

GEOCRONOLOGIA Rb-Sr DE LOS COMPLEJOS ERUPTIVOS DE LA ESPERANZA MACIZO NORDPATAGONICO (68°28'W, 40°28'S)

Rb-Sr GEOCHRONOLOGY OF LA ESPERANZA ERUPTIVE COMPLEXES, NORTH PATAGONIAN MASSIF (68°28'W, 40°28'S)

EDUARDO J. LLAMBIAS¹, CARLOS W. RAPELA², CLAUDIO PARICA³

1. CONICET - Secretaría de Minería
Sta. Fe 1548 Piso 11, 1060 Buenos Aires, Argentina
2. CONICET, Univ. Nacional de La Plata
Centro de Investigaciones Geológicas
Calle 1, No. 644 - 1900 La Plata - Argentina
3. CONICET, INGEIS
Ciudad Universitaria, 1428, Bs. Aires, Argentina

The north Patagonian Massif (NM) is essentially composed by 1) a basement, formed by low to medium grade metamorphic schists and migmatites and some magmatic intrusions of Late Precambrian to Early Palaeozoic age; and 2) plutonic and plutonic-volcanic sequences of Late Palaeozoic age. Regional descriptions of these units have been recently reviewed by Caminos and Llambías (1984) and Llambías et al. (1984) respectively.

The Upper Palaeozoic eruptive sequences are widespread along the N.M. They are composed by postorogenic granitic intrusions emplaced near the surface, and the later events are often related to ignimbritic shields. During the Late Palaeozoic the (NM) became rigid and its petrologic and tectonic features may be important in order to understand the evolution of the pre-andean terranes in the eastern side of the Cordillera.

The eruptive complexes of La Esperanza are representative of most of the units described for the Upper Palaeozoic eruptive sequences of the (NM). The stratigraphic relations and petrographic characteristics of these eruptive complexes have been recently described by Llambías and Rapela (1984) and their chemical evolution by Rapela and Llambías (1985). A synthesis of their most important features is given below.

Two igneous complexes have been recognized 1) the oldest one, La Esperanza plutonic complex, is characterized by distinct petrographic units that in order of decreasing age consist of hornblende-biotite granodiorites and hornblende-biotite granites with K-feldspar megacrysts (Prieto Granodiorite); biotite granites, and biotite granites with K-feldspar megacrysts. The contacts between units are sharp, while within individual units there are often transitional facies. Several microdioritic to spessartitic dikes intruded these units. 2) Dos Lomas plutonic-volcanic complex, which is composed by dacitic ignimbrite sheets; a rhyolitic dome; rhyolitic aplitic dykes; rhyolitic ignimbrite sheets, and leucogranites (Calvo Granites). The leucogranites intruded the lower units of the volcanic sequence. Field relationships and chemical similarities between the volcanic rocks and the

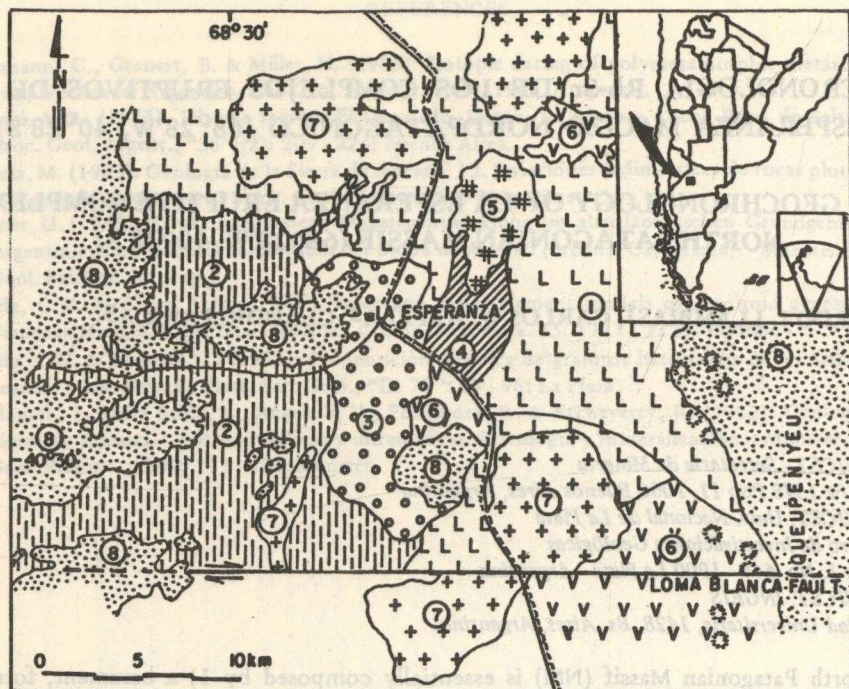


Fig.1. Generalized geologic map of La Esperanza. 1-3 La Esperanza plutonic complex; 1) Hornblende biotite granodiorite and hornblende-biotite granites with K-feldspar megacrysts (Prieto Granodiorite); 2) Biotite granites; 3) Biotite granites with K-feldspar megacrysts. 4-7 Dos Lomas plutonic-volcanic complex, 4) Dacitic ignimbrite sheets; 5) rhyolitic dome; 6) Rhyolitic ignimbrite sheet; 7) Leucogranites (Calvo Granite); 8) Tertiary basalts. Simplified after Llambías y Rapela (1984)

