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EVOLUCION DE MAGMAS DERIVADOS DEL MANTO Y ANATECTICOS DEL PALEOZOICO INFERIOR EN LA SIERRA DE ANCASTI (NW - ARGENTINA)

EARLY PALAEOZOIC MANTLE DERIVED AND ANATECTIC MAGMA EVOLUTION IN THE SIERRA DE ANCASTI (NW - ARGENTINA)

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The Sierra de Ancasti, E of Catamarca, is a typical example of the Sierras Pampeanas of NW-Argentina (Fig. 1).

Their meta-psammopelitic rocks were originally deposited as turbiditic sediments in the Upper Precambrian to Lower Cambrian Puncoviscana trough and subjected to isoclinal folding with penetrative banding and large scale shearing in the Middle Cambrian. During this event (metamorphism at 570 - 540 Ma; Bachmann et al. 1985), basic magmas (gabbros, diorites and quartzdiorites) intruded into the shear zones, while hornblendites were tectonically implaced. Although these rocks constitute only 5°/o of all the magmatites of the sierra, they are most important for the understanding of the overall magmatic history (Lottner 1985).

Intensive magma formation in the lower crust (tonalites, trondhjemites and early granodiorites), which was syn - to post-tectonic to a second deformation phase, gave rise to a static metamorphism. This locally graded to migmatization and partial melting (postkinematic metamorphism at 470 - -430 Ma; Bachmann et al. 1985). Anatectic granites were formed by increased melting of crustal rocks.

The region between Ramblones and La Majada, in the central southern part of the Sierra de Ancasti, has been studied in detail, since here nearly all magmatic rock types known from the whole range occur within a surveyable area.

The hornblendites, gabbros, diorites and quartzdiorites of the La Majada – Ramblones intrusive complex derived from the fractional crystallization of a tholeiitic magma formed by the partial melting of peridotite in the upper mantle. The origin from lower crustal basic rocks as well as from subducted oceanic crust, transformed to eclogites, can be excluded.

The partial melting of mantle peridotite was possibly initiated by fluid phases derived from dehydrating subducted oceanic crust during transition to eclogitic phases.

Cr-rich hornblendites (up to 2824 ppm Cr) and both titanomagnetite and Cu-sulfide mineralization in the hornblendites of several areas of the Sierra de Ancasti (Schalamuk et al. 1983) indicate a formation as cumulates and primary sulfide-silicate segregations in the beginning of the magma differentiation.

Within the originally mantle-derived intrusives, nearly uncontaminated rocks can be distinguished from hybrid ones. In the northern part of the Sierra de Ancasti a discontinuous differentiation produced final products comprising a monzogranite (Albigasta) and a muscovite-granite (El Alto). Their initial $^{87}Sr/^{86}Sr$ ratios of 0.705 indicate that both members have an I-type genesis (Knüver 1983). In the intrusive complex of La Majada–

