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Abstract

Deep magmatic process play a fundamental role in earth process; from plate tectonics to climate changes. The direct link between deep igneous cycles and the earth's surface is represented by volcanos. These are formed when magma rising from deep sources reach the surface. In some cases magma crystallize inside the earth's crust and do not reach the surface. This phenonema is called magmatic intrusion and mainly occurs under the form of large bodies, called plutons. This process is thought to be principal emplacement mechanism for the earth's lithosphere, especially for the continental crust. These latter is mainly composed of felsic rocks. The study of large granitic plutons represent therefore an important step for the understanding of magmatic process. The Torres del Paine igneous complex (TPIC) in southern Chile, is a well preserved and exposed example of magmatic intrusion. The TPIC extend over $\sim$100Km 2 and is mainly composed by a granitic complex, the Torres del Paine laccolith (TPL). The TPL intruded during the Miocene under at least 3 main injections. These are called batches and are distinguished mainly because have a proper structure, chemistry and rock texture. Batches intruded in discrete periods into cold an brittle conditions. The period between batch emplacement therefore has to be long enough to allow the old intrusion to cool down. The largest batch of the TPL is called the Catderal unit. It reaches 1Km height in the central part of the pluton. In this work we will mainly focus on this unit. The principal aim is to describe the internal structure of the batch. For that, detailed field observations will be provided. Results demonstrate that the Catedral unit is composed of by a multitude of small bodies, called pulses. These have distincted textures, chemistries and structures. Pulses intruded in a cahotic way under ductile conditions. Rapid cooling is demonstrate by eutectic texture and mineral zoning. Textural variations between pulses are mainly represented by changes in the amount of cumulate minerals. Negative Eu anomalies show a positive correlation with the amount of residual melt. Shallow depth of emplacement are indicated by cold host rock conditions and water saturation textures. We estimated pressure (P) using Qz-Ab-Or experimental data and found it to be well contrained at 1kbar. Am-Pl thermobarometry for such P yield T higher than 1000°C. We attempt to estimate the T of intrusion and cooling timing of the Catderal unit using a simple thermal model and chemical diffusion modelling. Results show strong uncertainties. Limited diffusion nevertheless suggest rapid cooling-down for the whole batch. Our new field data bring evidences for a small-injection accretionary mechanism for the Catedral batch. These would emplace quite randomly, contrary to previous models. Fast emplacement is in agreement with the literature. Accordingly to U-Pb dating, modelling simulations suggest that cooling is rapid. Based on previous U-Pb time estimations we further suggest that pulsing may occurs continously with periodical fluctuations. Such dynamic will could be similar to low viscosity eruptions.