

The Bolnisi mining district, southern Georgia: present knowledge and open questions about volcanism, geodynamics and ore formation

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The Bolnisi mining district represents consists of gold-copper-polymetallic stockworks and vein as well as low sulfidation epithermal gold deposits. It lies within a larger metal rich, Late-Cretaceous tectonic zone of the Alpine Tethyan Belt stretching from south Georgia and northern Armenia into northern Turkey (Pontides), Bulgaria (Srednegorie), Serbia and Romania (Balkan Region). This tectonic zone developed during subduction and collision of the Afro-Arabian (southern) plate beneath the Euro-Asia (northern) plate resulting in the closure of the northern branch of Tethys ocean.

Mineralization within this corridor includes such deposits as Chelopech, Elshitsa, Medet, (Bulgaria), Murgul, Artvin-Borchka, Gerat Jape and Madenkoy (NE Turkey), Alaverdi, Kafan (Armenia), Madneuli, and Sakdrisi (Georgia). The deposit types in this tectonic zone are Kuroko-Cu, Pb, Zn-Ag-Ba, Au ores, porphyry Cu-Au, stock work and vein of copper-polymetallic gold-bearing deposits, and low sulfidation Au vein deposits.

The Bolnisi mining district includes various types of mineralization characteristics of the belt. The host rocks are Upper Cretaceous acid, intermediate and basic volcanic rocks unconformably overlying the Paleozoic basement.

The Madneuli deposit is one of the most significant deposits within the Bolnisi mining district and we are at the first stage in our study of the whole district.

In spite of the long history of investigations of the Madneuli copper-gold deposits, questions are still open about its origin. Some researchers consider Madneuli as an epigenetic deposit and its formation was attributed to Tertiary geological processes (Nazarov, 1966; Tkemaladze, 1982). Other researchers think, that there is a genetic relationship between ore generation and Cretaceous volcanism, although they consider that ore mineralization was epigenetic (Bachaldin and Tkvarchelidze, 1963; Malinovski, 1987; Gugushvili and Omiadze, 1988; Kekelia, 1993). In the Bolnisi mining district, gold-copper-polymetallic mineralization as well as epithermal mineralization are located along cauldron subsidence ring structures and are related to the tumescence stage of their development. Mineralization preceded the ignimbrite ejection and cauldron subsidence (Gugushvili 2004). The existence of syngenetic volcanogenic ore mineralization is also supported by several authors. A hybrid genetic character of the Madneuli deposit has been proposed, as well as a close similarity with transitional volcanogenic-sedimentary –epithermal types of ore deposits (Migineishvili, 2001).

Our aim is to use modern analytical data (isotope geochemistry and absolute dating), to reinvestigate in detail the volcano-sedimentary setting of the Madneuli deposit, to undertake litho-geochemistry of magmatism of the district and of the hydrothermal alteration of the volcanic-sedimentary rocks, in order to try to characterize the ore deposit typology at Bolnisi-Madneuli. In addition, the aim is to clarify some of those open questions about the character of the volcanism in the district, and its geological setting (submarine or subaeral).