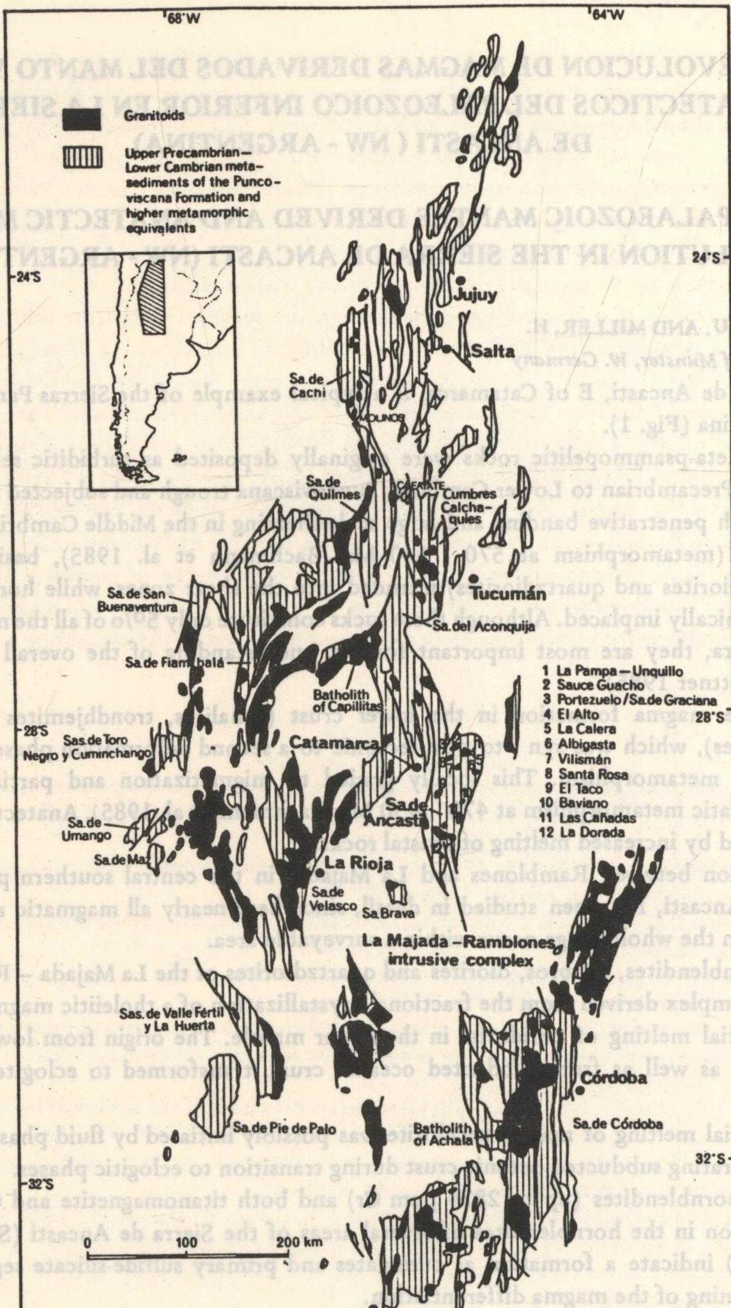

Fig. 1. Map showing the Pampean Ranges mentioned in the text and the location of the intrusive rocks within the Sierra de Ancasti.

Fig.1. Mapa del área de las Sierras Pampeanas mencionadas en el texto y ubicación de las rocas intrusivas en la sierra de Ancasti.

Ramblones predominantly middle– to coarse-grained tonalites formed, having been moderately contaminated by crustal rocks.

Furthermore, the igneous rocks of the La Majada–Ramblones complex developed in a tonalitic-trondhjemitic trend as a result of an early fractionation of biotite and also because of the separation of K-rich fluid phases from the differentiating magma.

The K-rich fluid phases partially altered the tonalites by intergranular diffusion, producing late-magmatic phases of large porphyric granites. A potassic-sodic metasomatism is connected with the intrusion of coarse-grained tonalites, resulting as a plagioclase blastesis in the gneisses (ophthalmitic texture).

Nearly all granites and granodiorites of the La Majada–Ramblones area and some of the other parts of the Sierra de Ancasti developed independently from the partly mantle derived basic-intermediate suite. They are definitely younger than the mantle derived ones.

At the beginning of the anatexis only the plagioclase, quartz, and muscovite components melted, forming pegmatoid intrusives rich in plagioclase, quartz and H_2O. With increasing temperature more biotite reacted, introducing larger amounts of K, Rb, Fe, Mg, Cr, Li and Be into the melt, thus creating an overall granodioritic composition. With the exception of K and Rb all the other components of biotite decreased in the course of differentiation. This permits to assume an apparently increasing incongruent melting of a relatively Fe-rich metamorphic biotite.

The sequence of coarse-grained granodiorites and biotite granites through to predominantly aplitic muscovite granites and pegmatites, indicates the production of progressively greater amounts of anatectic-granitic magmas by partial melting followed by magma differentiation over an 80 million years period.

While in the igneous complex of La Majada and Ramblones small granitic stocks prevail as last intrusive phases, in the north of the sierra two-mica granites intruded as two huge stocks (Santa Rosa and Sauce Guacho). These equigranular to porphyric granites appear to be petrographically and geochemically only weakly differentiated.

Here local heat domes caused a quick and radical melting of the gneisses. These two-mica granites intruded during the last Palaeozoic deformation phase and contemporaneously with the intrusion of the mostly aplitic muscovite granites and pegmatites in the south (Late Devonian - Early Carboniferous).

In the Cr-TiO_2-diagram (Fig. 2) both, the basic-intermediate and the anatectic-granitic lithochemical trends, become obvious: the first one originated from the differentiation of a mantle tholeiite and the latter one was generated by anatexis, the meta-psammopelitic rocks of the Sierra de Ancasti plot exactly between the anatexites and the residuals.

In Fig. 3 the variation trends for the suites from La Majada–Ramblones (Fig. 3a), for the intrusives of the whole Sierra de Ancasti (Fig. 3b) and for several intrusives from NW-Argentina (Fig. 3c) are compared (for locations see Fig. 1; Fig. 3c after data from Rapela & Shaw 1979, Rapela & Heaman 1982, Galliski 1983 and Willner, unpubl. data).

The elemental ranges of the respective differentiation fields are generally identical. The investigation of the igneous complex in the Majada and Ramblones area of the Sierra de Ancasti has clearly documented a continuous and widespread range of compositions of a basic to intermediate magmatic suite, overlapping with a continuing anatactic-granitic sequence. The scarcity and small size of basic intrusives in the eastern Pampean Ranges allow to assume that similar occurrences may also exist in other areas and may have been overlooked so far.

