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ARTICLE

Constraining the timing of porphyry mineralization in northwest Iran in relation to Lesser Caucasus and Central Iran; Re–Os age data for Sungun porphyry Cu–Mo deposit

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ABSTRACT

The Neo-Tethyan subduction in Iran is characterized by the Urumieh–Dokhtar magmatic arc (UDMA), formed by northeast-ward subduction of the oceanic crust beneath the central Iran. This belt coincides with the porphyry copper metallogenic belt that comprises several metallogenic zones, including Ahar–Jolfa in northwest Iran. The Ahar–Jolfa metallogenic zone encompasses two main batholiths of Qaradagh and Sheyvardagh and numerous intrusive bodies of Cenozoic, which have produced many base and precious metal deposits and prospects. The former is considered as continuation of the Meghri–Ordubad pluton in South Armenian Block (SAB), which also hosts porphyry copper deposits (PCDs). The Sungun PCD is the largest occurrence in northwest Iran. Rhenium-Osmium ages of Sungun molybdenites are early Miocene and range between 22.9 ± 0.2 and 21.7 ± 0.2 Ma. Comparison of the ages obtained here with published ages for mineralization across the region suggests the following sequence. The earliest porphyry Cu–Mo mineralization event in northwest Iran is represented by Saheb Divan PCD of late Eocene age, which is followed by the second epoch of middle Oligocene, including the Cu–Mo–Au mineralization at Qarachilar and the Haftcheshmeh PCD. Mineralization in Sungun, Masjed Daghi, Kighal and Niaz deposits corresponds to the third mineralization event in northwest Iran. The first epoch in northwest Iran postdates all Eocene mineralizations in SAB, while the second epoch is coeval with Paragachay and the first-stage of Kadjaran PCDs. Its third epoch is younger than all mineralizations in SAB, except the second stage in Kadjaran PCD. Finally, the Cu mineralization epochs in northwest Iran are older than nearly all PCDs and prospects in Central Iran (except the Bondar Hanza PCD), altogether revealing an old to young trend along the UDMA and the porphyry Cu belt towards southeast, resulted from diachronous, later closure of the Neo-Tethyan oceanic basin in central and SE Iran.

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Introduction

The NW–SE striking and 2000-km-long Tertiary Urumieh–Dokhtar magmatic arc (UDMA) in Iran represents the northeast-ward subduction of the Neo-Tethyan oceanic crust beneath the central Iranian domain in late Mesozoic and early Cenozoic (Berberian and King 1981; Alavi 1991). This belt also coincides with the porphyry copper metallogenic belt of Iran, comprised of three major metallogenic zones in its NW (Ahar–Jolfa), central and southeast (Kerman) parts, and hosts many major and small porphyry copper deposits (PCDs) and prospects, such as world-class PCDs of Sarcheshmeh (central Iran; Shahabpour 1982) and Sungun (northwest Iran; Calagari 1997, 2004; Hezarkhani and William-Jones 1998) (Figure 1 and Table 1), which are mostly associated with Oligocene and Miocene intrusive bodies.

Due to the emplacement of the major Qaradagh and Sheyvardagh batholiths and numerous smaller intrusions in northwest Iran and the widespread occurrence of hydrothermal alterations and Cu-Mo-Au-Pb-Zn-Fe mineralizations (Figure 2 and Table 2), the area encompassing these intrusive bodies is known as Ahar–Jolfa (Arasbaran) metallogenic zone. This zone mainly exposes Cretaceous–Cenozoic volcanic and sedimentary rocks and Cenozoic intrusive bodies. The Ahar–Jolfa metallogenic zone shares many tectonic, lithologic, geodynamic and mineralization features with the neighbouring South Armenian Block (SAB), southern Lesser Caucasus, where the Meghri–Ordubad composite pluton of Eocene–Miocene age hosts Cu–Mo mineralizations (Moritz *et al.* 2012; Mederer *et al.* 2014).

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The supplemental data for this article can be accessed here