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MESOZOIC AND CENOZOIC PLUTONIC DEVELOPMENT IN THE ANDES OF CENTRAL CHILE (30°30'-32°30')

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Mesozoic and Cenozoic granitoids of this segment of the Andes (Fig.1) which have been studied by RIVANO et al. (1985) are grouped here in three NS- trending belts; western (WB), central (CB) and eastern (EB). The most important features of the belt components are summarized in Table 1. The WB is formed by the Mincha and Illapel superunits; the CB includes the Cogotí superunit and the San Lorenzo unit and the EB is occupied by the Rio Grande and Rio Chicharra superunits.

The country rocks adjacent to the western flank of the WB comprise Paleozoic low-grade metasediments and metavolcanic rocks, together with Lower Mesozoic sediments and siliceous volcanics. Various roof-pendants are recognised in the central and eastern part of the WB. They consist of volcanogenic sequences and less frequent clastic sediments and limestones assigned to Lower Cretaceous formations. Plutons of the CB are roofed by gently folded Upper Cretaceous volcaniclastic sequences. The envelope of the EB comprises several sedimentary and volcanic formations with ages decreasing eastwards from Upper Jurassic to Paleogene. There is no evidence of deposition of younger cover rocks over the plutonic belts.

K-Ar ages show discrete ranges for each of the belts (Table 1) with a pronounced eastward migration of magmatism with time: WB (Jurassic to Late Cretaceous), CB (Early Tertiary), EB (Late Tertiary). Some units within the WB have now also been dated by the Rb-Sr whole-rock isochron method, which suggests some N-S migration within the Puerto Oscuro unit. The jumps in the sites of the magmatic belts correspond to essentialy non-magmatic intervals (85-70 Ma) and (38-36 Ma) may relate to periods of subduction erosion or changes in the dip angle of the subducted lithosphere. Particularly rapid migration corresponds to very rapid oceanic spreading at 110-85 Ma (18 cm/yr; LARSON and PITMAN, 1972) and fragmentation of the Farallon plate to the present day configuration at 25 Ma ago (WORTEL, 1984).

Within each superunit the chemistry shows typical major element oxide variations with trends of increasing K_2O and decreasing Al_2O_3, CaO and FeO with respect to increasing SiO_2, but Na_2O is rather constant. TiO_2 and P_2O_5 increase to a maximum in rocks of intermediate composition (47-60% SiO_2) and thereafter decrease slowly. There are few distinctive differences between the chemical compositions of different superunits: high Al_2O_3, CaO, Na_2O and P_2O_5 and low K_2O and Rb content in the Limahuida granitoids are characteristic of a trondhjemitic association (BARKER and ARTH 1976). The transition metal contents of the intermediate granitoids (56-63% SiO_2) are comparable with those of oceanic island-arc andesite (BAILEY 1981). Very low initial $^{87}Sr/^{86}Sr$

TABLE 1

SUMMARY OF PETROGRAPHIC AND CHEMICAL FEATURES FOR MESOZOIC AND CENOZOIC GRANITOI… SUPERUNITS BASED ON ANALYSES FROM RIVANO AND SEPULVEDA (IN PREP.)