Major occurrences of ultrabasic and basic intrusive rocks are restricted to a strip in the western Pampean Ranges (Caminos 1979; Toselli et al. 1985; for location see Fig. 1).

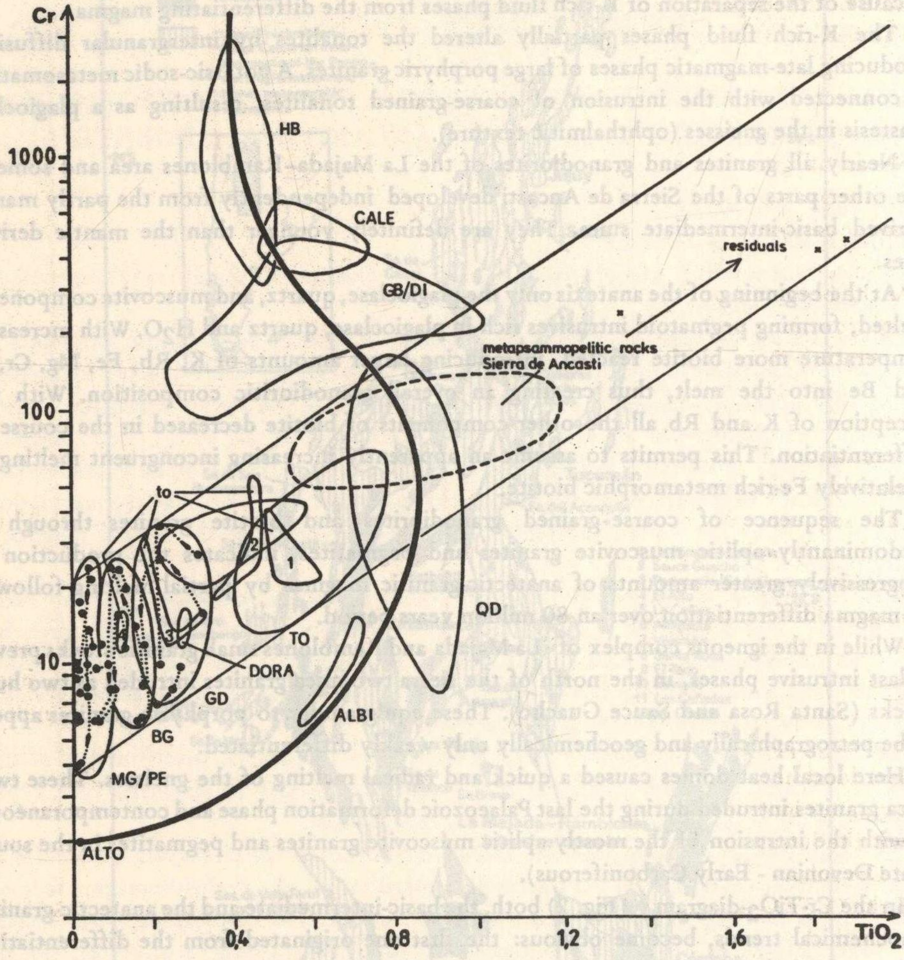

Fig. 2. The primary magmatic trend of the tonalitic- trondhjemitic suite (heavy line) in the Cr-TiO_2 diagram intersects the anatecting-granitic trend (Between thin lines) within the field of the meta-psammopelitic rocks in the Sierra de Ancasti. The metasedimentary rocks are situated between the granitic melts and the residuals. The dotted lines in the field of the granitic rocks represent Cr differentation curves of several occurrences probably indicating the incongruent melting of biotite. For abbreviations see Fig. 3.

Fig. 2. La tendencia magmática primaria del costejo fonalítico trondjhemitico (línea gruesa) intersecta en el diagrama Cr-TiO_2 a la tendencia granítica anatéctica (entre líneas delgadas) dentro del campo de las rocas meta-psammopelíticas en la Sierra de Ancasti. Las vías metasedimentarias se situan entre los fundidos graníticos y las composiciones de los re iduos de fusión. Las Líneas punteadas en el campo de las rocas graníticas representan curvas de diferenciación de Cr de diversas ocurrencias, indicando probablemente la fusión incongruente de la diotita. Las abreviaciones son las usadas en la Fig. 3.

