LICANCABUR, AN ANDESITIC VOLCANO OF THE SOUTH-CENTRAL ANDES

Oscar FIGUEROA A.(1) and Bernard DÉRUELLE(2)

- (1) Departamento de Ciencias de la Tierra, Universidad de Concepción, Casilla 3-C, Concepción, Chile.
- (2) Laboratoire de Magmatologie et Géochimie Inorganique et Expérimentale, Université Pierre et Marie Curie, 4, Place Jussieu, Paris, France.

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INTRODUCTION

Licancabur volcano (22°56' S, 67°53' W) is located in the Central Volcanic Zone (CVZ) of the Andes, on the Chilean-Bolivian boundary (fig. 1). It looks like a 1500 m high almost perfect cone, 9 km base diameter, and a constant slope of 30°. The total volume of the cone is 35 Km³. Due to its location on the border of the Altiplano which dips in Chile towards the Salar de Atacama pull-apart basin, the western flank is better developed than the eastern one. Although this volcano is one of the most famous in Chile and Bolivia, it has not been yet the object of a detailed geological study (Déruelle, 1979; Marinovic and Lahsen, 1984; De Silva and Francis, 1991).

GEOLOGY

A sketched geological map (fig. 2) based on field work and photo interpretation has been established. Licancabur is built upon Chaxas and La Pacana ignimbrite formations (Gardeweg and Ramirez, 1987). No historical activity has been recorded. Nevertheless all the lava flows are well-preserved and were not affected by glaciations. Some of them present pristine levees and ridges. The oldest lava flows (OLF) occur West and North and are partially covered by the lava flows that built up the cone (CLF). Some OLF are underbedded with pre-caldera Sairecabur lava flows. Avalanche deposits occur west of the cone. Numerous N130° faults, parallel to the Calama-Olacapato-El Toro lineament, affect the Licancabur and Sairecabur basement.

PETROGRAPHY

The most common phenocryst phase is plagioclase. Orthopyroxene phenocrysts predominate over clinopyroxene ones. Scarce subhedral olivine phenocrysts and/or amphibole, with some Fe-Ti oxides are also present. The basaltic andesite contains olivine phenocrysts (up to 6 mm) which are generally rimmed by orthopyroxene. No biotite has been found at Licancabur.

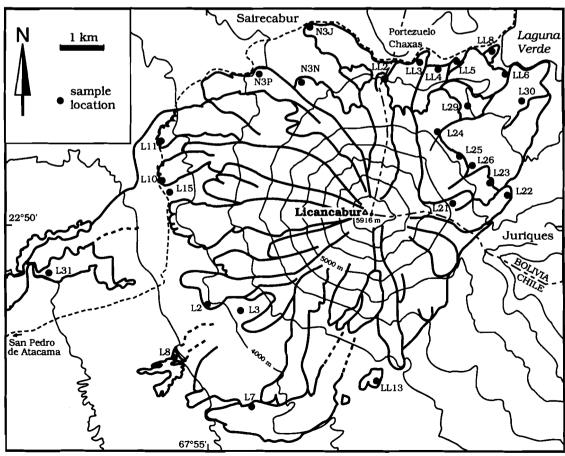
MINERALOGY

Olivine phenocrysts generally present normal zoning, with Fo 82 cores and Fo 69 rims. Orthopyroxene phenocrysts are also zoned with En 78 cores and En 70 rims. Clinopyroxene phenocrysts

Fig. 1. Location of Licancabur volcano in the Central Volcanic Zone.



Fig. 2. Geological sketch map of Licancabur volcano.



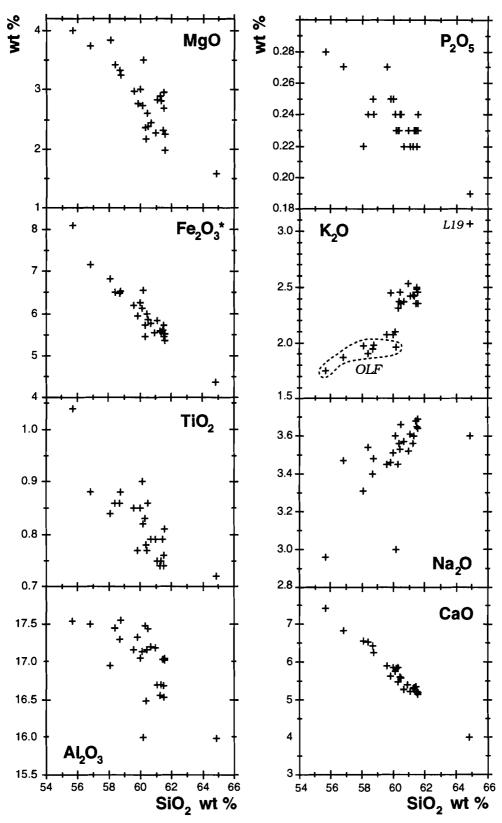


Fig. 3. Harker diagram for Licancabur lavas.

are mainly augite and scarce diopside. Plagioclase phenocryst compositions vary from An 78 to An 52 (core) and An 74 to An 48 (rim). Scarce Mg-hornblende phenocrysts occur in some andesites and the dacite and are commonly rimmed with Fe-Ti oxides, plagioclase and pyroxene crystals. Phenocrysts of titanomagmetite are common whereas ilmenite ones are rare.

GEOCHEMISTRY

CLF are only andesites ($56 < SiO_2$ wt % < 63) and one dacite (L19, 64.84 SiO₂ wt %). OLF are andesites and one basaltic andesite (L31, 55.69 SiO₂ wt %). In a Harker diagram (fig. 3), CaO and Fe₂O₃ distributions define a clear trend for all the lavas. On the contrary, TiO₂, Al₂O₃, Na₂O, and P₂O₅ show a rather scattered distribution. MgO contents permit to well distinguish between OLF (with higher MgO) and CLF. OLF present a good differentiation trend for K₂O (from 1. 7 to 2.2 wt %), whereas CLF are gathered around 2.5 K₂O wt %, except the dacite which has higher SiO₂ and K₂O contents. Transition element (Co, Cr, Ni) contents also allow to distinguish between OLF and CLF (fig. 4).

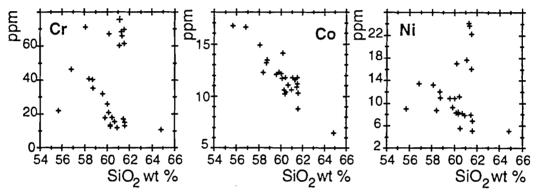


Fig. 4. SiO₂ - Cr, - Co, and - Ni diagrams for Licancabur lavas.

DISCUSSION AND CONCLUSIONS

The geochemical data confirm that OLF and CLF are distinct. OLF are somewhat similar to oldest Sairecabur lavas (Déruelle, 1982) and also to shoshonitic lavas of NW Argentina, which erupted along the Calama-Olacapato-El Toro lineament, and were recognized as the result of magma mixing (Déruelle, 1991). OLF are more basic and richer in transition elements than CLF. An origin of CLF as the result of various steps of mixing between OLF and L15 dacite magmas (see fig. 3, K₂O-SiO₂) is proposed.

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