

GEOCHEMICAL FEATURES OF THE SOUTHERN ANDES OLIGOCENE-MIOCENE VOLCANISM IN THE PRECORDILLERAN REGION OF TALCA-LINARES (35°20'-35°50'S)

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INTRODUCTION

Tertiary volcano-sedimentary sequences constitute an important geological unity that covers a large part of the Andean Cordillera at least between latitudes 33°S and 37°S. However, Tertiary volcanic outcrops are scarce between 37°S and 40°S, being restricted to the Longitudinal Depression (Central Valley) and Coastal Range. Deep drilling projects, carried out by ENAP (Chilean Oil Company), have allowed to determine the distribution and thickness of this unity in the latter region.

This report discusses the stratigraphy and geochemistry of the Tertiary volcanism that outcrops in the Andean precordillera between latitudes 35°20'S and 35°50'S, that is between the latitudes of the Chilean cities of Talca and Linares.

GEOLOGY

In the Andean precordillera between Talca and Linares, Beccar (1966) defined a 1500 m thick Tertiary unit mainly consisting of volcanic rocks. Its base is represented by a sequence of basaltic lava flows showing amygdules of zeolite, pyroclastic tuffs, pyroclastic flows (ignimbrites) and volcanoclastic sediments. Overlying this sequence there is a thick sequence of volcanic detritus flows, tuffs and volcanic sediments of fluvial, alluvial and lacustrine origin. The latter sediments, that represent about 70% of this column, consist of turbidity deposits, volcanoclastic deposits with normal and/or inverse gradation, planar lamination and traction structures. This sequence also shows deposits of detritus flows and lahars related to the synchronous volcanic activity. On the basis of K/Ar age determinations, the basaltic lava flows from the base of this unit are Upper Oligocene (Karzulovic et al., 1979). A ³⁹Ar/⁴⁰Ar age obtained in plagioclase from a basal weldge tuff gave 27.4 Ma. (Fig. 1). On its eastern side, this Tertiary unit is intruded by the Río Melado granodioritic stock, dated at 23 Ma by Drake et al. (1982). On its western side, this unit is overlain by ignimbrites, rhyolitic domes and basaltic lava-breccia flows of Miocene age (17 Ma). Dyke clusters and volcanic plugs of Miocene age are also found on the western part of the Andean precordillera. Beccar (1996) has described an intense alteration with zeolite minerals such as wairakite and laumontite. This suggests the existence of a high paleogeothermal gradient associated with paleogeothermal fields.

GEOCHEMISTRY

Lava flows from the base of the Tertiary unit are mainly Cpx basalts, Cpx+Opx basaltic andesites and, in less proportion, Opx + Amph andesites. Basalts and basaltic andesites are prophyritic with phenocrysts of plagioclase (An₅₄-An₆₀), augite-type clinopyroxene (En₄₁Fs₁₈Wo₄₁) and orthopyroxene immersed in a groundmass whose texture varies from intergranular to hyalophitic. Analyzed samples have a relatively low K content, being tholeiitic according to the Peccerillo and Taylor (1976) classification criteria. Their location in the AFM diagram also confirm their tholeiitic affinity. However, their MgO contents are low (3.8-4.2%), indicating that they are quite differentiated. Compared with most Southern Andes Quaternary volcanic rocks, Tertiary basalts from the Talca-Linares region exhibit low (La/Yb)_n (1.5-2.2; Fig. 2) and (La/Sm)_n ratios (0.97 to 1.42), and slightly positive Eu anomaly (probably due to plagioclase accumulation). Their (La/Yb)_n and (La/Sm)_n ratios are similar to those presented by island arc tholeiitic series (Pearce et al., 1995). Samples N° 9 and 12 are basalts with 45 and 47% SiO₂ respectively; samples 10 and 11 are basaltic andesite and andesite respectively.

