

Geology and petrology of the Corona and Cerros de Saltar domes near the Lascar volcano system, Northern Chile

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INTRODUCTION

Lascar Volcano in the Central Andes, Northern Chile ($23^{\circ}22' S/67^{\circ}44' W$; 5593 m) is currently the most active volcano of the Central Volcanic Zone of the Andes (Fig. 1). Right next to this volcanic system are Cerros de Saltar Dome (5192 m) to the north, and Corona Dome (5293 m) to the south, respectively. Lascar Volcano is a composite calc-alkaline stratovolcano; its eruption products are medium to high-K andesitic to dacitic rocks in the form of lavas and pyroclastic flows (Matthews *et al.*, 1994a). The magmas are the product of combined mixing, fractional crystallization and assimilation of country rocks. The dominant magmas are 2-pyroxene andesites although 2-pyroxene dacites and hornblende and biotite rich dacites are also important. Both dome complexes are formed in pre-Lascar time and have preliminary similarities about composition: major dacite and dacitic tuff (Ignimbrite), minor pyroxene andesite and acid pumice. These dome complexes are aligned in NNE – SSW trend, along with other intrusive bodies up north (Cerros de Atana; 5493 m). The age for both domes is between the Miocene – Pliocene periods.

This present work is about the geology and petrology of Cerros de Saltar and Corona dome complexes, in attempt to establish the relationship between them and prior to the formation of Lascar Volcano, and focuses on the magma composition and properties to study their evolution. Chemical analyses have been performed on nearly 16 samples from both domes during stage I of this work, and more analyses will be done in order to increase the database, until all sectors are covered.

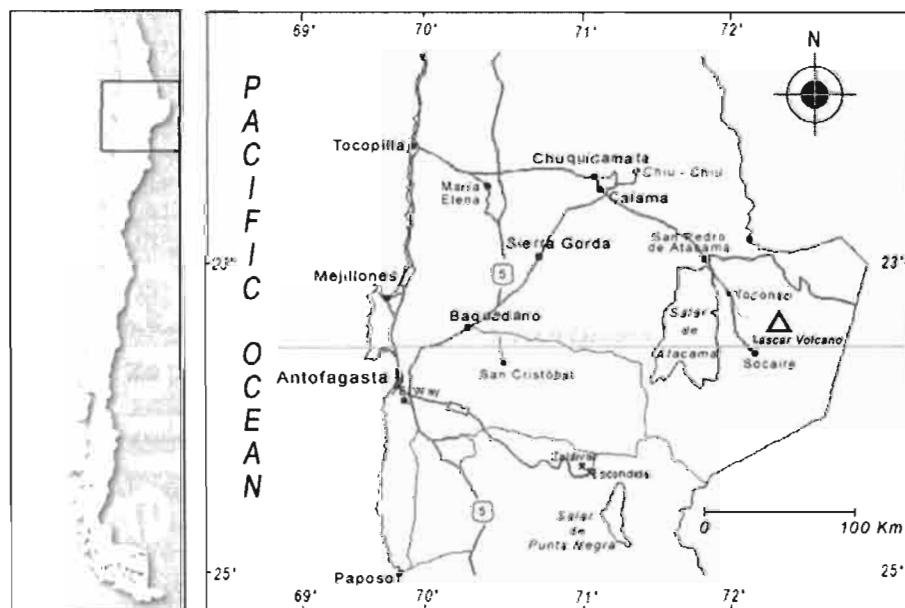


Fig. 1 Location map of Lascar Volcano.

