

Role of Li and B bearing fluids in crystallization and alteration of granitic pegmatites,
San Diego, California

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Abstract

The San Diego County, zoned pegmatite dikes intruded between 2 and 3 kbar and thus contain miaroles, or “pockets,” that may contain feldspars altered to kaolinite, quartz, and gem-quality minerals—e.g. elbaite tourmaline and spodumene. This study of mineralogy and subsolidus alteration controlled by fluid-soluble elements, Li, B, Cl, and F, includes two of these pegmatites: the San Diego and La Posta pegmatites. The fluxing properties of Li and B, may increase water solubility in pegmatite melts, and facilitate the development of miarolitic cavities that form by accumulation of aqueous fluids near centers of dikes.

Fluid inclusion data show that in the San Diego pegmatite, Li was highly concentrated in residual liquids, leading to crystallization of Li-rich minerals in the core. Thermodynamic calculations show that Li was an essential component in the formation of acidic fluids—HF and HCl. Increased activity of acids lead to alteration of feldspars to form kaolinite in pockets. HF also promoted solubility of Si resulting in growth of quartz in cores and pockets. Reactions between Li-bearing fluids and minerals is also revealed by lepidolite filling of fractures throughout the pegmatites.

The two studied pegmatites share similar emplacement mechanisms and structures. Yet they are compositionally different in that the San Diego pegmatite contains abundant Li-bearing minerals, whereas the La Posta pegmatite does not. The difference is attributed to lower Li in La Posta pegmatite. This study shows why some pegmatites in the San Diego County pegmatite district contain gem-quality Li-bearing minerals, while others do not.