Geological setting, lithogeochemistry, and hydrothermal alteration in the Crni Vrh licence area, Late Cretaceous Timok belt, Eastern Serbia

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The Crni Vrh licence area belongs to Dundee Plemeniti Metali and are located in the Western Timok tectonic zone, Eastern Serbia, about 27 km south of Madjanpek, 18 km northwest of Bor and 140 km southeast of Belgrade. The licence area includes from north to south the Coka Kuruga, Lipa and Coka Kjupatra high-sulfidation type gold-copper prospects. Coka Kuruga and Coka Kjupatra are characterized by extensive silica caps and altered andesites (silicification, advanced argillic alteration, pyritization). The Lipa prospect is an open pit mined between 1958 and 1967, with estimated total ore reserves of about 1Ma tons with 1.1% Cu; 3-6 g/t Au and about 20 g/t Ag. The Lipa prospect is currently the target of extensive exploration drilling, and is the subject of the present contribution. Specific aims are to constrain the geometry and evolution of the hydrothermal alteration, identify breccia events, and clarify the genesis of this prospect.

The mineralization at Lipa is hosted by Senonian volcanic rocks of the second volcanic stage of the Timok magmatic complex. The mineralization at Lipa is hosted by the upper part of the volcanic sequence composed of hornblende andesitic clast-supported breccia. Based on XRF analyses of least altered whole rock samples, the host rocks are andesite/basalt according to the Winchester and Floyd (1977) classification diagram. Thus the volcanic rocks in the Western Timok belt around the Lipa area appear to be more basaltic in composition compared to other counterparts from the Banat-Timok-Srednogorie belt.

The main ore body at Lipa is controlled by a steeply dipping NNW- oriented fault. In the open pit the mineralization, mainly enargite with luzonite, is in veins, matrix cementing host rock clasts of hydrothermal breccia, and dissemination in hydrothermally altered rocks. At depth, as revealed by drill cores, the mineralization consists of a brecciated massive sulphide, veins and disseminations.

The hydrothermal alteration at the Lipa prospect was studied by transmitted light microscopy, XRD and Raman spectroscopy. Propylitic alteration with zeolite veins is predominant on surface followed by argillic alteration (mainly with kaolinite and quartz) in the open pit vicinity. Intense silicification and advanced argillic alteration occur within the open pit. The latter is characterized by quartz-diaspore-dickite and pyrophyllite-quartz assemblages. Drill cores next to the open pit show propylitic alteration with a sericite-chlorite-calcite-quartz assemblage down to a depth of 120m. Next, a transitional propylitic-advanced argillic alteration consists of pyrophyllite-sericite-calcite±quartz. Advanced argillic alteration occurs below 125m and the predominant assemblage is pyrophyllite-diaspore-quartz. Alunite is only present below 294m in assemblages together with quartz, dickite, pyrophyllite and diaspore in various proportions. Abundant anhydrite and gypsum veins are present in the advanced argillic alteration zone, and anhydrite is part of the assemblage within this alteration zone. Anhydrite also cements fragments of the brecciated massive sulphide.

High gold and silver concentrations are especially associated with the propylitic zone (depth of 74-121m), and a zone between a depth of 145 and 208m on both sides of the brecciated massive sulphide characterized by the advanced argillic alteration assemblage pyrophyllite-diaspore-quartz. Gold contents are low within the advanced argillic alteration assemblages containing alunite in the lowermost parts crosscut by the drill holes. Lead and zinc are also enriched within the zone of the brecciated massive sulphide ore body.