Reconstructed crustal section of a Cretaceous oceanic plateau: petrographical and geochemical evidences from Ecuador

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Mafic and ultramafic igneous rocks with oceanic plateau affinities crop out in Ecuador. They occur as slices caught in the Late Cretaceous and Palaeocene sutures or form the oceanic basement of coastal Ecuador (Piñón Formation). They offer an unique opportunity to study the deepest levels of an Early Cretaceous oceanic plateau.

The oceanic rocks exposed in the Late Cretaceous suture (east of the Western Cordillera) consist of a plutonic assemblage (San Juan), picrites (Guaranda) and pillow basalts. In the Palaeocene suture and in coastal Ecuador, the crustal fragments are composed of pillow basalts and diabases intruded by shallow level gabbros.

In the San Juan assemblage, the cumulate peridotites are formed of olivine cumulus + cpx $\pm$ opx with locally interstitial late crystallizing plagioclase. The cumulate gabbros are either layered with cpx $\pm$ opx, or isotropic with brown-green pleochroic amphiboles. The picrites are formed of cpx microphenocrysts asssociated or not with olivine pseudomorphs. Basalts and diabases are olivine-free. The basalts present plagioclase and clinopyroxene glomeroporphyric agregates embedded in a glass-poor groundmass. The diabases are composed of oxides and plagioclase laths enclosed in anhedral clinopyroxene.

The peridotites are markedly depleted in light rare earth element (*LREE*) [$0.20 < (La/Yb)_{cn} < 0.44$] and their *REE* concentrations are very low (1 time the chondritic abundances). Relative to N-MORB, they are very depleted in Ta, Nb, Zr and Hf. The cpx and its ultramafic host rock show similar depleted *LREE* patterns [SJ10 WR: $(La/Yb)_{cn} = 0.44$; cpx: $La/Yb)_{cn} = 0.27$].

Compared to the peridotites, the gabbros have higher *REE* concentrations (10 times the chondritic abundances) and are less depleted in *LREE* [$0.52 < (La/Yb)_{cn} < 0.62$] but, relative to N-MORB, they exhibit similar negative Ta, Nb, Zr and Hf anomalies.

The diabases have almost flat *REE* patterns [slightly *LREE* depleted; MA18: $(La/Yb)_{cn} = 0.88$]. Their *REE* concentrations are similar to those of the gabbros (10 times the chondritic abundances). Relative to N-MORB, these rocks are depleted in Zr and Hf but not enriched in Nb and Ta.

A comparison between the three rock-types described above (peridotite, gabbro and diabase) and their minerals show a geochemical evolution from the deepest to the highest levels of an oceanic crust. The *REE* abundances and *LREE* enrichment relative to the *HREE* increase from peridotite to gabbros and diabase. The cpx of the peridotite is very depleted in *LREE* compared to that of the diabase. This indicates a preferential partitionning of the *REE* and more specially the *LREE* in the liquid. The cumulate peridotite and gabbro represent the solid while the diabase represents the melt (Fig. 1).

The olivine-picrites are slightly depleted in *LREE* [$0.70 < La/Yb)_{cn} < 0.97$] and their *REE* concentrations do not exceed 3 times the chondritic abundances. In contrast, the ankaramites are *LREE*-enriched [$La/Yb)_{cn} = 1.79$] and have higher *REE* abundances (20 times the chondritic abundances).

All these rocks have a large range of $\varepsilon Nd_{(T=110mA)}$ ($+10 < {}^{\varepsilon}Nd < +4.5$) and $^{206}Pb/^{204}Pb$ and $^{207}Pb/^{204}Pb$ ratios. The highest and lowest εNd ratios correlate with the lowest and highest $^{206}Pb/^{204}Pb$ ones, respectively. This suggests that the Ecuadorian

rocks derive from different mantle sources and/or different mixing of depleted N-MORB and enriched OIB types.

Assuming that all these Ecuadorian rocks have similar ages, the San Juan cumulates, the picrites, diabases and basalts likely represent a crustal section of an Early Cretaceous oceanic plateau formed by the activity of near-ridge or ridge-centered hot spot.

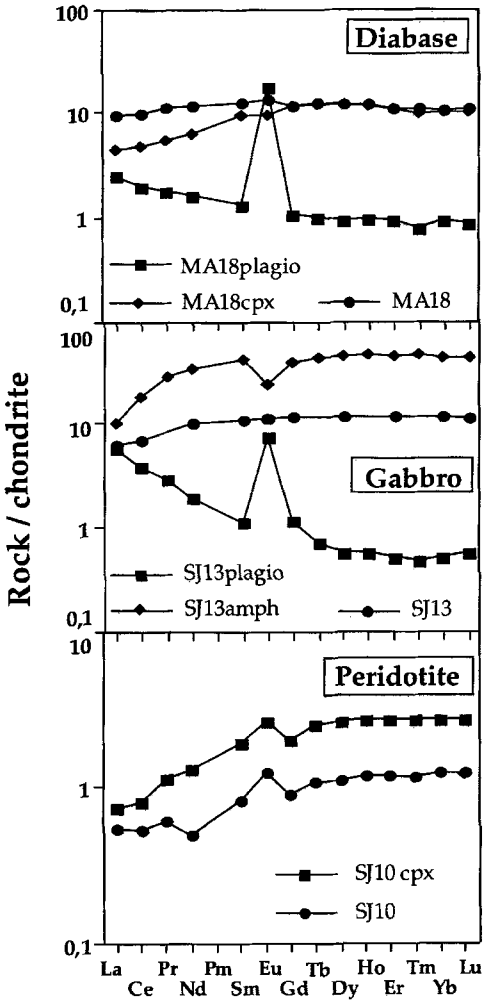

FIG. 1. *REE* patterns of three rock-types (peridotite, gabbro and diabase) and their minerals normalized to chondrites (Sun and McDonough, 1989).