Geochemical characteristics of hydrothermal alteration zones in the Sarcheshmeh porphyry copper deposit, SE of Iran

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Porphyry copper deposits

The Sarcheshmeh copper mine, located in the Uromieh-Dokhtar volcanic belt, is one of the largest porphyry copper deposits in east of Iran. The ore-hosting rock comprises Eocen andesites and granodiorite (12±0.5 Ma). The orebodies consisting of veinlet-disseminated mineralization with grade ranging from 0.20 to 0.60% Cu [1]. The dominant ore minerals are chalcopyrite and pyrite with lesser amount of chalcocite, sphalerite and magnetite. Gangue minerals include quartz, sericite, calcite, chlorite and biotite with minor hornblende, pyroxne, epidote and calcite.

Discussion of results

Three different alteration zones (propylitic, phyllic and argillic) have been recognized with notable differences in major and trace elements behaviour [2].

LREE's in the phyllic zone with mineral assembleges (sericite, pyrite, quartz, kaolinite) are strongly enriched in comparison with argillic facies. HREE in both zones particularly in argillic facies are strongly depleted. Also, a weak negative slope is observed in the REE pattern of the propylitic zone.

High and low field strength elements (HFSE, LFSE) are enriched and depleted in phyllic and argillic zones respectively. Geochemically speaking, major and trace elements behave highly selective in different alteration facies. Sulfur isotopic determination on pyrite, galena and chalcopyrite cluster around -1.8 to +3.6 $\delta^{34}S$ suggesting a mantle – magmatic origin for the sulphides of Sarcheshmeh porphyry copper mine.

[1] Shafiei (2001) M.Sc thesis, University of Kerman, Kerman, Iran, 380p. [2] Mehrabi (2008) M.Sc thesis, University of Isfahan, Isfahan, Iran, 140p.

Geochemistry and petrogenesis of hornblendites in an island arc tectonic setting

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Hornblendites occur as mega enclaves in granites abutting the eastern periphery of the Neoarchean Narayanpet-Gadwal granite greenstone belt trending NNW-SSE in the eastern Dharwar craton, India. The absence of chilled margins and granitic xenoliths within the hornblendites preclude an intrusive origin for these rocks whilst tectonic juxtaposition cannot be ruled out. Their texturaly coarse grained mineralogy comprises of metamorphic magnesio-hornblende, interstitial oligoclase, relict diopside, with minor zircon, magnetite and apatite. We report new major and high-precision ICP-MS trace element data for these rocks which provides significant constraints on their petrogenesis and geodynamic evolution of the associated arc volcanics in the belt. Compositionally these rocks have consistently high MgO (~17 wt%), Mg# (~0.70) and CaO (~11 wt%), low SiO_2 (~47 wt%), TiO_2 (~0.5 wt%) and Al_2O_3 (~8 wt%), with variable Cr (400-1000 ppm) and Ni (100-300 ppm) contents. They display coherent and fractionated chondrite normalized REE (La_N/Yb_N ~4) with mild negative Eu anomalies (Eu/Eu*~0.85). Their primitive mantle normalized spider diagram exhibits depletions in HFSE (Nb, Ta, Zr, Hf, Ti) relative to light REE. Their inter-elemental ratios Ti/V (~10), Ti/Sc (~55), Ti/Zr (~98), Zr/Sm (~9), are distinct and similar to rocks generated in an arc setting. Therefore, we propose that the highly magnesian nature of these rocks requires prior removal of a least fractionated olivine-pyroxene bearing cumulative phase at high pressures. The depletions observed in Zr-Hf and low Zr/Hf ~ 29 ratios coupled with heavy REE fractionation (Gd_N/Yb_N ~2.6) in these rocks indicates an original magmatic feature due to melting of the source rock at depth with garnet in the residual phase [1]. These hornblendites define a typical geochemical signature of subduction zone magmas, although it could also reflect crustal contamination. But, their proximal association with boninite – adakite – Nb-enriched basalt suite in the Gadwal belt [2] is consistent with a subduction zone model.

[1] Polat *et al*. (1999) *Precambrian Research* **94**, 139–173. [2] Manikyamba & Khanna (2007) *Gondwana Research* **11**, 476–491.