

# **Lithium and Lithium Isotopes in Tourmaline as Indicators of Crystallization Processes: A Study of San Diego County Pegmatites, California.**

Jennifer Maloney

Dr. Peter Nabelek, Thesis Advisor

## **ABSTRACT**

The pegmatites of San Diego County, California, are part of the Mesozoic Peninsular Ranges Batholith of southwestern California and Baja California, Mexico. Three LCT-pegmatites were studied. The pegmatites have texturally, mineralogically, and chemically distinct footwalls, pegmatitic zones, and central pocket zones.

Tourmaline shows enrichment in incompatible Li from the wall zones towards the pocket indicating that the dikes crystallized inward from the wall rock contact, with the line rock crystallizing until the melt reached fluid saturation, at which point, fluid and melt separated to form the pegmatite and the pockets, respectively. Li was strongly partitioned in favor of the fluid.

The isotopic composition of tourmaline is reflective of the medium from which it crystallized and is controlled by the coordination of Li in that medium.  $^7\text{Li}$  prefers sites with smaller coordination numbers and stronger bonds while  $^6\text{Li}$  fractionates into weaker sites with higher coordination numbers. Tourmaline in the pegmatitic zone is isotopically heavier than that in the pocket zone, suggesting that  $^7\text{Li}$  was enriched in the melt and that the bonds of Li in the melt are stronger than the hydrated bonds of Li in the fluid. The  $\delta^7\text{Li}$  values in tourmaline crystallized in the pocket are similar to those in the line rock tourmaline, which is consistent with the accumulation of the bulk of the initial Li that was in the original melt in the pocket fluid, as this would result in little change in the isotopic composition of the Li.