Metamorphic and structural evolution of the Prospect meta-granite, SE CA

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The Prospect meta-granite represents a fine-grained leucocratic microcline-rich dike within a 161.3 ± 2.4 Ma Jurassic gneiss complex. It is truncated along its north margin by the southward dipping Copper Basin reverse fault and along its southern margin by the Sortan detachment. Petrologic and field studies indicate a complex history involving multiple phases of solid-state recrystallization and fluid-assisted alteration. Peak metamorphic conditions produced a relatively coarse grained white mica ± chlorite ± biotite metamorphic assemblage. In addition, sub-grain development along the margins of both plagioclase and microcline suggest that temperatures may have exceeded 400° ± 50°C. Such an interpretation is consistent with the presence of undulose extinction, deformation bands, and sub- and new-grain development within quartz crystals.

In wide zones adjacent to both the Sortan detachment and Copper Basin reverse fault, the peak metamorphic assemblage is partially replaced by microcrystalline calcite ± sericite ± chlorite. The latter assemblage in fills a pervasive set of brittle fractures that disrupt the peak metamorphic assemblage and breaks and fragments both quartz and feldspar crystals. The brittle behavior of quartz and feldspar during development of the fractures implies that temperatures fell below 300° ± 50°C. Hence, the calcite ± sericite ± chlorite assemblage is the record of a fluid assisted retrograde event.

Thin section work showed that 3 out of 10 samples collected across the Prospect meta-granite were significantly less affected by the retrograde event. Using these samples as representative of the Prospect meta-granite prior to fracturing and invasion by fluids, non-central principal component analysis revealed that in molar A-CN-K space, principal component 1 explained 99.6% of the variation of the 7 more altered samples about a well-defined linear compositional trend. Significantly, the resulting trend is oriented toward the CN apex, and thus is consistent with thin section observations indicating influxes of fluids rich in CO_2 and Ca.

Though the timing of the retrograde fluid assisted event is not well constrained, it may be related to the exhumation of the Prospect meta-granite and enclosing gneiss complex along the Sortan fault, ~23-24 Ma, and the subsequent formation of the Copper Basin reverse fault after ~9.45 ± ~0.27 Ma.