# A WITHIN-PLATE GEOCHEMICAL SIGNATURE AND CONTINENTAL MARGIN SETTING FOR THE MESOZOIC – CENOZOIC LAVAS OF CENTRAL CHILE

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## Geological Setting

The studied segment of the Chilean Andes is characterized by two parallel longitudinal belts of Mesozoic volcanics of successively younger ages towards a central axis that is occupied by a Late Cretaceous to Tertiary volcanic belt. Up to the 'middle' Cretaceous the lavas are intercalated with alternately continental and marine sedimentary rocks, whereas the Late Cretaceous and Tertiary lavas formed in a continental caldera/graben environment (Thiele et al., 1991). The presence of symmetric volcanic belts combined with a lack of geochemical trends expected at an active continental margin (e.g. an increase of K towards the interior of the continent) was interpreted as the result of ensialic spreading-subsidence during volcanism (Levi and Aguirre, 1981; Levi et al., 1988), enhanced by spreading caused by intrusion of granitoids (Drake et al., 1982).

## Results

The various populations of lavas at given $SiO_2 - K_2O$ contents (cf. Peccerillo & Taylor, 1976) each have rather uniform chemical compositions, the main exception being the few lavas belonging to the low–K series. The standard deviations for the average compositions are quite small considering that each population is composed of lavas of quite different age and geographic location (see example in Table 1). All the lavas have a common within–plate geochemical signature (i.e. they are enriched in incompatible elements that are

Table 1. Average compositions and standard deviations for 36 samples of calc–alkaline basaltic andesites from six E-W profiles in central Chile (Jurassic: 7 west, 6 east; Early Cretaceous: 1 west, 6 east; Late Cretaceous: 4 west, 4 east; Tertiary: 8). See Levi et al. (1988) for analytical methods.

| | Jurassic | | Early Cretaceous | | Late Cretaceous | | Tertiary | |
|---|---|---|---|---|---|---|---|---|
| | $\bar{x}$ | SD | $\bar{x}$ | SD | $\bar{x}$ | SD | $\bar{x}$ | SD |
| $SiO_2$ | 52.8 | 1.3 | 52.8 | 1.2 | 52.6 | 1.3 | 53.1 | 1.4 |
| $TiO_2$ | 1.60 | 0.66 | 1.47 | 0.49 | 1.26 | 0.32 | 1.21 | 0.34 |
| $Al_2O_3$ | 16.6 | 2.3 | 16.4 | 2.2 | 17.7 | 1.5 | 17.6 | 1.7 |
| FeO* | 9.86 | 3.15 | 9.34 | 2.28 | 9.30 | 1.38 | 8.77 | 1.21 |
| MnO | 0.16 | 0.04 | 0.17 | 0.04 | 0.22 | 0.08 | 0.18 | 0.04 |
| MgO | 3.83 | 0.69 | 3.95 | 1.29 | 3.39 | 0.62 | 3.89 | 0.96 |
| CaO | 8.56 | 0.75 | 8.34 | 0.56 | 8.01 | 0.82 | 7.96 | 0.83 |

