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# EDADES Ar-Ar, K-Ar Y RAZONES ISOTOPICAS DE Sr DE LAS ROCAS ANDESÍTICAS MIOCENAS, DE LA FRANJA MARICUNGA Y LAS POSIBLES FUENTES MAGMATICAS

# K-Ar AND $^{40}Ar/^{39}Ar$ AGE AND Sr ISOTOPIC COMPOSITION OF MIOCENE ANDESITIC ROCKS OF THE MARICUNGA BELT AND THEIR POSSIBLE MAGMA SOURCES

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Volcanic rocks in the 150 by 30 km north-trending Maricunga belt range in age from latest Oligocene through Miocene based on 19 new K-Ar, 5 new $^{40}Ar/^{39}Ar$, and 15 published K-Ar and $^{40}Ar/^{39}Ar$ age determinations (table 1 and fig. 1). The oldest rocks dated are about 25 Ma, and the youngest are about 6 Ma. There appears to be no time-spatial patterns of volcanism in the Maricunga belt either by longitude or latitude; volcanic rocks of both the oldest and youngest ages are found together, although only latest Oligocene and earliest Miocene volcanoes are present in the northernmost part of the belt. The Maricunga belt is too narrow to be subdivided into belts of short time duration, but it fits well within the longer-term pattern of easterly migrating volcanic activity across the Andes. Magma was generated in the region for about 19 million years before the locus of volcanism migrated eastward to the present crest of the Andes where volcanoes are active today.

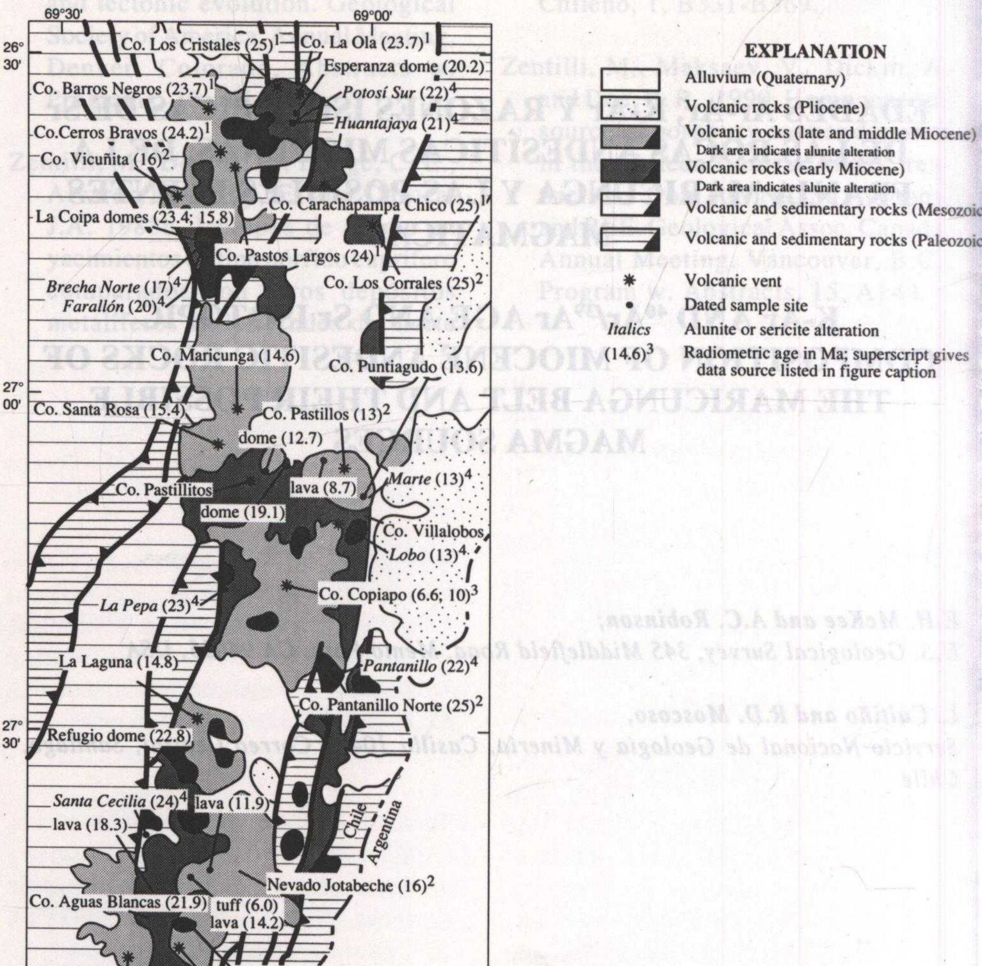

*Figure 1 Geologic map of the Maricunga volcanic belt (modified from Davidson and Mpodozis, 1991). Names of volcanic centers are in block print, areas of alteration are in italics. The radiometric age of unaltered rock and alteration is in parenthesis. Sources of data: 1.Moscoso* et al., *(1993), 2. Davidson and Mpodozis, (1991), 3. Walker* et al., *(1991), 4. Sillitoe* et al., *(1991), 5. Kay* et al., *(1991), 6. Baker* et al., *(1987).*

