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Wall rocks as recorders of multiple pluton emplacement mechanisms— Examples from Cretaceous intrusions of northwest Nevada

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ABSTRACT

We examined numerous coeval mid-Cretaceous intrusions emplaced at different depths into Triassic slate and phyllite to evaluate wall-rock features and contact relations associated with emplacement mechanisms. The pre-emplacement regional deformation of the wall rocks is well-characterized, which facilitated clear and unambiguous identification of emplacement-related structures. The depth of intrusion in the different study areas ranged from ~5 to 12 km, which allowed us to examine emplacement mechanisms from the ductile to the brittle regime. Intrusions range in size from dikes and small pods to stocks and plutons up to 90 km² in area. Our analyses indicate several important findings: (1) At all depth levels, the pre-emplacement (Jurassic) structural grain of the wall rocks (pervasive foliation, folds at various scales, reverse faults) had significant influence on the geometry and distribution of intrusions. (2) Evaluation of emplacement mechanisms in this study was facilitated by observing several intrusions that offered “snapshots” of different emplacement depths and different levels of the intrusive system (from the roofs to sides). (3) Emplacement mechanisms and intrusion geometry vary with depth, time, and location; as a result, emplacement via multiple mechanisms is pervasive. At the shallowest levels, magma was intruded primarily by diking and merging of dikes via stoping into small stocks that typically had highly irregular wall-rock contacts. Faulting associated with roof uplift and/or cauldron subsidence is locally evident where larger intrusive bodies reside at depth. At intermediate levels, intrusions were emplaced by a combination of stoping and rigid host-rock displacement (roof uplift and lateral flexure), with minor radial expansion. Discordant pluton–wall-rock relations are prevalent, and markedly irregular contacts are still seen, but dikes are much less common. Stopping has removed portions of the intrusion contact aureoles, and has likely obliterated much evidence for processes associated with initial intrusion. At the deepest levels, intrusions are nearly circular in shape and have more common concordant contacts and ductile wall-rock features (synemplacement folding and foliation). These deeper-level stocks were emplaced as diapirs, which then experienced late-stage radial expansion and rigid host-rock displacement (lateral flexure and roof uplift?).

Keywords: pluton emplacement, stoping, wall rocks, intrusion depth, Nevada, Cretaceous.

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