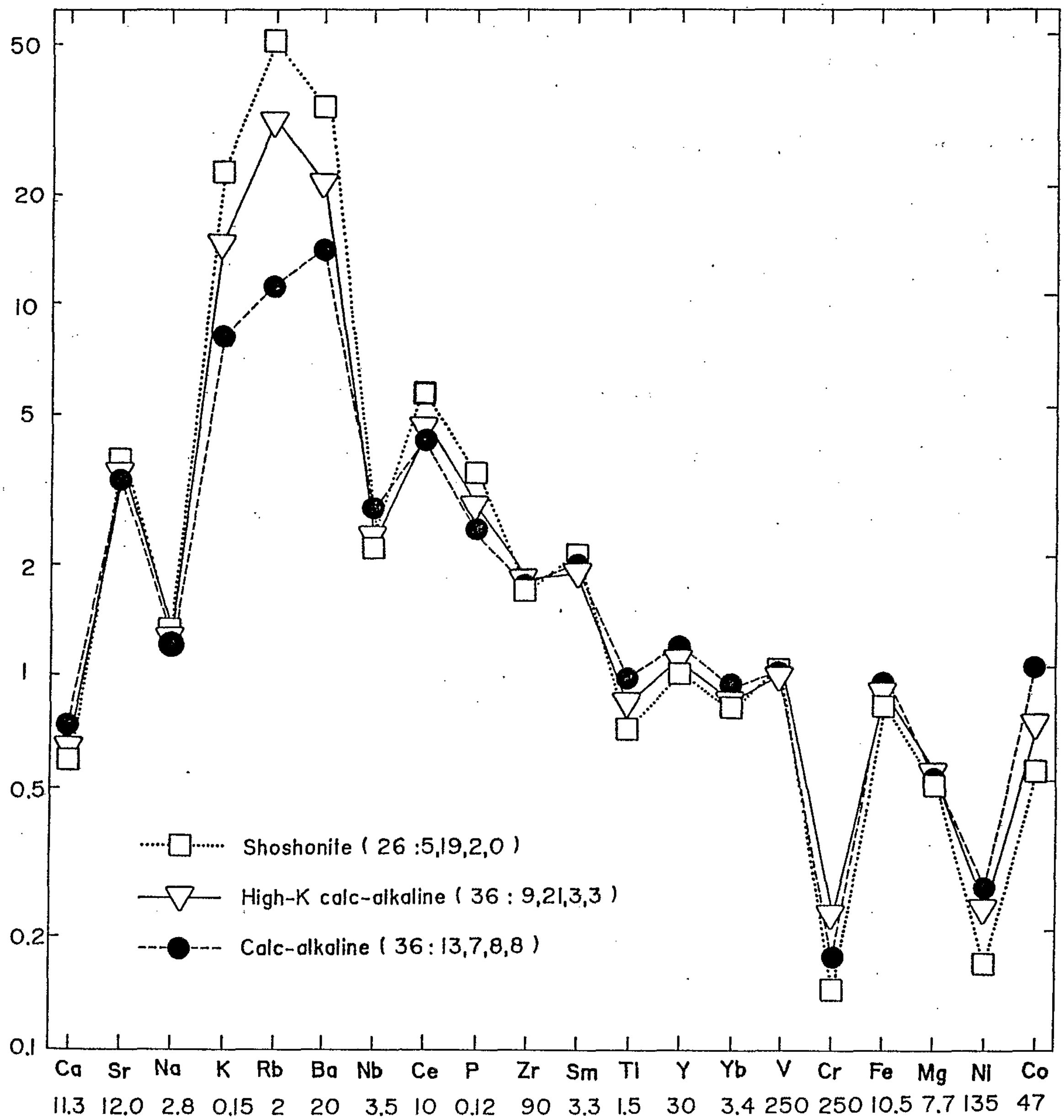


Fig. 1. MORB–normalized multielement diagram for the average compositions of Jurassic to Tertiary basaltic andesites of different K content from central Chile (total number of samples averaged in parenthesis, followed by number of samples within each age group: Jurassic, Early Cretaceous, Late Cretaceous, Tertiary). MORB values from Pearce (1983) except Ca, Na, V, Cr, Fe, Mg, Ni and Co (after Taylor & McLennan, 1985).

known not to be accomodated in the subduction component, with high concentrations of Nb relative to Zr, and of Zr relative to Y and Yb; Pearce, 1983), showing only variations in K, Rb and Ba at constant $SiO_2$ values and $SiO_2$–related differences in Cr, Mg and Ni. This signature is illustrated for basaltic andesites of different K–series in Fig. 1.

## DISCUSSION AND CONCLUSIONS

The relatively uniform chemical compositions of each $SiO_2$–$K_2O$ population of lavas erupted during a time–span of ca. 200 million years in central Chile is remarkable. However, there are some differences related to geographic position and age (e.g. a decrease in Ti with time, and a slight difference between Jurassic to Early Cretaceous and Late Cretaceous to Tertiary lavas; Table 1). Changes in tectonic regime with time in the studied area are reflected in the relative abundance of different rock types rather than their geochemical signature. Shoshonitic rocks, scarce during the Late Cretaceous, appear to be absent during the Tertiary, and high–K calc–alkaline types also become less abundant with time.

A within–plate component, indicating a contribution from incompatible element–enriched upper mantle, has earlier been indicated for some Jurassic to Tertiary lavas in the Chilean Andes (Pearce, 1983). Such component is also seen in the published analyses of Quaternary lavas from the Central and South Volcanic Zones occurring in the investigated area (25°30' to 35°S). This persistent geochemical feature despite considerable differences in age, location, Sr–Nd isotope composition (see Nyström et al., this volume) and inferred tectonic regime is consistent with a simple process of magma generation operating on a similar source material. The within–plate component suggests that the lithospheric plate was a major source for the