Characterization and evolution of mafic magmatism in the late orogenic Variscan batholith of Corsica.

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Within a large batholith varied expressions of mafic magmatism are commonly present within granitic rocks, they may take the form of finegrained enclaves, doleritic dykes or net-veined complexes (NVC), large mafic-ultramafic plutons (MUP), or volcanic rocks (basalt or andesite; Rossi *et al.*, 1993). In Variscan Corsica a significant amount of mafic rocks were emplaced between 300 and 250 Ma ago. The aim of this study is to identify any change that may have taken place in the mafic magmatism during this 50 Ma in order to determine whether any change in the geotectonic environment occurred between the Late Carboniferous and middle Permian. The Th-Hf-Ta geotectonic diagram (Wood *et al.*, 1979) was used after critical selection of samples and trace elements.

Three groups of samples were studied: 1) a gabbro-norite to diorite suite from an MUP including cumulates considered to represent a magmatic chamber (Cocherie *et al.*, 1986) and samples from the NVC; 2) doleritic dykes that are widespread in Variscan Corsica; 3) basalt from Scandola and andesite from Osani (Cabanis *et al.*, 1990). In order to characterize the initial magmas the overprints of crustal contamination, fluid-magma and fluid-rock interactions, and fractional crystallization have to be subtracted.

Trace element analyses plotted on log-log diagrams have previously enabled interpretation of mafic rocks from the Sartène plutons (group 1 above) as a differentiated suite derived from gabbro-norite, gabbro evolving to diorite by fractional crystallization. The equilibrium cumulate (troctolite, gabbro), the *REE* patterns of which show typical positive Eu anomalies, composes the rest of the presumed magma chamber. The operation of fractional crystallization is clearly shown using a highly compatible element such as Ni and an incompatible element rather insensitive to weathering and alteration such as Ta. As the SiO_2 content of the 'liquid' increases, Ta increases and Ni shows an extremely strong decrease. In the Cs-Hf-Ta triangular diagram, all the points remain in the same area and show no relationship to the fractional crystallization; these elements therefore have the same bulk distribution coefficient (D). On the other hand the Th-Hf-Ta diagram shows a trend towards Th with increasing SiO_2 content, as with the variation of Ta in the Ni-Ta log-log diagram. In a granite-contaminated mafic rock (SiO_2 46%), from a net-veined complex (NVC), a large increase of Cs takes place without any significant increase in Th. Thus Cs, Hf and Ta behave similarly during fractional crystal- lization, whereas Th seems to have a lower D value. Cs in contrast appears to be much more sensitive to selective continental crust contamination. In the same way we have also at the same time identified the initial uncontaminated magma, which has low Ta, Th and Cs contents. This is confirmed by a previous Sr and Nd isotope study (Cocherie *et al.*, 1994) indicating the mantle origin of the gabbro-norite.

Points representing the second group of samples, taken from dolerite dykes, were plotted in the Cs-Hf-Ta diagram. This shows a wide spread along a straight line trending towards Cs. As samples of varied SiO_2 content are present at both ends of the line, this trend cannot be related either to fractional crystallization or to simple magma-mixing between two end-members. The Cs enrichment is more likely related to selective interactions between the mafic magma and the surrounding rocks; magmatic fluids could be involved. In contrast, the points plotted in the Th-Hf-Ta diagram define a line, variation along which is related to SiO_2 content. This increase in Th with SiO_2 is the same as that found in the mafic plutonic group (1), indicating that it is related to a process of magmatic differentiation. Two samples can be identified that have undergone only weak crustal contamination (low Cs) and representative of primitive liquid (low SiO_2 and Th), making it possible to characterize the source and geotectonic environment of this type of magma.The third group is composed of volcanic rocks, mainly basalt and andesite; the Cs contents of these rocks have not been determined. In the Th-Hf-Ta

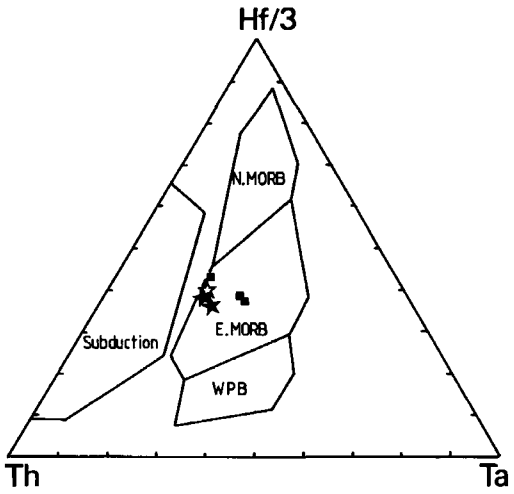

FIG. 1. Th–Hf–Ta diagram with the fields of erupted magmas after Wood et al., (1979). Uncontaminated and less-differentiated samples plot in the E-MORB field showing that the initial magmas yielding to gabbro-noritic pluton (star), to doleritic dykes (black stars) and to basaltic rocks (squares) were emplaced in the same geotectonic environment of crustal-thinning.

diagram, the sample points are clustered in a restricted field far from the Th apex. There is thus no evidence of substantial fractional crystallization. As the andesites show weak Th enrichment, only the basalts are considered as primitive liquids.

All the less-differentiated rocks from the three groups (plutons, dykes and volcanic rocks) showing no intense crustal contamination (Fig. 1) plot in the field of E-MORB in the Th-Hf-Ta geotectonic diagram of Wood *et al.* (1979). The mafic rocks of tholeiitic composition emplaced as MUC, NVL, dykes or volcanics during the Late Carboniferous to middle Permian were derived from the same source and were emplaced in a geotectonic environment of crustal-thinning.

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