THE UPPER CRUSTAL EMPLACEMENT OF THE BALBUENA PLUTON BY MULTIPLE MATERIAL TRANSFER PROCESSES

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The ascent of melt from source to surface typically involves a wide variety of material transfer processes. Processes accommodating the ascent and emplacement of magma into upper crustal conditions are typically dominated by stoping, roof uplift, and diking. Processes such as ductile flow and large-scale rotation of panels of host rock are commonly subordinate. The material transfer processes associated with the upper crustal (<7 km depth) emplacement of the Balbuena pluton, however, included, at various times, ductile strain, large-scale rotations and stoping of the surrounding host rock.

The Balbuena pluton, located ~80 km south southeast of Ensenada, Mexico, intrudes the late Early Cretaceous Alisitos Formation after most of the contraction associated with the accretion of the Alisitos arc to the continental margin. It is comprised of two distinct magmas (tonalite and qtz diorite) separated into three zones. The outer and middle zones are crescent shaped about the inner zone which is nearly circular. Field and petrographic observations demonstrate that the middle (qtz diorite) zone is the oldest but was still locally molten when the melts of inner and outer zones were intruded. U/Pb zircon ages of the two melts that are within error of one another support this conclusion.

While the time between the intrusion of the magmas must have been relatively short, the material transfer processes operating in the structural aureole of the Balbuena pluton were very distinct. Early-formed structures in the aureole include a marked increase in ductile strains and rotation of folds by as much as 75° away from regional trends. Stoping was the principle material transfer process operating during the emplacement of the magma of the inner and outer zone as evidenced by stepped margins partially removing the ductily strained and rotated aureole formed during emplacement of the earlier phase. Additionally, contacts with the inner, outer and middle phase commonly include abundant stoped blocks of the early phase including some that have shattered so completely as to form a slurry-mix of the younger magma choked with particles of the older.

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