



Emplacement of the Paine Mafic Complex: successive sill injections? (Patagonia, Chile)

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The Torres del Paine Laccolith in Patagonia/Chile is part of a chain of isolated Miocene intrusions, which intruded into the eastern foothills of the southernmost Patagonian Andes (13-12 Ma, Michel et al. submitted) and is possibly emplaced in relation to the opening of the subducted Chile Ridge slab window (Altenberger et al., 2003). It is composed of a ~400m-thick Mafic Complex, overlain by a ~1000m-thick granitic laccolith, emplaced at pressures of ~0.1 GPa. The Paine Mafic Complex (PMC) has been built up in a short time, by emplacement and crystallization of several pulses of high K calcalkaline to shoshonitic basaltic to andesitic magmas. Igneous structures of the PMC are vertical in the Western most part while internal structures and major contacts were found to be sub-horizontal in the central and Eastern most parts of the PMC. Detailed field work on four crucial outcrops, rock textures and chemical analyses are used to tentatively reconstruct the 3-D intrusive stratigraphy of the PMC.

The major mass of the PMC consists of two 100-150m thick gabbroic units that are mainly composed of sills locally displaying normal modally graded layers of 1-5m. In many places the internal stratigraphy is disrupted and crosscut by smaller (10-20m thick) gabbroic and dioritic sills. The intraplutonic contacts frequently display diffuse transitions and cusped-lobate structures indicating supersolidus conditions during most of the emplacement history. Some diorites are later emplaced as indicated by fractures cutting the gabbroic rocks and by the local formation of 1-5 m long evolved granodioritic diapirs intruding surrounding mafic sheets. The youngest intrusive rocks are porphyritic granitic dikes, which may contain up to 50% of dioritic

and granodioritic enclaves. They form small, up to decametric (about 40 x 40 x 5m) magma bodies. Some of the dioritic enclaves show chilled margins suggesting that the emplacement of porphyritic granites is probably triggered by replenishment of mafic magma at depth.

Field criteria and microscopic observations permit to distinguish up to three different types of mafic cumulates within the gabbroic units: (i) some cumulates consisting of olivine, pyroxenes and hornblende show reaction relationships within the gabbroic sills indicating that they formed in the source and are later transported as mafic lenses; (ii) some are formed in-situ by crystal settling processes and (iii) the most spectacular ones are formed by accumulation of dm-scale layers rich in subhedral ferromagnesian minerals in the center of a sill, where the emplacement velocity is highest.

We tentatively propose that the Torres del Paine mafic complex forms a sheeted sill complex, fed by the source region in the Western part of the Paine massif.

References:

Altenberger U., Oberhänsli R., Putlitz B., Wemmer K.; 2003; Tectonic controls of the Cenozoic magmatism at the Torres del Paine, southern Andes (Chile, 51°10'S); *Revista Geologica de Chile*; vol30, n°1; pp65-81.

Michel J., Baumgartner L, Putlitz B., Schaltegger U., Ovtcharova M.; 2007; Incremental growth of the Torres del Paine laccolith over 80kyrs in the shallow crust, Patagonia; submitted to *Geology*