Mantle plumes beneath Europe? Non Merci! We already have enough imaginary plumes!

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The mantle plume hypothesis, originally suggested by Morgan in 1971, has been used widely over the last few decades to explain intraplate magmatic activity. This includes the small volcanic areas that comprise the European Cenozoic Volcanic Province (ECVP), which have been popularly explained by one or several mantle plumes. However, none of the primary predictions of the mantle plume model are fulfilled in the ECVP:
(1) Long-term magmatic sources fixed relative to the overriding plate should produce age-progressive volcanic chains. Such chains are non-existent;
(2) Plume volcanism should begin with a flood basalt event, i.e., Large Igneous Province (LIP) formation as the plume head arrives. The area covered by volcanic rocks in the ECVP is much too small to be classified as a LIP;
(3) Plumes are believed to have excess temperatures of up to 400 K in the mantle, which would produce voluminous picritic melts. No evidence for picritic (high-Mg) magmas is reported from the ECVP;
(4) Hot plumes are thought to be rooted in the deep mantle, probably the core-mantle boundary (D''). Low-wave-speed seismic mantle anomalies are detected beneath some, but not all, sub-areas. Where they are observed, they are confined to the upper mantle;
(5) An arriving plume is expected to be preceded by several Ma by a phase of rapid uplift, followed by slower subsidence. Such a sequence of uplift and volcanism is not observed in the ECVP;
(6) High $^{3}He/^{4}He$ ratios are often assumed to reflect the less-degassed, deep source of mantle plumes. However, ECVP $^{3}He/^{4}He$ ratios are homogeneous ($R/Ra = 6.32 \pm 0.39$) and lower even than MORB values (8 ± 1 Ra).

The primary observations from the ECVP contradict every prediction of the classical plume hypothesis and major adaptations of that model are required to explain them. The mantle plume model is therefore not an acceptable explanation for ECVP formation. A more likely explanation is that the volcanism is linked to Alpine subduction processes that affect stress, deformation and flow in the European continental crust and underlying shallow mantle, coupled with the influence of local lithospheric conditions.