deformation in ancient island arcs. We assume, that similar relationships between granitoids emplacement and tectonic switching may be, in general, common feature of many plutons throughout the European Variscides (e.g. Vosges, Massif Central, etc.).

References

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Eastern Margin of the Tuolumne Intrusive Suite (Sierra Nevada Batholith): Magmatic Fabrics, Internal Structures, Host Rocks Deformation and Emplacement Models in a Continental Island Arc Magma Chamber

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The Tuolumne Intrusive Suite (TIS) (~2000 km^2) crops out in the central part of the Sierra Nevada Batholith (California, USA), which represents highly voluminous continental margin arc emplaced during the Jurassic to Cretaceous. The TIS (91–82 Ma) is normally zoned from outer mafic phases (Glen Aulin and Glacier Point tonalites to the west and Kuna Crest granodiorite to the east) to progressively more silicic inner phases (Half Dome and Cathedral Peak granodiorite and Johnson granite porphyry). Geochemical and geochronological data show that TIS consist of 5 different pulses and the entire suite was emplaced and crystallized over a 10–13 Ma period. The TIS host rocks are represented by the 102 Ma El Capitan granite or Early Cretaceous granitoids and thin metasedimentary pendants along the western margin and metasedimentary and metavolcanic rocks with complex polyphase structural history to the east. Deformation of the eastern margin of the TIS is interpreted as a result of steep syn-crystallization shear zones (Gem Lake and Cascade Lakes shear zones) displaying mostly steep to moderate stretching lineations and more than 20 km dextral offset. Geophysical measurements and field relations suggest that the exposed part of the TIS represent the upper part of much deeper magma chamber with vertical contacts that may extend downward 7–10 km.

Our structural work focused mainly on the eastern central part of the TIS including host rocks and internal contacts between several different intrusive phases. Country rock adjacent to the contact with the Kuna Crest granodiorite, dominated by Ordovician and Mesozoic metasediments and metavolcanics, are strongly deformed (Gem Lake shear zone), characterized by steep foliation dipping to the E or ESE parallel to the intrusion margin and steep to moderate stretching lineation. We have not observed consistent kinematics along the eastern margin of the TIS, which shows both dextral and sinistral shear sense, suggesting more complex kinematic history of the Gem Lake shear zone. According to our observations, we suppose that concepts of shear zones adjacent to intrusion margins could have mixed up local shears with contact aureoles. In places, pure shear component of transpression dominates. Deformation of host rocks along intrusion margin was strongly controlled by the presence of syn-deformational melt, either in-situ or injected from the adjacent granodiorite.

Magmatic fabric in the outermost Kuna Crest granodiorite is characterized by steep lineation and steep foliation striking NW-SE, oriented at high angles to the contact, which are overprinted by margin parallel steep sub-solidus fabric and shear zones. In the internal parts of the TIS, our structural mapping revealed mostly homogenous orientation of magmatic fabrics oblique to contacts between internal units, characterized by steep lineations and steep foliations striking NW-SE. Locally we find steep magmatic foliation striking NE-SW forming two perpendicular sub-fabrics. Zones of cumulates, mafic schlieren, ladder dikes and volatile-rich schlieren tubes are most common in the Cathedral Peak granodiorite and increase in number near contacts throughout the studied part of the TIS, mafic schlieren are sometimes oblique to magmatic fabric. Internal contacts between intrusive pulses diplay various geometries, from clear and sharp contacts between the Half Dome and the Cathedral Peak granodiorite to complex sheeted instable contact between the Half Dome and Kuna Crest granodiorite with wide range of disequilibrium structures. Internal magmatic fabric patterns, cross-cutting contacts between intrusive phases within the TIS suggest that fabrics in magmatic systems originate after or during the final stages of magma chamber construction and represent last strain increments before complete crystallization.

Various emplacement models have been proposed for the TIS, including expansion of concentrically emplaced plutons, passive emplacement into tensional bridges between en-echelon P-shear arrays and nested diapir model, where multiple material transfer processes operated during emplacement. Although preliminary results of our structural work suggest that emplacement of the TIS could have been controlled by both transtensional and contractional tectonics, where most of material transfer occurred in a vertical direction, further research will result in evaluating and testing the above mentioned emplacement models. In addition, abundant geochronological data in the TIS, provide a basis for estimation of magma chamber construction rates and strain rates within intrusion aureoles. Strain intensities in the host rock vary significantly with distance from intrusion margin, indicating that deformation rates associated with intrusion of large volumes of magma may be much faster (in range of 10–4 – 10–13) than rates of regional deformation, as proposed by previous research, kinematic models and preliminary strain analysis in host rocks of the TIS.