

## GEOCHEMISTRY OF UPPER PALEOZOIC-LOWER TRIASSIC GRANITOIDS OF CENTRAL FRONTAL CORDILLERA, ARGENTINA

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**RESUMEN:** Nuevos análisis químicos de granitoides del Paleozoico superior-Triásico inferior del sector central de la Cordillera Frontal de Argentina, muestra que se trata de rocas metalumínicas a levemente peralumínicas, con diópsido normativo. El alto valor promedio de Na<sub>2</sub>O (4.3 %), la presencia de hornblenda y esfena modal así como una relación A/CNK < 1 indican que pertenecen a los granitoides de tipo I. La abundancia y las relaciones entre los elementos mayoritarios y minoritarios permiten señalar que estas rocas integraron un arco magmático sobre corteza continental en el margen Pacífico del sector central de Chile y Argentina, generado por la implantación de un sistema de subducción activo durante el Paleozoico superior-Triásico inferior.

**KEY WORDS:** Geochemistry, granite, Frontal Cordillera, Argentina.

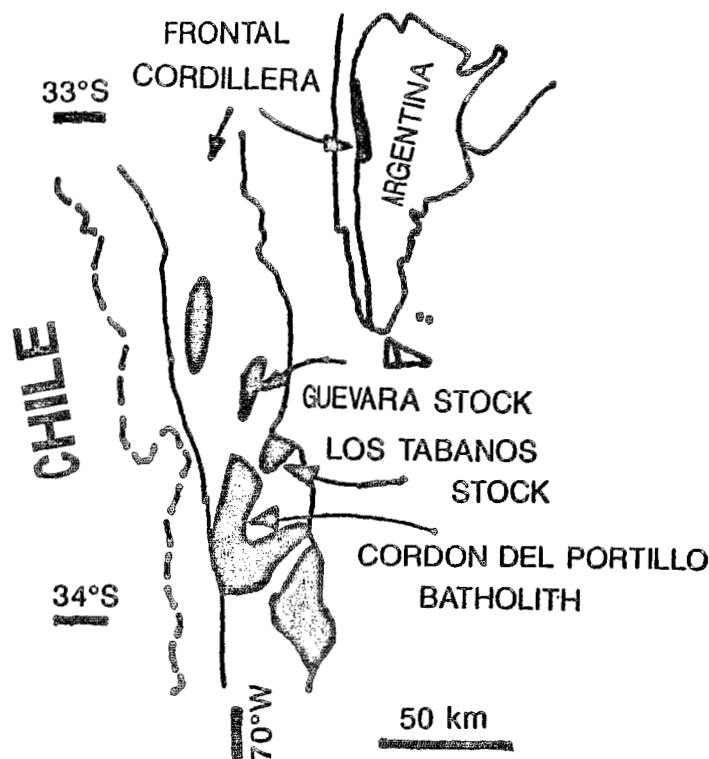
### INTRODUCTION

Upper Paleozoic-Lower Triassic intrusive rocks crop out in the Frontal Cordillera of Argentina and Chile, between 27°S and 34°S. Although detailed field, petrological, geochemical and geochronological studies of granitoids have been carried out in the northern portion (29°S to 32°S) of Frontal Cordillera (Llambías et al., 1987; Nasi et al., 1985; Parada, 1988; Parada et al., 1991) relatively scarce geochemical and petrological data are available in the southern sector to 33°S. (cf. Caminos, 1979; Llambías and Caminos, 1987). In this paper we present new geochemical data, a brief description on the petrology and the possible tectonic setting of granitoids outcropping from 33° 10'S to 33° 45'S, in the Frontal Cordillera of Argentina.

### GEOLOGICAL SETTING

Igneous activity during Late Paleozoic in Frontal Range of Argentina and Chile was described by Hervé et al. (1987) as Frontal Range Magmatic Belt (FRMB). Upper Paleozoic-Lower Triassic intrusive rocks at Frontal Cordillera of Mendoza province form the so-called "Frontal Cordillera Composite Batholith" (Polanski, 1958). It extends for 130 km south to Mendoza River and its width vary from 20 km at the Cordón del Plata to 40 km in the Cordón del Portillo. Several important plutonic bodies were mapped and described by Polanski (1972) in the Cordón del Plata area: Guevara Stock, Carrera Stock, Yesera Stock and Santa Clara Stock. In the Cordón del

Portillo area, the Las Cuevas Stock, Las Delicias Stock and the Cordón del Portillo Batholith were recognized, as is showed in the figure.