BELT	SUPERUNIT	UNIT	PETROGRAPHIC & TEXTURAL FEATURES	AREA PROPORTION*	CHEMICAL FEATURES
WESTERN BELT	MINCHA 200-143 Ma; Rb-Sr 191-138 Ma; K-Ar	Millahue	Medium-grained monzogranite and sienogranite; CI ≤ 10.	~ 15%	73-77% SiO_2 (75.0); 12.4-13.… (12.9); 0.01-1.34% CaO (0.6… Na_2O: 0.78-1.21; A/CNK: 0.9… K/Rb: (189); Rb/Sr: (3.0).
		Tranquilla	Sienogranite; CI < 10. Equigranular, fine grain size, porphyrytic, graphic.	~ 5%	73-76% SiO_2 (74.9); 12.5-13.… (13.0); 0.1-0.92% CaO (0.57); … 4.4% Na_2O (4.0); 3.4-5.1% K_2… K_2O/Na_2O: 0.83-1.36; A/CNK : … 1.16 K/Rb: (213); Rb/Sr (3.3…
		Puerto Oscuro	Two-pyroxene diorite and monzodiorite. Minor olivine gabbro and quartz diorite. CI : 30-50, idiomorphic, medium grain size. Local mineral orientation.	~ 35%	47-57% SiO_2 (53.7); 16.1-19.… (18.1) 0.9-3.8% Na_2O (2.9); … 2.72% K_2O (1.3) K_2O/Na_2O: … K/Rb: (197); Rb/Sr: (0.13); … ppm Cr in rocks with > 50% … 21 ppm Ni in rocks with > 50…
		Cavilolén	Hb + Bt tonalite and granodiorite. CI :10-30, medium grain size, isotropic. Mafic inclusions.	~ 45%	51-67% SiO_2 (64.3); 15.5-17.… (16.1) 3.7-5.7% CaO (4.7); 3… Na_2O (3.7); 1.9-3.0% K_2O (2.… A / CNK : 0.92-0.98; K_2O/Na… 0.90 K/Rb :(213); Rb/Sr: (0.…
	ILLAPEL I 134-86 Ma K-Ar	Chalinga	Hb + Bt ± Px tonalite and quartz diorite. CI: 10 - 30, medium grain size.	~ 90%	53-64% SiO_2 (60.7); 7.3-2.0… (4.98) 3.4-6.5% Na_2O (4.1); … K_2O (2.3); A/CNK < 1.0; K_2O/… 0.35-1.01; K/Rb: (315); Rb/S…
		Limahuida	Leucodiorite, trondjhemite with Cpx and Hb. Medium grain size.	~ 10%	50-70% SiO_2 (61.7); 2.6-10.… (7.8) 3.6-6.1% Na_2O (4.9); … K_2O (0.4); high Al_2O_3 and P_2… A/CNK: 0.68-1.09 K_2O/Na_2O: … K/Rb: (209) Rb/Sr: (0.02).
CENTRAL BELT	COGOTI 67-38 Ma K-Ar	Fredes	Hb + Cpx, diorite, quartz monzodiorite and granodiorite. Minor olivine gabbro. Fine to medium grain size seldom porphyrytic. CI: 5-35.	~ 90%	50-69% SiO_2 (59.4); 144-195% … (17.0); 2.4-9.7% CaO (5.6) 3.… 5.2% Na_2O (3.9); 0.3 - 4.4% K_2… (2.2); A/CNK: 0.78-1.03; K_2O/… 0.22-.165; K/Rb: (2.61); Rb/S… (0.56).
		Nogalada	Mainly fine-grained leucogranite. CI 5	< 10%	63-77% SiO_2 (72.7); 12.2-15.… Al_2O_3 (13.6) 41-0.63% CaO (1.… 3.3-4.3% Na_2O (3.7); 3.1-5.5 … (4.6) K_2O/Na_2O: 0.72-1.52; A/… 0.88-1.15 K/Rb: (278); Rb/Sr: (2.04).
		San Lorenzo (65 Ma)	Fine grained diorite, andesite porphyry, with hornblende and clinopyroxene.		49-57% SiO_2 (53.0); 4.7-8.9% … (7.2); 2.7-5.6% Na_2O (3.9); … 2.0% K_2O (1.4) K_2O/Na_2O: 0.19… A/CNK: 0.77-1.0; K/Rb: (311); … Sr (0.07).
EASTERN BELT	RIO GRANDE 26-24 Ma K-Ar	Rio Tascadero	Hb + Bt monzonite and monzodiorite. CI < 20.	< 20%	58-66% SiO_2 (62.4); 2.7-5.8% … (4.6); 4.0-4.6% Na_2O (4.2) 1.… 4.1% K_2O (2.7); A/CNK: 0.83- … K_2O/Na_2O: 0.44-1.0; K/Rb: (2… Rb/Sr: (0.33).
		Rio Las Cuevas	Leucomonzogranite and leucogranodiorite. Medium grain size.	80%	68-75% SiO_2 (72.4); 1.0-3.5% … (1.89) 3.6-4.2% Na_2O (3.9) 3.… 4.9% K_2O (4.2); 12.6-15.8% Al_2… (13.9); A/CNK: 0.93-1.0 K_2O/… 0.83-1.36.
	RIO CHICHARRA 17-8 Ma K-Ar	Rio Cerro Blanco	Monzodiorite with variable amount of hornblende, clinopyroxene and biotite. Subidiomorphic, medium grain size and CI: 15-35.	90%	51-67% SiO_2 (58.6); 3.2-9.9% … (6.2); 2.8-5.7% Na_2O (4.4) … 4.3% K_2O (2.0); A/CNK: 0.76 - … K_2O/Na_2O: 0.20-1.1; K/Rb: … Rb/Sr: (0.25).
		Portezuelo del Azufre	Dacite porphyry. Felsitic and intergranular textures.	~ 10%	

Between 31° to 32°S. Numbers in bracket: average; A/CNK. Molar ratio $Al_2O_3/(CaO + Na_2O + K_2O)$. Rb-Sr dates were obtained at the British Geol… cal Survey. Most of the K-Ar ages were determined at the Servicio Nacional de Geología y Minería (Rivano et al., 1988)

