The Torres del Paine laccolith, S-Chile

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The Torres del Paine Laccolith (TPL) in Patagonia/Chile is part of a chain of isolated Miocene intrusions which intruded into the eastern foothills of the southernmost Andes of Chile and Argentina. The TPL has been dated by Halpern (1973) at 12±2 Ma (Rb/Sr model) and 13±1 Ma (K-Ar biotite), respectively.

The laccolith intruded at a shallow level (2-4 km) between mudstones, sandstones and conglomerates of the Cretaceous Punta Barrosa and Cerro Torre Formation. It consists of a basal part with layered gabbroic and minor dioritic and granitic rocks (Paine-Mafic-Complex PMC, Michael 1984).

The main i-type granite is peraluminous and can be subdivided into an alkali-feldspar porphyritic medium grained granite. A fluid-saturated miarolitic granophyric alkali-granite is found towards the host-rock. Miaroles contain mainly quartz and feldspar, with some biotite, tourmaline, sphene, pyrite and fayalite. Granitic phases with miaroles, inside the main-granite body, bordered by biotite-Schlieren indicate transport and ascent of fluid-saturated magma through the crystallizing mush.

Major element chemistry indicates a development towards evolved granites from centre to the rim of the intrusion.

Contact between granite and host-rock is sharp and with minor or no stoping in the roof areas. Striking features are multi-phase dykes, oriented perpendicular to the host rock contact. They continue for several tens of meters into the host rock.

Late basaltic, rhyolitic and composite dykes cross-cut the intrusion and the host rocks.

Field evidence shows the intrusion of the granite after the PMC and a feeder-zone is located at the western end, in the Lago Grey area. Here PMC-rocks are vertically cut by the granite. Here no fluid-saturation is evident at the contact of PMC and granite. Further east granite overlays the PMC with mostly sharp contacts. Edges of the PMC are partially broken and intruded by the granite.

Sediments south of the intrusion have been regional deformed showing horizontal N-S trending fold-axes, being tighter in the western part. Approaching the intrusion the fold-axes begin to dip southwards with increasing angle closer to the granite.

In the west structures indicate the ascending limb of an anticline, which is underlain by the PMC and the granite. Similar features, with inverse dip relations, can be observed at the western contact.

Vertical emplacement of the granite most likely occurred at the level of PMC resulting in uplift of sedimentary strata.

We present models using the discrete element model (DEM), (Malthe-Sørenssen et al. 2004), for different scenarios of emplacement for the granitic laccolith to reproduce the field observations.
References:

