



A PRELIMINARY PALEOMAGNETIC TEST FOR INCREMENTAL PLUTON
EMPLACEMENT

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Abstract

Field observations and geochronological measurements of plutons in Yosemite Valley suggest that plutons grow incrementally as a series of stacked sheets of smaller intrusions (*i.e.*, dikes and sills) (Coleman *et al.*, 2004; Glazner *et al.*, 2004; Bartley *et al.*, 2006). This interpretation is in contrast to the traditional view of pluton emplacement through crystallization of a single, massive magma chamber. Most of the observations supporting incremental pluton emplacement use the relationship between zircon U-Pb dating of pluton sections and estimated granitic magma cooling rates to argue that a single magmatic event would crystallize significantly faster than the geochronologic data permit. Incremental pluton emplacement also predicts specific relationships between the age of intruded sheets of magma and the original orientation of these sheets, such that older sheets are expected to be tilted or deformed more than younger sheets. Here we test this prediction of differential tilting by measuring the paleomagnetic inclination preserved in well-dated and structurally characterized sheets of the Tuolumne Intrusive Suite. Magnetic inclination provides a tilt-meter with respect to the Earth's magnetic field direction at the time of pluton emplacement; the reference inclination assuming an untilted pluton is known from independent data sets. We also present rock magnetic data (temperature-dependent magnetic susceptibility, magnetic remanence characteristics) and results from petrographic investigations to characterize the mineralogy and stability of the magnetization. Our results suggest that the low-titanium magnetite remanence carriers are primary and are not biased by secondary magnetizations. The distribution of magnetic inclinations in our sample set – in which older sheets on the periphery of the pluton are shallower than those in younger, more interior sheets, and with respect to the reference inclination – is consistent with predictions from the incremental pluton emplacement hypothesis.

REFERENCES

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