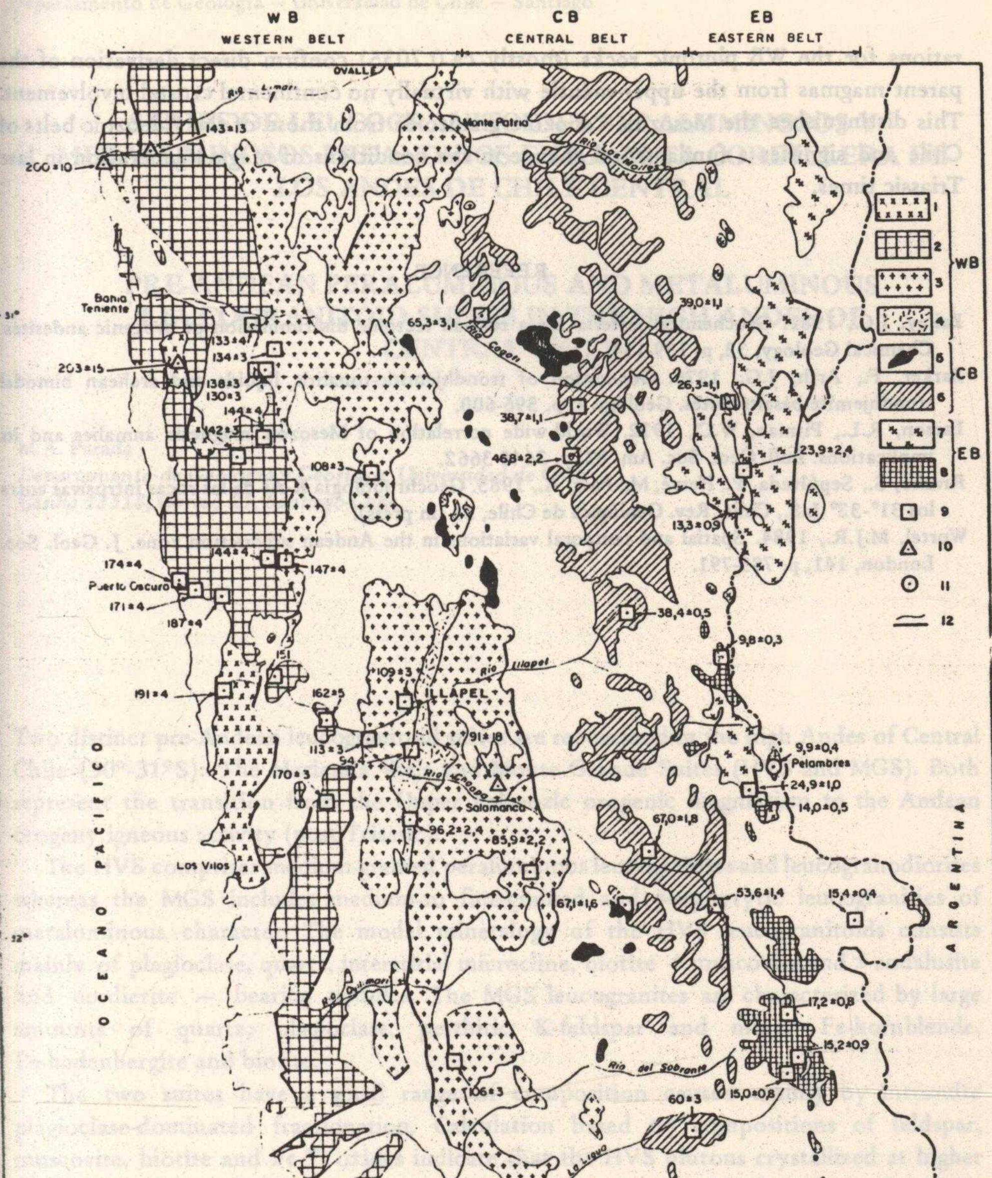

Fig. 1. Mesozoic and Cenozoic plutonic rocks distribution in the Andes of Central Chile (30° 32'-32° 30'): units and super units.

1) Tranquilla and Millahue Units
2) Puerto Oscuro and Cavilolén Units
3) Chalinga Unit
4) Limahuida Unit
5) San Lorenzo Unit
6) Cogotí Super Unit
7) Rio Grande Super Unit
8) Rio Chicharra Super Unit

For more detailed information see Table

9) K-Ar ages in Ma. Errors quoted at the 2 sigma level.
10) Whole rock Rb-Sr isochron ages in Ma. Errors quoted at the 2 sigma level.
11) Average of 8 K-Ar ages in Ma.
12) Intrusive and Tectonic contacts of plutonic rocks.

rations for the WB plutonic rocks (mostly ca.0.7035) confirm direct derivation of the parent magmas from the upper mantle with virtually no continental crustal involvement. This distinguishes the Mesozoic-Cenozoic granitoids from those of the Paleozoic belts of Chile and signifies a fundamental change in the conditions of magma generation in late Triassic times.

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