Geochemical constraints on the origin of Chargar low-sulfidation epithermal Au-Cu deposit, NW Iran

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The Chargar low-sulfidation epithermal Au-Cu deposit is located in southern part of the Tarom subzone of the Alborz magmatic belt, northwestern Iran. Apart from Chargar, there are several other epithermal deposits in the southern and northern parts of Tarom. The Chargar host rocks including Eocene andesite, andesitic basalt, basalt, olivine basalt, and trachyte to rhyolite volcanic and andesitic, dacitic and basaltic volcaniclastics are intruded by younger pyroxene quartz monzodiorite and quartz syenite (Type-I) in the south and gabbro – gabbro diorite (Type-II) in the west of the deposit. The principal host rock is an andesitic lapilli-lithic tuff. The volcanics are syn-subduction and calc-alkaline to high-K shoshonitic and metaluminous. The intrusions are metaluminous and enriched in LREE, K, and Ba; depleted in Nb, similar to the continental arc magmatism. The intrusions occurred in a continental arc and on a post-collisional arc. Types I and II were originated from a metasomatized garnet-spinel lherzolite and spinel lherzolite mantle, respectively. The main alteration types include silicification, carbonatization, argillization, sericitization, chloritization and potassic. Two sets of NW and NE trending faults cut the area; mineralization occurs along an NW fault. Gold is hosted mostly within the lithic-lapilli crystal tuff as microscopic and submicroscopic grains in quartz, chalcopyrite, and lautite. Part of the gold occurs in nanoparticles. The negative chalcopyrite $\delta^{34}S$ values (−7.3 to −5.3 ‰) and framboidal pyrite in the volcaniclastic host suggest a sedimentary origin for the $\delta^{34}S$. The isotopic composition of barite ($\delta^{34}S$ = +9.0 to +15.0 ‰ and $\delta^{18}O_{SO4}$ = +7.6 to +7.9 ‰) is compatible with a magmatic origin of sulfate. Homogenization temperatures and salinities of the fluid inclusions are comparatively high for the Tarom northern deposits and are lower for the southern deposits (e.g., Chargar), up to 370 °C and 20 wt.% NaCl equiv., respectively. All these data suggest mixing of magmatic and meteoric fluids. Those deposits in the northern part of Tarom formed at deeper and from more dense fluids than the ones in the southern part, implying zoning in the Tarom district.