Volcanogenic beryllium deposits at Spor Mountain, Utah, USA: impact on past production and material flow cycles

NORA FOLEY, ROBERT AYUSO, GRAHAM LEDERER, AND BRIAN JASKULA

[1] United States Geological Survey, Reston, Virginia, 20192 USA, (*correspondence: nfoley@usgs.gov)

Beryllium ores are used to make strong alloys, metals, and ceramics that are critical for computer, telecommunication, aerospace, medical, and defense industries. Data on changes in Be sources, production cycles, and material flow pathways over time is required for interpreting trends in global supply and demand. Both beryl ($Be_3Al_2Si_6O_{18}$) and bertrandite ($Be_4Si_2O_7(OH)_2$) are currently mined to ensure a stable supply of Be; beryl is mainly derived from Li-Cs-Ta-type pegmatites; bertrandite is obtained from a single volcanic-hosted resource at Spor Mountain, Utah, USA [1]. Since the Spor Mountain mine opened in 1968, this single deposit has accounted for more than two-thirds of global beryllium production [1]. At Spor Mountain, the Be ores occur in lithic-rich, phreato-magmatic base-surge deposits situated mainly along the ring fracture of an Oligocene caldera [2]. The Be ores are part of a sequence of lithophile element-rich, topaz-bearing rhyolite lava flows, pyroclastic deposits, and fluorite-bearing pipes. Ore nodules containing Mn-oxides, calcite, opal (~100 ppm Be), and fluorite, and ~1-2% bertrandite occur in mineralized tuff. New geochemical modeling indicates that alteration assemblages, fluorite, and bertrandite likely formed under pH-buffered, isothermal to cooling conditions (200º-100ºC), when F-, Mn-, Li-, Si-, and Be-bearing fluids reacted with dedolomitized carbonate clasts in the base-surge deposits. Geochemical evaluation of Be transport and accumulation processes, including direct release of Be (plus volatiles) from cooling hypabyssal rhyolite (or a pluton at depth), and remobilization of Be from vitric tuff [3], is the focus of this work. Quantifying the timing and flux of Be and the relative roles of magmatic fluids and meteoric water leading to precipitation of bertrandite, fluorite, and other minerals are the subject of ongoing studies. Widespread occurrence of geochemically similar volcanic rocks in the southwestern US indicates potential for additional deposits of volcanic-hosted Be. Such discoveries can safeguard a long-term, reliable, and stable supply of US-produced Be to global markets.

[1] Jaskula (2015) USGS 2013 Minerals Yearbook 28-29. [2] Burt et al. (1982) Economic Geology 77, 1818-1836. [3] Foley et al. (2012) USGS-SIR 2012-5070-F, 43.