GEOLOGICAL SETTING

Late Tertiary to Quaternary volcanism in northern Chile, specifically in the Lascar Volcano zone, is at least 10 My old (Gardeweg & Ramirez, 1985a). Volcanic centres vary from andesitic stratocones to dacitic dome complexes and large caldera buildings with associated ignimbrites. Tertiary Ignimbrites have buried the basement topography forming a 3°-steep plateau (Guest, 1969); (Gardeweg & Ramirez; 1985a, 1987). The ignimbrite bodies close to Lascar Volcano are Atana (4.5 a 3.8 My), Pampa Chamaca (2.6 a 2.2 My) y Tuyajto (< 1My). Lascar Volcano developed over a silica lava and dome ridge of Tertiary to Quaternary age (< 5 My) called Corona and Saltar domes complex, which extends north and south of Lascar along a major tectonic lineament: the Miscanti Line. Thin monomict debris flow units coming from Corona porphyritic rhyodacitic rocks overlap Tertiary ignimbrite and reach the Salar de Atacama. Lascar Volcano is bounded by two major volcanic centres: To the SW is Tumisa Volcano (5658 m) which consists on dacite complexes surrounded by several pyroclastic flow deposits fans (Gardeweg, 1991). The Tumisa Complex was dated by K/Ar method showing ages varying from 2.5 to 0.4 My. Aguas Calientes (Simba) volcano is located to E of Lascar volcano and consists of dacite and hornblende andesite lavas. All Lascar pyroclastic deposits are younger than those of Aguas Calientes.

The geomorphological evolution has influenced Lascar products distribution greatly. The Altiplano is dissected by numerous deep "quebradas" (canyons) which are up to 150 m depth and 300 m wide. These incisions cut trough Tertiary ignimbrites and Corona and Cerros de Saltar deposits.

Valley glaciers existed prior to and during the evolution of Lascar. Glacial erosion features have been recognized on local canyons next to Cerros de Saltar.

MIO – PLIOCENE SUBVOLCANIC DOMES

Corona and Cerros de Saltar rocks have similar texture features. Generally, these dome complexes have rocks with porphyritic texture and rhyolitic to andesitic composition, with ages ranging from Upper Miocene to Pliocene. These bodies form flat hills and extent in about 90 Km².

According to petrography analyses, four major types can be distinguished: rhyolitic, dacitic, hornblende and biotite andesitic; and pyroxene and/or hornblende andesitic. These subvolcanic bodies are distributed mainly to north of Cordón Puntas Negras, along two N-S stripes. The longest stripe (about 40 Km long) includes Corona, Cerros de Saltar and Cerro Rayado (Cerros de Atana) dome complexes and matches the Alitar-Lascar-Lejia volcanoes axis.

These porphyritic bodies are overlapped by Atana, Cajón and Tuyajto ignimbrites (Pliocene, Pleistocene and Quaternary ages, respectively). Besides, these domes are overlapped by strato-volcanoes II, III and IV (Pliocene – Holocene). At the same time, the domes are intruding strato-volcanoes I deposits (Gardeweg *et al.*, 1994), allowing ages for these dome complexes ranging from Upper Miocene – Pliocene (7,5 and 4 My, approximately).