The host rocks where the Upper Paleozoic magmas were emplaced consist of metamorphic and sedimentary rocks. The metamorphic rocks comprise phyllites, schists, marbles, quartzites and serpentized ultrabasic rocks, which show several deformations and the thermal effect of the granite intrusion. Radiometric age determinations presented by Caminos et al. (1979) confirm that the episode of regional metamorphism have a minimum age of  $500 \pm 50$  Ma. The sedimentary rocks are represented by shallow water marine sequences composed by conglomerates, sandstones and pelites outcropping in the eastern side of Cordón del Plata. Finally, Permian to Triassic andesitic and rhyolitic lavas (Choiyoi Group) overlies and are intruded by the granitic rocks under study. The Guevara and Los Tábanos Stocks and Cordón del Portillo Batholith (Cerro Punta Blanca, Cerro Punta Negra, Quebrada del Portillo Argentino), were included in this study because radiometric ages were obtained by Caminos et al. (1979) in the Cordón del Portillo Batholith (Cerro Punta Blanca: K/Ar  $337 \pm 15$  Ma; Rb/Sr  $348 \pm 35$  Ma., Quebrada del Portillo: K/Ar  $291 \pm 10$  Ma. Rb-Sr  $264 \pm 8$  Ma.; Cerro Punta Negra: K/Ar  $234 \pm 10$  Ma.) and in the Guevara Stock (K/Ar  $209 \pm 10$  Ma.).

#### PETROGRAPHY

The granitoid rocks consists of medium (1-4 mm) to coarse (5-8 mm) grained biotite and hornblende granodiorites with equigranular to porphyritic textures. The mineralogy is composed mainly of plagioclase ( $An_{10}$ - $An_{20}$ ), quartz, microcline, biotite and  $\pm$  Fe-hornblende. Common accessory minerals are zircon, apatite and sphene. Chlorite partially replaces biotite and sericite  $\pm$  calcite is commonly found within plagioclase grains. Zoned plagioclase exhibiting altered cores and corroded quartz possibly represent an early stage of crystallization, whereas the later is characterized by unaltered euhedral grains of plagioclase, perthitic K-feldspar and granophyric intergrowth of K-feldspar and quartz.

## GEOCHEMISTRY

Twenty seven samples of Guevara and Los Tábanos Stocks and Cordón del Portillo Batholith (Cerro Punta Blanca, Cerro Punta Negra, Quebrada del Portillo), collected mainly through east-west traverses along rivers, were analyzed for major and trace elements concentrations. The rocks have typical compositions of calc-alkaline magmatic suites, ranging from metaluminous quartz-monzonite to moderately peraluminous granites. The co-variation of element oxides with  $\text{SiO}_2$  of different stocks shows that decreasing trends exist for nearly all the major and trace elements, except for  $\text{K}_2\text{O}$ ,  $\text{Na}_2\text{O}$  and  $\text{FeO}^*$  where a considerable scatter occurs. This fact may partly be due to incipient post-magmatic alteration processes (e.g. albitization). Harker variation diagrams show decreasing trends with two clusters of samples in the range 61 to 70 %  $\text{SiO}_2$ , and 73 to 76 %  $\text{SiO}_2$ .

The co-variation of Rb vs. K/Rb supports the idea that all samples are part of a cogenetic suite, where a general differentiation trend from quartz-syenite and quartz-monzonite to granodiorite, granite and alkali-feldspar granite seems to exist. Chemical and mineralogical properties such as the relatively high  $\text{Na}_2\text{O}$  content (4.3 % average), A/CNK ratio < 1.1, normative diopside, modal hornblende and sphene and a broad spectrum of composition, show as these rocks may be interpreted as I-type granitoids (Chappell and White, 1974).

According their Rb-Ba-Sr relationships, the 80 percent of them are granodiorites and quartz-diorites whereas the rest are granites. A late-orogenic trend with R2 approximately constant and a broad range of R1, as result of major variation of total alkalis, was identified using the R1-R2 diagram.

Tectonic discrimination diagrams after Maniar and Piccoli (1989) classify the rocks studied as IAG+CAG, whereas that ocean ridge granite (ORG) normalized multi-element variation diagrams (Pearce et al., 1984) display typical patterns of volcanic arc granites, with relative enrichments in K, Rb, Ba and Th to Nb, Zr and Y. Nb-Y and Rb-Nb+Y discrimination diagrams apparently confirm overall volcanic arc affinities for these rocks. Normal continental arc is reflected in the Rb/Zr versus Nb diagram (Brown et al., 1984).

## CONCLUSIONS

Pre-Andean Upper Paleozoic-Lower Triassic plutonic activity in the Pacific margin of central Argentina and Chile were interpreted as a magmatic arc generated by the existence of an eastward-dipping subduction regime (Ramos et al., 1984; Nasi et al., 1985). The new geochemical and mineralogical data of granitoid rocks from the central area of the Frontal Cordillera presented in this paper show that the intrusive bodies have similar features to the I type granites. They were possibly related with a continental arc generated by the subduction of oceanic plate underneath the continental plate.

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