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The Continuum Between Porphyry and Carbonate-Replacement-Type Mineralization Exemplified by the Salinbas Au-Ag and Ardala Cu-Au (Mo-Re) Deposits, NE Turkey

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The >1 Moz Salinbas Project Area (SPA) is located at lat.41°07'30"N, long.41°56'30"E, within the Pontide Metallogenic Province, 20 km east of Artvin in northeastern Turkey. The SPA is located midway along a ca. 35-km-long NNE trend of mineralization, marked at its southern end by the Hot Maden Au-Cu deposit (~4 Moz Au equivalent). The SPA is characterized by a transition in mineralization styles from porphyry to epithermal, including skarnoid replacement in the vicinity of the intrusions (Fig. 1). The SPA comprises the Salinbas deposit (10 Mt at 2.03 g/t Au, 10.2 g/t Ag for a total of 0.65 Moz of gold) and the Ardala porphyry (16 Mt at 0.6 g/t Au, 0.22% Cu, and 0.014% Mo).

The Salinbas deposit is represented by a 5- to 10-m-thick 20° ENE-dipping mineralized body (1.4 x 0.5 km), largely emplaced along the unconformable contact between folded Late Cretaceous (ca. 100 Ma) Ziyarettepe Formation and Late Palaeocene (ca. 56 Ma) Kizilcik Formation. The Ziyarettepe Formation comprises massive fossiliferous limestones, whereas the overlying Kizilcik Formation consists of an intercalated sequence of conglomerates, limestones, siltstones, and mudstones (including black shales). This style of mineralisation is interpreted to be a carbonate replacement type and is sulphide rich to gossanous in character, selectively occurring within an irregular polymictic horizon. A steeply plunging breccia-pipe style of mineralisation is developed beneath part of the Salinbas deposit, emanating from the Ardala porphyry.

Contiguous with but at a lower elevation to the east of Salinbas lies the Ardala Cu-Au (Mo-Re) Porphyry Complex, characterised by a nested series of Eocene quartz-diorite stocks, which intrude the Upper Cretaceous to Paleocene volcano-sedimentary sequence. Exposed parts of the porphyry measure 600 x 700 m, displaying a well-developed potassic alteration core (including phyllic overprint with overlying argillic alteration), with lateral extensions beneath cover. Sulfide mineralization formed at 50.4±0.2 Ma (Re-Os on molybdenite), relating to active magmatism during 51-48 Ma constrained by LA-ICP-MS U-Pb dating on zircon. Precious metal- and base metal-bearing skarns and related disseminated mineralization in the host rocks are also evident, particularly at the northern margins.

A magmatic-hydrothermal event, which coincided with the intrusion of both mineralized and unmineralised porphyries in the APC, is interpreted to represent the source of the sulphide-rich mineralising fluids. This event also resulted in the deposition of volcanic units of the Avcilar Formation during the Early Eocene (56-48 Ma), which lie unconformably over the Kizilcik Formation. Zircon trace element ratios from a mineralized granodiorite yield $\text{Eu}/\text{Eu}_N^* > 0.58$ and $\text{Ce}/\text{Ce}^* > 101$, suggesting a high magma oxidation state. Furthermore, to the immediate south of the main mineralized porphyry lies an intrusion distinguished by its rhenium content with up to 2 ppm Re and >400 ppm Mo in zones up to 10 m wide. Understanding the genetic relationship between proximal and distal mineralization, particularly with respect to fluid flow and decreasing geothermal gradients, contributes to improved exploration targeting in the area.

Fig. 1. Schematic three-dimensional model of Salinbas, showing the relative position of the Salinbas Zone and the Ardala Porphyry.

