

The Characteristics of Fenitization of the Syenites at Bengge Gold Deposit, Northwestern Yunnan, China

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Fenitization is defined as the process of alkali metasomatism associated with igneous activity, usually alkaline igneous activity. The alkaline syenites of the Bengge gold deposit, located in the south Yidun arc, in the eastern part of the Tibet Plateau and Tethyan orogenic collage, are characterized by an irregular pattern of fenite veins. An enriched mantle source is constrained by geochemistry and Hf isotope data of the syenites, which occurred in the extensional back-arc setting related to the westward subduction of the Garze-Litang oceanic crust in the Late Triassic.

The widths of fenite veins range from 0.01 to 1 m, and two types of veins can be recognized. One is dominated by aegirine augite and the other by orthoclase. The aegirine augite veins contain irregular patches of aegirine augite, in which relic feldspar and pyroxene grains demonstrate their syenite parentage. In contrast, the orthoclasites are homogeneous and have coarser grains than the aegirine augite veins. In comparison with the major and trace elements of the syenites, contents of CaO, MgO, and P₂O₅ and compatible elements (e.g., Ni, Cr) of the fenites decrease, whereas the Fe₂O₃, TiO₂, and Na₂O contents of the aegirine augite veins and contents of FeO and K₂O of orthoclase veins increase; there are higher concentrations of U, Th, Pb, Zr, and Hf but a lower concentration of Sr in the fenites. The changing mineral composition indicates that the fenitizing fluid is Fe-rich solution, which contains significant amounts of high field strength elements. Similar to the syenites, the REE distribution patterns of the fenites display a regular enrichment in the LREE relative to the HREE, implying that the fenitizing fluid is comagmatic with the alkaline syenite magma. The different K-rich and Na-rich fluids were released during different stages of evolution of the syenites and are responsible for the two types of veins. The increase in Fe₂O₃ seems to reflect the oxidation character of the fenitizing fluid.

The most notable is the gold mineralization occurring along the fenite veins in Bengge gold deposit, which related the mineralization to the fenitization. Zircons have been found in the fenites, which are brownish to black and range from 20 to ~150 μm. In CL images, the zircon grains display textures of homogeneous crystals and irregular patchy patterns. BSE images show that they contain gold particles, quartz and fluid inclusions. In order to constrain the timing of the gold mineralization, further study on these zircons will be undertaken. The fluid inclusions of zircons will help us reveal the composition of the fenitizing fluids and the P-T conditions of the gold mineralization.