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Intrusion and cooling history of the Torres del Paine Intrusive Complex, Chile

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The Miocene bimodal Torres del Paine Intrusive Complex (TPIC) consists of the basal Paine-Mafic-Complex (PMC) and the upper Paine Granite (PG). Based on field-observations and high precision U/Pb zircon dating we distinguish three different units in the PG. Each granite pulse is sheet-like, several tens to hundreds of meters thick and can be followed over large parts of the TPIC. The oldest granite forms the top layer (12.58 Ma) is intruded by its underlying unit, which in turn is underlain and intruded by the youngest dated unit (12.50 Ma).

The internal structures and AMS fabrics of the TPIC support the interpretation of an intrusion assembled by horizontal transfer of magma in the form of sheet-like pulses, stacking them vertically. Igneous structures (layering, xenolith orientations, and major contacts) are vertical in the westernmost part of the PMC. The layering and major contacts were found to be sub-horizontal in the central and eastern parts. AMS analyses on 145 samples reveal magnetic lineations with a WNW-ESE trend (parallel to the long axis of the intrusion) and subhorizontal foliations in the central part. Steeper magnetic foliations were measured closer to the steep contacts on the sides of individual pulses. Lineations and foliations are steep at the Western end of the intrusion, in agreement with observed magmatic layering.

Laser ablation 40Ar/39Ar-cooling-ages on biotites from the intrusive complex decrease towards lower topographic levels. They are covering a time span of nearly

400.000 years. Closure temperature ages of biotites in the upper granitic part overlap with the obtained U/Pb-ages on zircons.

The above data and observations reveal a consistent picture: a succession of 3 major granitic magmas pulses was fed from the West (E-side of the Lago Grey). The individual sheets formed a laccolith-like intrusions (15 km E-W direction, 3-9 km N-S). The roof was uplifted during each pulse. Successive pulses intruded at the base of the previous pulse, on top of the PMC, as indicated by abundant mafic enclaves at the base of some granite pulses. 2-D thermal models explain the observed 40Ar/39Ar-cooling-ages of biotite well provided the main mass of the mafic rocks does not intrude at the same time as the granites. This highlights the need for accurate radiometric ages of the PMC, which we hope to obtain in the near future.