The Shahrestanak Zn-Pb deposit, southeastern Qom: Considerations on ore mineralization, geochemistry of stable isotopes, and distribution of rare earth elements

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Abstract

The Shahrestanak Zn-Pb deposit, as a part of Urmia-Dokhtar magmatic arc, is located 50 km southeast of Qom town. Intrusion of monzodiorite to quartzdiorite igneous masses of Miocene age into Eocene volcanic-sedimentary sequences (mainly andesi-basalt) has been the main factor in the development of carbonatic, silicic, and chloritic alterations along with the occurrence of Zn-Pb ore mineralization in the form of veins and breccia in the Shahrestank area. Petrographic and mineralographical observations show that sphalerite, galena, pyrite, tennantite, cerusite, planetrite, hydrozincite, hematite, and limonite are accompanied by ganque minerals such as calcite, barite and quartz. Dominant textures in ores include disseminated, vein, stockwork, replacement, and remnant. Although the distribution pattern of rare earth elements (REE) normalized to chondrite in andesi-basalts with monominerals such as galena, sphalerite, and calcite of ores are somewhat different, however, the close ratio of Y/Ho values between them indicates that the leaching of metals from andesi-basalt host rocks have played an important role in the formation and development of this deposit. The occurrence of positive anomaly of Eu and Ce in galena (Eu/Eu* = 2.18-2.83 and Ce/Ce* = 1.35-1.54) and sphalerite (Eu/Eu* = 1.92-2.28 and Ce/Ce* = 1.36-1.63) indicates the reduction nature of ore-forming fluids. The $\delta^{34}S$ isotope values in galena and sphalerite samples show the range of changes from -3 to +1‰ and -2 to +0.9‰ respectively, which indicates the magmatic origin of these two sulphide minerals. Plotting the values of $\delta^{18}O$ against $\delta^{13}C$ in calcite samples shows the mixing of magmatic solutions with meteoric solutions during the evolution and development of this deposit. Combining the results obtained from field observations, mineralogy, structure and texture, type of hydrothermal alterations, REE geochemistry, and stable isotope studies show that the mineralization that occurred in the Shahrestanak area is very similar to intermediate sulfidation epithermal ore deposits.

Keywords: Zn-Pb deposit, Intermediate sulfidation epithermal, Stable isotopes, REE, Shahrestanak.