

Nonsulphide zinc mineralization in Turkey Ore Belts: the case of Hakkari

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The Hakkari Nonsulphide Zinc project area (Red Crescent Resources) is situated at the extreme SE margin of Turkey (Reynolds & Large, 2010). Nowadays lying at the northern margin of the Arabian Platform (at the limit of the Zagros Ore Belt), the Hakkari area was once located between two Megaccontinents (Laurasia to the north and Gondwana to the south), which collided during the Alpine-Himalayan orogeny. The geology of the area consists of sedimentary units ranging in age from Precambrian-Cambrian to Paleogene-Middle Miocene. The Hakkari orebodies are located in Middle-Triassic to Early Cretaceous shallow water carbonate rocks (Cudi Group): the carbonates consist of both structurally deformed limestone, strongly fractured dolomitic rocks, and extensive hydrothermal breccias with calcite veins. The zinc mineralization is generally hosted in a more porous “reef limestone” or in the breccia units and the most enriched area corresponds to the oxidized levels. The mineralized horizons occur as multiple layers ranging in thickness from a few cm to a few m. Since the Hakkari area is situated in a fold and thrust belt region adjacent to two suture zones (the Bitlis and Zagros sutures), it is highly likely that the compressional tectonism of the area has produced multiple duplications, and hence probable thickening, of the mineralized levels. A complete petrographic and mineralogical characterization of a few core samples from the nonsulphide section of the Hakkari project has been carried out between the NHM (London) and Naples University. The samples were examined using a range of techniques: XRD qualitative and quantitative (Rietveld) methods, chemical analysis, SEM-EDS and WDS analysis. The main findings of our study were the attribution of most of the zinc to the minerals smithsonite (occurring up to max 55% in the core samples) and hemimorphite (occurring up to max 70%). Zinc is present in Mn/Fe-(hydr)oxides as well, which are always present in the Hakkari samples. Lead is hardly present and, where detected, occurs as cerussite (which ranges up to few weight % in most samples), or as remnant galena. Silver is present in some samples, although relatively scarce. Barite can be locally very abundant (up to 13% by weight), and has been observed in two different forms: as fragmented and largely unplaced remnants of presumably primary mineralization, and as thin secondary needle-like growths, possibly precipitated in association with smithsonite and/or hemimorphite. The calcite veins in the hydrothermal breccia are locally enriched in lead and minor cadmium.