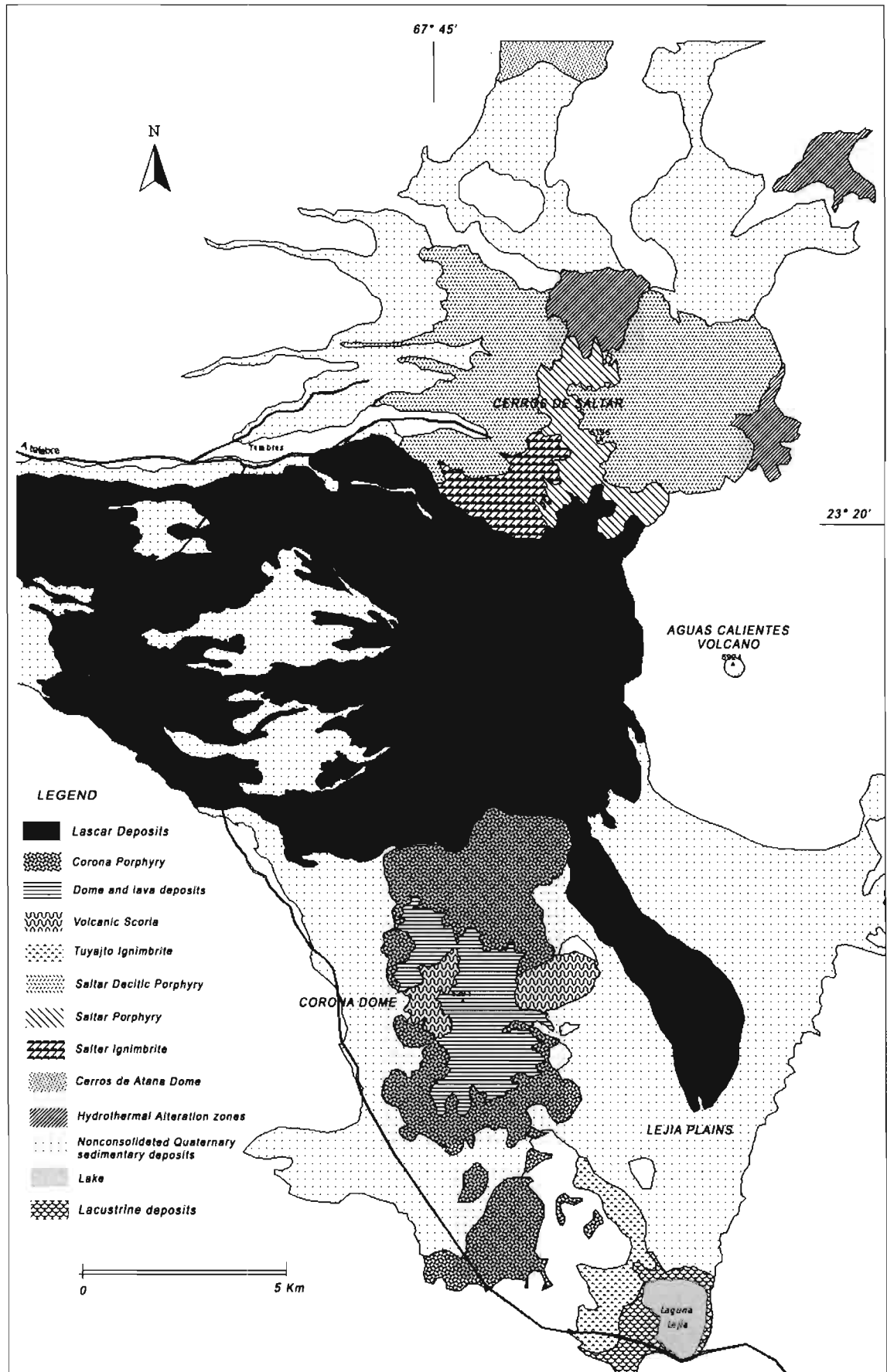


Fig. 2 Simplified geological map of Lascar Volcano and Corona – Cerros de Salтар dome complexes.

Next is a brief chart showing principal rock features.

Cerros de Salta

1. Litology: Dacitic Porphyry.
2. Exposed Surface: 16 Km²
3. Macroscopic Description: gray porphyritic rocks, with plagioclase mega-phenocrystals, quartz and biotite.
4. Microscopic Description: eudral plagioclase phenocrystals (15 – 25%), fractured and, frequently, with dark mesostasis inclusions; rounded quartz and/or cavities; brown to green biotite; green hornblende with opacitic edges; occasionally small clinopyroxene. Pylotaxitic and/or hialopilitic fundamental mass, with few plagioclase crystals, hornblende and opaque minerals in cryptofelsic mass, uncolored or reddish.
5. Observations: N – S body, with important alteration zone on the northern side.
6. Dates: K/Ar in biotite $5,2 \pm 0,8$ My (Ramírez y Gardeweg, 1982)
7. Alteration: presence of Cu, Mo, Au, Pb, Zn, As, Ag. (presence of Pyrite, Magnetite and Hematite)

Cerro Corona

1. Litology: Biotite y Hornblende Andesitic Porphyry bodies.
2. Exposed Surface: 20 Km²
3. Macroscopic Description: gray and pink porphyritic rocks, with variable quantities of plagioclase mega-phenocrystals (2 – 6 cm), biotite, amphibole y low quartz.
4. Microscopic Description: 10 – 15 % of fractured and zoned plagioclase phenocrystals, some of them with glass inclusions; low quartz (< 1%), softly carved; red biotite with inclusions of opaque minerals; eudral oxyhornblende with opacitic edges; low pyroxene, gray to brown fundamental mass, with intercortal texture and occasionally, fluidal, with plagioclase microlites, pyroxene granules or oxyhornblende needles, cryptofelsic mass, and few scattered opaque minerals.
5. Observations: On its summit it shows a singular crown-shaped body, formed by high-density tuff and dacite rocks, which is why it gets its name.

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