



Genesis of beryllium in the Miocene Kizilcaö

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The K₁ z₁ lcaören fluorite-barite-rare-earth-element (REE) complex ore deposit, associated with alkali phonolite, trachyte and subalkaline pegmatite, is located east of Eskişehir, and developed within Miocene volcanic sandstone, graywacke, agglomerate and tuff units. Beryllium-containing solutions – products of alkaline volcanism – coexisted with the F, Ba and REE of the K₁ z₁ lcaören ore deposit. This deposit comprises fluorine (11.4-40.2 %), barium (31300-237600 ppm), ΣREE (11028-43172 ppm), and accompanied by appreciable amounts of beryllium (13-92 ppm). However, the beryllium contents (6-31 ppm) of the phonolite, trachyte and pegmatite units are relatively depleted. Euhedral green emerald and light bluish-green aquamarine-type beryl crystals – with crystal sizes of ~35 μm, hexagonal structure, and refractive indices of $n_o = 1.568$ and $n_e = 1.584$ – have also been recognized in detrital sediments derived from the metamorphic rocks. Geochemically, the depletion of REEs in the ore deposit is due to fractionation of amphibole and feldspar, and the presence of a fluid phase. Also, rocks in the ore deposit are characterized by positive Eu anomalies, revealing an oxygen-rich environment that resulted in a crystallization temperature possibly below 200°C. It may be concluded that beryllium was concentrated hydrothermally in the complex fluorite-bearing ore deposit and in relatively decreased amounts in Al-bearing crystals in the phonolite, trachyte and pegmatite units. This hydrothermal injection along upthrust faults and fractures weakly affected the metamorphic unit resulting in the development of beryl crystals.

Keywords: beryllium; beryl, genesis, geochemistry, K₁ z₁ lcaören fluorite-barite-REE ore deposit