Most of the rocks erupted over the 19-million-year span of volcanic activity in the Maricunga belt are calcic andesites and dacites with 60 to 64% $SiO_2$ (normalized anhydrous). They are porphyritic with phenocrysts of plagioclase and hornblende, and some have pyroxene. Major and trace element contents show limited and gradational ranges, but strontium isotopic compositions define two distinct groups; a western group with initial $^{87}Sr/^{86}Sr$ ($Sr_i$) values between about 0.7048 and 0.7051 and an eastern group with $Sr_i$ between about 0.7058 and 0.7061 (fig 2). The two groups have no correlation with the age of the rock; rocks in the higher $Sr_i$ group range in age between about 20 Ma to 9 Ma and those in the lower $Sr_i$ group between about 18 Ma and 12 Ma.

When the Maricunga belt samples (18 total including five from Kay et al. 1991 and one from Walker, et al., 1991, two from Baker et al., 1987) are plotted on a $^{87}Sr/^{86}Sr$ versus $^{87}Rb/^{86}Sr$ diagram (fig. 3), the two $Sr_i$ groups are readily apparent as coherent data fields. Limiting lines ($LL_1$ and $LL_2$ on fig. 3), defined by the minimum $^{87}Rb/^{86}Sr$ per $^{87}Sr/^{86}Sr$ values of each of the higher and lower $Sr_i$ data fields, approximate the parent magmas derived from two time-integrated Rb-Sr sources. These limiting lines are not isochrons.

The two groups of generally similar rocks with different $Sr_i$ are interpreted to be generated from two compositionaly similar lower crustal magma sources of different age and $Sr_i$. The overall similarity of major and trace elements indicates that the two magmas formed by like degrees of partial melting of similar lower crust with subsequent like degrees of fractional crystallization. It seems unlikely that exactly the right amounts of contamination by variable upper crustal

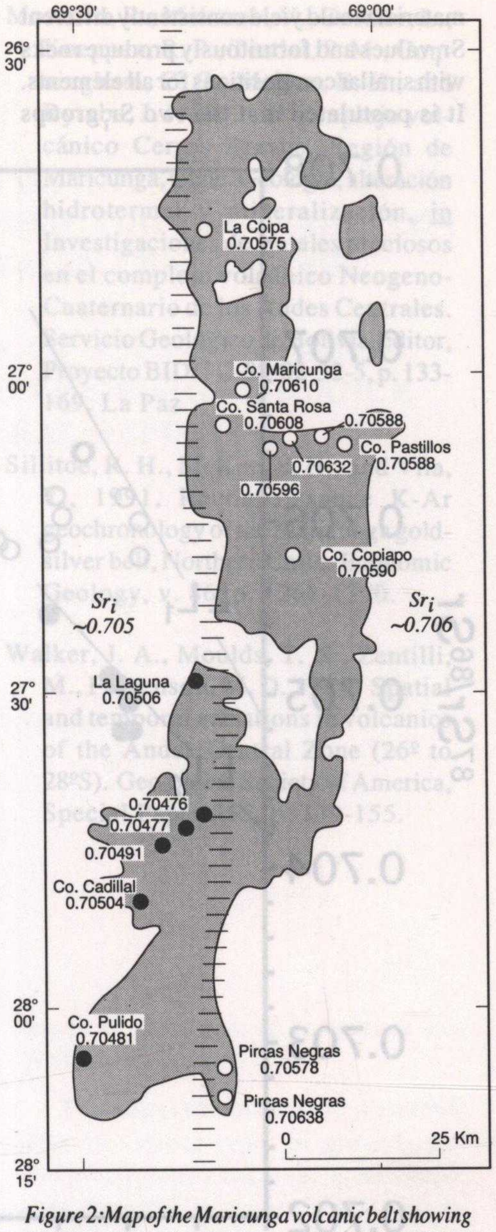

*Figure 2: Map of the Maricunga volcanic belt showing locations of samples with measured $^{87}Sr/^{86}Sr$ and initial $^{87}Sr/^{86}Sr$ ($Sr_i$). The $Sr_i$ values group near 0.7050 (filled circles) and 0.7060 (unfilled circles). The groups can be separated by a N-S boundary shown by horizontal hachures. The gray area is late Oligocene and Miocene volcanic rocks, modified from Davidson and Mpodozis (1991). The $Sr_i$ value for Co. Pastillos is from Baker* et al., *(1987); for Co. Copiapo from Walker* et al., *(1991); and the $Sr_i$ values for Co. Pulido and Pircas Negras are from Kay* et al., *(1991).*

material would yield consistently different $Sr_i$ values and fortuitously produce rocks with similar compositions for all elements. It is postulated that the two $Sr_i$ groups reflect two adjoining lower crustal magma sources belonging to a collage of differenting age crust on the western edge of the South American craton.