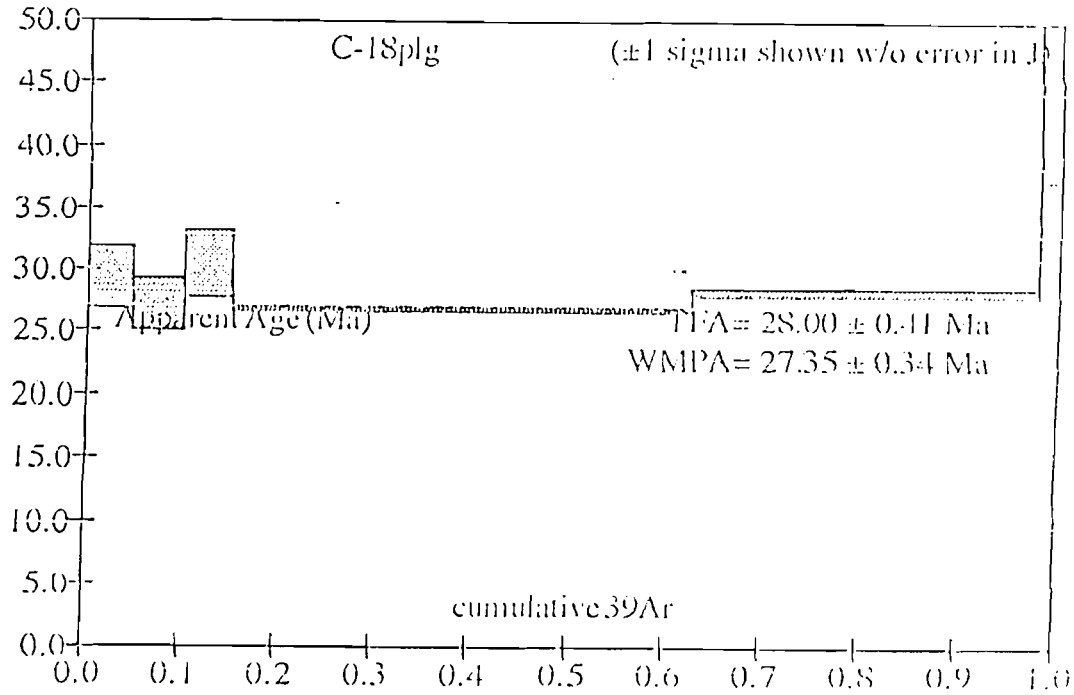


Fig. 1. Ar/Ar plateau age.

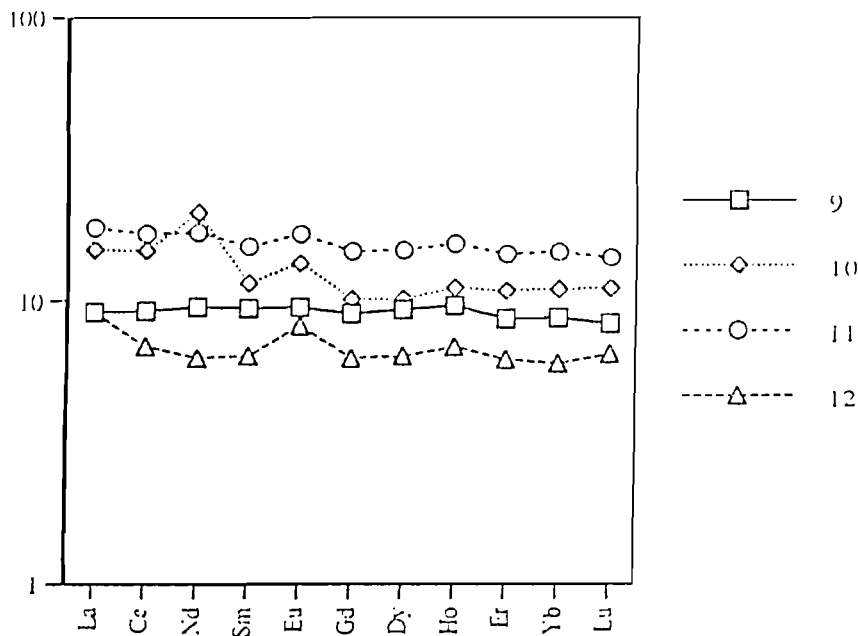


Fig. 2. Chondrite normalized REE abundances for Oligoce-Miocene lavas of the Talca-Linares precordillera.

CONCLUSIONS

The Oligocene-Miocene volcanic rocks from the Andean precordillera of Talca-Linares are representative of a magmatism that is more tholeiitic than the magmatism that gave origin to Quaternary basalts from the Southern Andes. This magmatism was probably associated with a thin crust and a relatively high geothermal gradient (as suggested by the alteration mineralogy of these rocks). The Upper Oligocene-Miocene volcanic rocks from further north (latitudes 33-34°S) also present tholeiitic affinities and their Sr and Nd- isotope ratios (López-Escobar et al., 1991; Nyström et al., 1993; Stern and Skewes, 1995) are more primitive than those exhibited by Quaternary basalts from the Southern Andes.

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