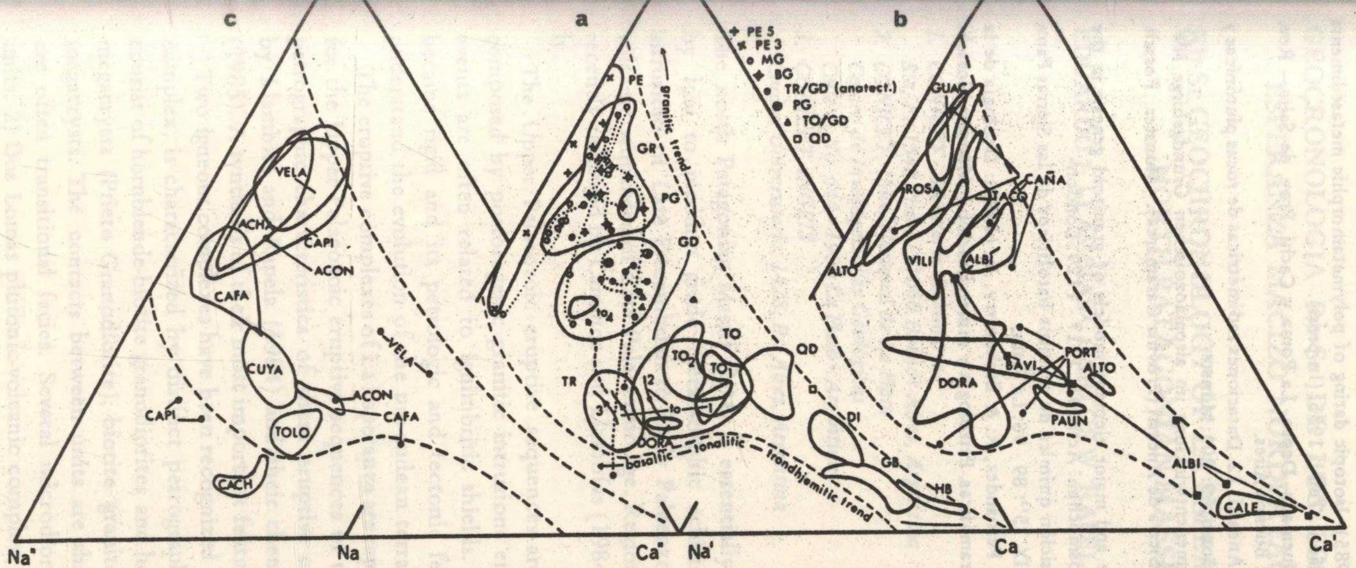

Fig.3. In the K-Na-Ca diagram the series of the La Majada Ramblones complex (3a) and of the whole Sierra de Ancasti (3b) area compared with further intrusive series in the northen Central Pampean Ranges of NW Argentina (3c). Except for the basic members (no data from areas outside the Sierra de Ancasti) the trend fields of Lower Paleozoic plutonites are remarkably similar. Rocks abbreviations in the La Majada-Ramblones area: 1— anatectic- granitic sequence: $PE_{(5,3)}$ pegmatites (5— carbonif.; 3— ordov. intrusive phase), MG muscovite granites, BG biotite granites, GR granite in general, GD grano- 2—basic to intermediate magmatic suite: PG porphyric granites, TR trondhjemites, $to_{1\text{-}4}$ different fine grained tonalites, $TO_{1,2}$ different coarse grained tonalites, QD quartzdiorites, DT diorites, GB gabbros, HB hornblendites.

Fig.3. En el diagrama K-Na-Ca se compara la serie del Complejo La Majada-Ramblones (3a) y la serie del total se la Sierra de Ancasti (3b) con otras series intrusivas de la parte N de las Sierras Pampeanas Centrales del NW Argentino. Exceptuando los miembros básicos (no hay datos fuera de los de Sierra de Arcasti) los campos de distribución de las plutonitas del Paleozoico inferior son notablemente parecidas. Abreviaciones usadas para rocas del área La Majada-Ramblones: 1—Secuencia granítica anatéctica: $PE_{(5,3)}$ pegmatitas (5— fase intrusiva carbonífera; 3—fase intrusiva ordovícica). 2— Cortejo magmático básico a intermedio: PG granitos porfiricos, TR trondjhemitas $a_{1\text{-}4}$ diferentes tonalitas de grano fino, $TO_{1,2}$ tonalitas de grano, QD ritas, DT dioritas, GB gabros, HB hornblenditas.

Intrusive occurrences in the whole Sierra de Ancasti: Ocurrencias intrusivas en la Sierra de Arcasti: ALBI Albigasta, ALTO El Alto. BAVI Baviano, CALE La Calera, CANA Las Canadas, DORA La Dorada, GUAC Sauce Guacho, PAUN La Pampa-Unquillo, PORT El Portezuelo, ROSA Santa Rosa, TACO El Taco, VILI Vilismán.

Further intrusive occurrences in NW-Argentina: Otras ocurrencias intrusivas en el NW Argentino: ACHA Achala, ACON Sierra del Aconquija, CACH Cachi, CAFA Cafayate, CAPI Capillitas, CUYA Cuchiyaco, TOLO Tolombón, VELA Sierra de Velasco.

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