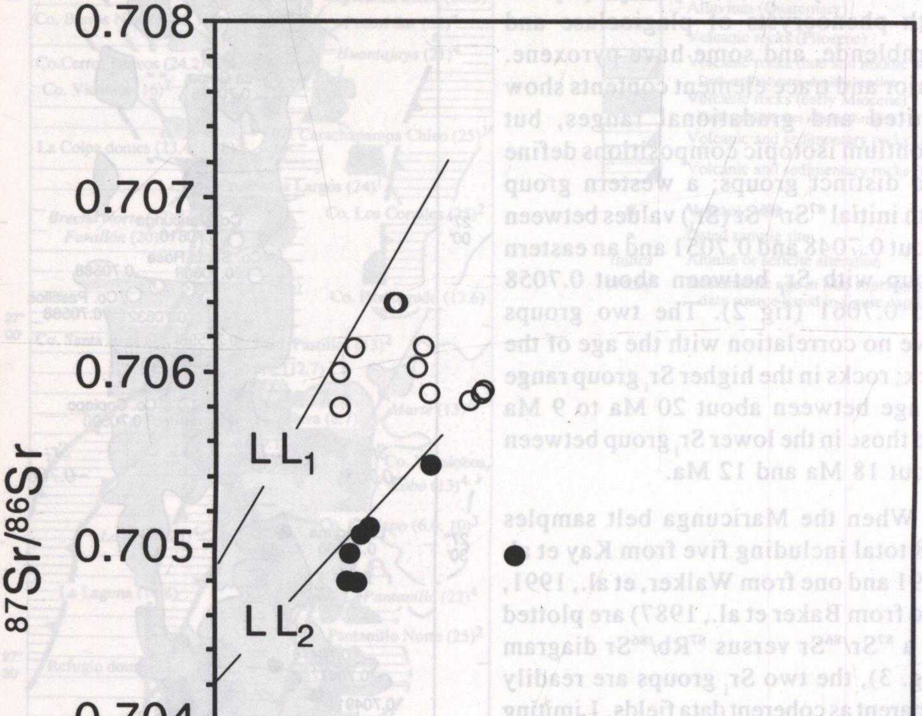

*Figure 3 Measured $^{87}Sr/^{86}Sr$ versus $^{87}Rb/^{86}Sr$ diagram for late Tertiary volcanic rocks in the Maricunga belt. Limiting lines (LL), defined by the minimum $^{87}Rb/^{86}Sr$ per $^{87}Sr/^{86}Sr$ values of each of the higher and lower $Sr_i$ data fields, constrain the isotopic composition of parent magmas derived from two time-integrated Rb-Sr sources. Sources of data: this paper; Baker* et al., *(1987); Kay* et al., *(1991); and Walker* et al., *(1991).*

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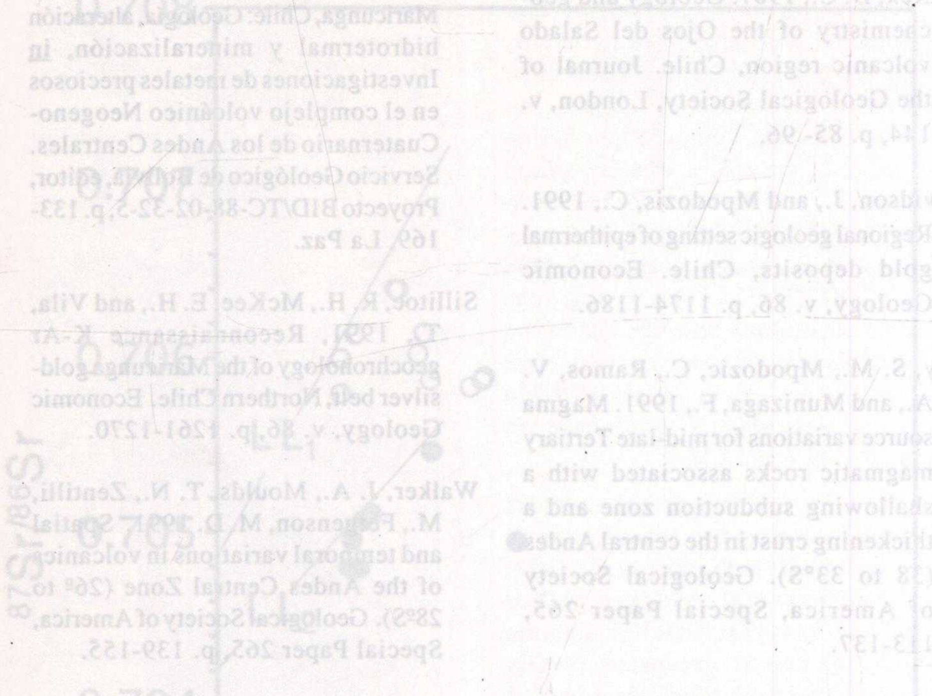

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