sulphide minerals. Local, semi-regional and regional scales of 3D/4D gOcad models were applied in most of the above mentioned deposit types achieving new metallogenic interpretations and exploration perspectives in relation to,

- The geology, the structural setting, the stratigraphy, the ore bodies, the alteration zones and part of the ore grades distribution of Perama Hill (Petrota graben), Aghios Demetrios and Viper epithermal Au deposits (Kirki Tertiary basin), along with their metallogenetic evolution within Carpathian-Balkan belt (Fig.2).
- The geology, the ore controlling structures, the host-rocks stratigraphy and the ore bodies geometry of Olympias manto polymetallic sulphides (Fig.3).
- The geology, the stratigraphy, the tectonic evolution with respect to ore deposition and its extension in depth and along the strike of the main mineralized fault, the ore body geometry and the geostatistics of the ore grades of the Mavres Petres manto polymetallic sulphides,
- The gold grade distribution of the Skouries porphyry Cu, and the genetic links between the spatially related porphyry and manto systems, based on airborne
geophysics, along with further interpretations for across border regional exploration potential.

Figure 2: Geology and structure of epithermal Au in Petrota and Kirki Tertiary rift basins.

Figure 3: Fault controlled ore deposits of Olympias manto polymetallic sulphides showing extension of potential mineralized structures to depth.

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