

DOWNWARD DUCTILE DISPLACEMENT OF VOLCANIC CRUST DURING PLUTON EMPLACEMENT IN THE CENTRAL SIERRA NEVADA: UNDERGRADUATE TEAM RESEARCH AT USC

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Emplacement of the Harriet Lake and Fremont Lake granodiorite plutons in Mesozoic metavolcanic strata exposed in Toiyabe National Forest adjacent to Yosemite National Park demonstrate striking vertical ductile strain in both pluton and host units. The pluton margins exhibit steep foliated and lineated fabrics parallel to that of similar fabrics in adjacent metavolcanic units. Based on Al-in-hornblende barometry, both plutons were emplaced at ~ 13 km (calibration of Anderson and Smith, 1995). Metavolcanic and metasedimentary units achieved peak metamorphic conditions of lower amphibolite grade as evidenced by a range of mineral assemblages including Pl+Hb+Bi+/-Ep in metavolcanic units and Cc+Wo+/-Tr,Di, Ep in associated marbles and calculated Pl-Hb thermometry, based on pressures derived from pluton emplacement. The Harriet Lake and Fremont Lake granodiorite plutons and host metavolcanic units exhibit comparable and overlapping chemical trends. The older Harriet Lake granodiorite (U/Pb age of 102 Ma), which is recrystallized particularly near its margins, and the younger Fremont Lake granodiorite (< 94 Ma) range in silica from 62-69 wt. %, and although distinct in detail, are comparable in being magnetite series (high fO₂) and metaluminous, calc-alkaline, and medium- to high K, with Sr abundances ranging 290-600 ppm and thus similar to other eastern Sierra plutons. The Harriet Lake also exhibits late development of leucocratic seams bearing tourmaline, indicative of the role of boron in its final stages of crystallization. Younger leucogranites range from 71-76 wt. % silica and range to peraluminous compositions. Older metavolcanics range from 61.1 to 76.5 wt. % silica and have compositions comparable to later intrusions, suggesting a common origin of magma and magma evolution to that of younger plutons. Although magma lineages in these northern Yosemite volcanic and younger plutonic units are distinct, their common geochemical affinity indicates a common magma source. Our evidence for overturn and downward displacement of these older volcanic strata during pluton emplacement is provocative given the expectation that such processes would be less ductile at these upper crustal levels.