

## **Puyehue-Cordón Caulle: a history of critical magma chambers**

D. Gilbert (1), A. Freundt (1,2), S. Kutterolf (1), T. Hansteen (1,2), and A. Amigo (3)

(1) SFB 574 at GEOMAR, Kiel, Germany, dgilbert@geomar.de, (2) GEOMAR, Kiel, Germany, (3) SERNAGEOMIN, Volcano Hazard Programm, Santiago, Chile

On June 4th 2011 the Puyehue-Cordon Caulle volcanic complex (PCCVC, 40.590°S, 72.117°W) in South Central Chile woke after 51 years of dormancy. The rhyodacitic eruption produced an ash plume that reached altitudes of ~13 km causing severe problems for civil aviation in the southern hemisphere. The 2011 eruption is the youngest of six larger explosive Post-glacial eruptions, that are documented in the tephrostratigraphic record (Lara et al. 2006). The 1960 PCCVC eruption, which occurred only 37h after the largest ever instrumentally recorded earthquake (MS=9.5), is probably the most often discussed example of a seismically triggered volcanic eruption (e.g. Walter and Amelung 2007; Lara et al. 2004).

We present estimates for pre-eruptive magma-chamber conditions (P-T-X) derived from several independent methods in order to investigate the criticality of the PCCVC magmatic system. Cpx-liq thermobarometry reveals crystallization pressures from 50 to 250 MPa suggesting a shallow magma chamber at depths of 2-9 km and magma temperatures of 870-890°C. Volatile data and the occurrence of water-dominated magmatic fluid inclusions indicate the exsolution of a chlorine-bearing fluid phase (Salinity<sub>mean</sub>=3.2±0.1 eq NaCl) at pressures of ~135 MPa.

Fluid inclusions and pre-eruptive H<sub>2</sub>O contents of 4-5.5 wt% suggest that relatively shallow reservoirs and pre-eruptive H<sub>2</sub>O-saturation appear to be typical features of explosive eruptive events at this volcanic system. The volatile supersaturation indicates that the system was due to erupt prior to eventual seismic activity. We suggest that PCCVC's state of criticality and its situation astride a NW fissure zone associated with the arc-wide Liquiñe Ofqui Fault Zone system – representing efficient pathways for both, the propagation of seismic energy/strain and magmatic ascent - probably controlled eruptive activity by magmatic overpressure that facilitated tectonic triggering by seismic events.

Lara LE, Moreno H, Naranjo JA, Matthews S, Pérez de Arce C (2006) Magmatic evolution of the Puyehue-Cordón Caulle Volcanic Complex (40° S), Southern Andean Volcanic Zone: From shield to unusual rhyolitic fissure volcanism. *Journal of Volcanology and Geothermal Research* 157 (4):343–366

Lara LE, Naranjo JA, Moreno H (2004) Rhyodacitic fissure eruption in Southern Andes (Cordón Caulle; 40.5°S) after the 1960 (Mw:9.5) Chilean earthquake: a structural interpretation. *Journal of Volcanology and Geothermal Research* 138 (1-2):127–138

Walter TR, Amelung F (2007) Volcanic eruptions following  $M \geq 9$  megathrust earthquakes: Implications for the Sumatra-Andaman volcanoes. *Geology* 35 (6):539-542. doi:10.1130/g23429a.1