Fig.1. Mapa geológico generalizado de La Esperanza. 1-3 Complejo Plutónico La Esperanza; 1) Granodioritas de hornblenda y biotita y granitos de hornblenda y biotita con megacristales de K. feldespato (granodiorita Prieto); 2) Granito de biotita; 3) Granito de biotita con megacristales de K-feldespato. 4-7 Complejo Plutónico volcánico Dos Lomas; 4) Mantos ignimbriticos dacíticos; 5) Domo riolítico; 6) Mantos ignimbriticos reolíticos; 7) Leucogranitos (Granito Calvo); Basaltos Terciarios. Simplificado de Llambías y Rapela (1984).

leucogranitic plutons suggest that they are evolving from the same magmatic source.

Both complexes are separated by an erosion surface elaborated on the granitic rocks of La Esperanza complex. The dacitic ignimbrites of the Dos Lomas complex flowed over this almost horizontal surface. However, the similarities in chemical and evolutive trends between the two complexes, probably indicate that they belong to a single eruptive cycle. Both complexes are mostly composed by high-K calc-alkalic associations showing metaluminous to peraluminous transition. Nevertheless, mildly peralkaline compositions, acmite normative, were found in the final magmatic episode of the Dos Lomas complex, represented by the leucogranites and associated dykes.

Four main magmatic episodes with distinctive chemical trends that show an overall increasing acidity and alkalinity were recognized within each complex. Clear consanguinity relationships relate rocks of a given petrographic unit, but the trends of the different units of a complex do not follow a co-linear pattern. Each complex appear then to be

composed by several progressively more acidic magmatic pulses emplaced at epizonal levels (La Esperanza complex) and subvolcanic to surface levels (Dos Lomas complex).

Samples for Rb-Sr analyses from Prieto Granodiorite and Calvo Granite were obtained from single intrusions in each case, taking into consideration their internal variations in order to obtain appropriate Rb/Sr ratios. All the samples were processed in the INGEIS laboratories, and Rb-Sr whole rock isochrons were obtained in both units. The method used is the same as that reported by Parica (1983).

TABLE 1

Rb-Sr DATA FOR WHOLE ROCKS SAMPLES FROM LA ESPERANZA ERUPTIVE COMPLEXES: PRIETO GRANODIORITE AND CALVO GRANITE

DATOS Rb-Sr PARA MUESTRAS DE ROCA DE LOS COMPLEJOS ERUPTIVOS LA ESPERANZA: GRANODIORITA PRIETO Y GRANITO CALVO

INGEIS number	Unit	Rb (ppm)	Method Used	Sr (ppm)	Method Used	$^{87}\text{Rb}/^{86}\text{Sr}$	+ -	$^{87}\text{Sr}/^{86}\text{Sr}$	+ -
602	CG	220	XRF	11	ID	56.23	1.125	0.9641	4×10^{-4}
603	CG	225	XRF	45	ID	14.12	0.282	0.7722	"
605	CG	236	XRF	19	ID	33.40	0.668	0.8557	"
606	CG	162	XRF	125	XRF	3.67	0.073	0.7244	"
604	PG	380	XRF	168	XRF	1.25	0.025	0.7113	"
607	PG	110	XRF	346	XRF	0.90	0.018	0.7099	"
608	PG	250	XRF	230	XRF	2.59	0.052	0.7178	"
610	PG	214	XRF	469	XRF	1.19	0.024	0.7116	"
611	PG	187	XRF	234	ID	2.25	0.045	0.7162	"

ID = isotopic dilution

XRF = X-ray spectrometry

CG = Calvo Granite

PG = Prieto granodiorite

The isotopic determinations were performed in a Micromass 30 mass spectrometer commanded by a HP-9845A, and the measured $^{87}\text{Sr}/^{86}\text{Sr}$ ratios were normalized to a $^{86}\text{Sr}/^{88}\text{Sr}$ ratio of 0.1194 (Faure and Powell, 1974) included in the HP's program (V.G. Micromass, 1979). The age, regression, MSWD, initial ratio and slope were determined according to McIntyre et al. (1966). A good alignment of points and low value of MSWD were obtained in both isochron diagrams, allowing to consider them as real isochrons.

The Prieto Granodiorite, which is the oldest unit of La Esperanza complex, yielded an age of 332 ± 6 Ma, with an initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.7055. The latest unit of the Dos Lomas complex, the Calvo Granite, gave 317 ± 4 Ma, with an initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.7078. The separation of both units by a short period of time is consistent with previous results based on field and geochemical grounds suggesting that both complexes represent a single major magmatic event. The difference in the initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratio require a more detailed explanation, however, it is probable that the ultimate source for the Calvo Granite would have been influenced by rocks with high Rb/Sr ratios.

