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New Constraints on the Neogene Volcanism in the Algerian Tell Belt and its bearing on the Geodynamics of the Western Mediterranean

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The geodynamic evolution of the Western Mediterranean is closely linked to the spatio-temporal evolution of the Cenozoic magmatism in this region. Here, we present a detailed Sr-Nd-Pb study of Cenozoic volcanism from the external and the internal zones of the Algerian Tell belt, a segment of paramount importance to unravel the Alpine geodynamic evolution of the westernmost Mediterranean. The age of the studied volcanism ranges from 17 to 3 Ma, and covers the temporal and spatial evolution of magmatism from calc-alkaline rocks with a clear signature of subduction (so-called "orogenic" magmatism), followed by progressively younger sub-alkaline and alkaline volcanism (so-called "post-orogenic" magmatism). On the basis of their major and trace element composition, the Tell Cenozoic volcanic rocks can be classified into three main groups: (1) a Si-poor group that is composed of basalt, trachybasalt and basaltic trachyandesite; (2) a Si-intermediate group —raging in silica from 56 to 66 wt. %— that is composed of andesite, dacite, trachyandesite et trachydacite; and a (3) Si-rich group —with silica contents generally greater than 66 wt.%— that is constituted by trachydacite, dacite and rhyolite. The Si-poor group occurs only in the External zone and it is characterized by non-radiogenic $^{87}Sr/^{86}Sr$ ratios, high initial $^{144}Nd/^{143}Nd$ ratios, significant variation of $^{206}Pb/^{204}Pb$ and $^{207}Pb/^{204}Pb$ ratios, and relatively constant $^{208}Pb/^{204}Pb$ ratios. The Si-intermediate and Si-rich groups from the Internal and External zones show substantial differences. The $^{206}Pb/^{204}Pb$ ratios of External zone volcanism are relatively constants [18.68–18.86], while they vary significantly in the Internal zone volcanism [18.55–18.92]. On the other hand, the initial $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios in Internal zone volcanism [38.81–38.95] are significantly higher than those of the External zone [38.68–38.84]. These differing isotopic signatures reflect variable source contamination by subducted sediments similar to those now occurring in the Oligocene Flysch units, and crustal contamination by Kabylian crust in the Internal zone volcanism. A deeper primitive asthenospheric mantle source in the western External zone is increasingly patent in progressively younger Silica-intermediate and -poor volcanism. This spatiotemporal evolution of the Cenozoic evolution of the Tell magmatism is intimately correlated with the deep structures imaged by seismic tomography in this region that show the importance role of slab tearing in the western Tell external zones, and remnants of two subducted slabs beneath the eastern Tell.

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