Similar Rb-Sr isochron ages and initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratios are reported by Caminos and Parica (this volume) for plutonic units located 140 km east of La Esperanza.

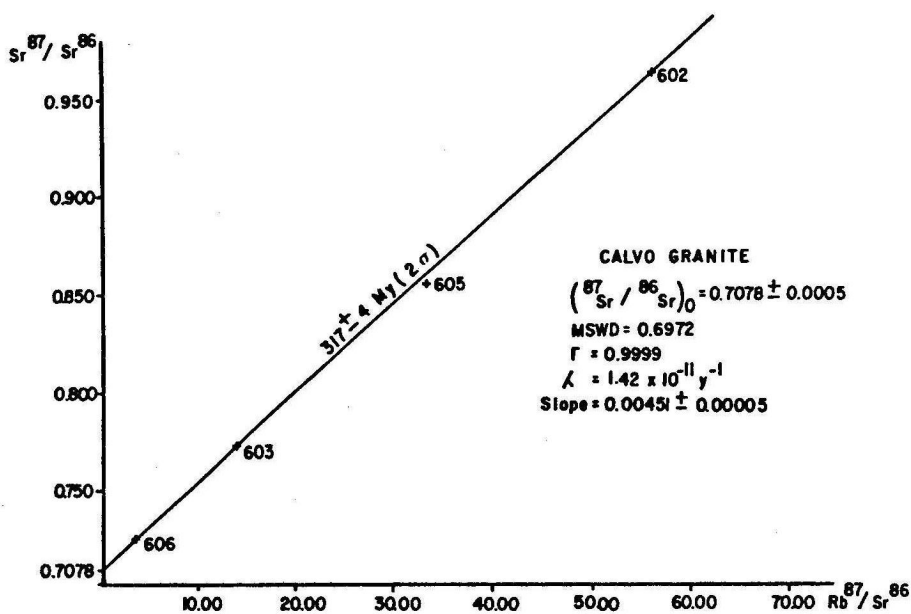
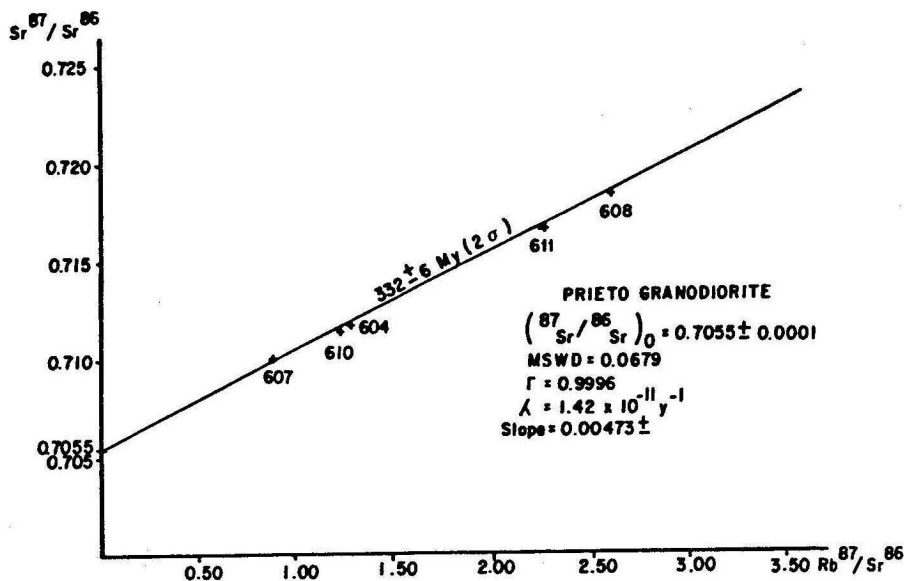


Fig.2. Rb-Sr isochrons for samples of the Prieto Granodiorite and Calvo Granite.

Fig.2. Isocronas Rb-Sr para muestras de la Granodiorita Prieto y el Granito Calvo.

Upper Palaeozoic magmatic activity in the (NM) had been recognized previously by Groeber (1929) and Stipanovic (1967). In La Esperanza area reported radiometric ages range from Permian to Triassic (Halpern, 1968; Stipanovic and Linares, 1969; Rosenman, 1979; Devicenzi, personal communication). Whole rock Rb-Sr analyses of widely spaced granitic plutons yielded Late Permian, while K-Ar gave Early Permian to Early Triassic ages.

The new radiometric data support the hypothesis that a major magmatic cycle developed during the Early Carboniferous and that it will be necessary to carry out more detailed research to determine the extension of the probable Permian cycles reported earlier. Taking into account that the Upper Palaeozoic complexes show postorogenic features and that each magmatic sequence is emplaced at higher levels of the crust with decreasing age, it may be concluded that since Early Carboniferous a process of progressive uplifting and cratonization of the (NM) has taken place.

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