



Crustal contamination and mantle source variations in an intra-oceanic arc: geochemistry of the Lopevi volcano lavas, Vanuatu, SW Pacific.

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Westward diving of the Australian plate beneath the North Fiji basin for the last 6 m.y. generated the Vanuatu island arc with several active volcanoes. The recent tectonic evolution is constrained by the subduction-collision of the “aseismic” d'Entrecasteaux Ridge with the central part of the Vanuatu active arc which began 2-3 My ago. The small Lopevi Island, 7 km large, is composed of a single cone topped with two craters. The most recent crater appeared during the 1963 eruption. Historical activity ranged from moderate sub-plinian eruptions at the summit to lava flow effusion at the summit craters and from flank fissures. Lavas are mostly basaltic to intermediate and form a medium-K calc-alkaline series.

We analysed major, trace element and isotopic compositions of rocks from the recent eruptions, as well as of older lava flows outcropping in gullies or showing as pebbles on the beach. SiO₂ and MgO range from 50.1 to 61.8 and from 7.8 to 2.5 wt% respectively, thus extending the known compositions of the old lavas (Handley et al., EPSL 2008) towards more silicic rocks. The samples display trace element compositions characteristics of arc magmas, with negative anomalies in Nb-Ta-Ti and high concentrations in Ba and U. The most recent lavas show on average higher Ba/La, Sm/Yb and La/Yb ratios than the older ones.

The samples show a restricted isotopic range compared to other Vanuatu volcanic islands, with ⁸⁷Sr/⁸⁶Sr ranging from 0.70392 to 0.70406, ¹⁴³Nd/¹⁴⁴Nd from 0.51296 to 0.51300 and ¹⁷⁶Hf/¹⁷⁷Hf from 0.28316 to 0.28318. Variations in Pb isotopic compositions are also limited, with ²⁰⁶Pb/²⁰⁴Pb ranging from 18.44 to 18.52.

Sr isotopic compositions correlate negatively with differentiation indexes such as SiO₂, MgO or Th, arguing for contamination of the magmas during differentiation. It suggests that the contaminant cannot be only the mafic oceanic crust (MORB-like type) but must also involve high silica rocks (>65 wt% SiO₂) with high K₂O and Sr content and more elevated Sr isotopic composition compared to Pacific MORB. This contaminant probably represents older lavas or intrusives related to former activity of the Lopevi volcano, thus suggesting a long history of felsic rock formation (unrecovered so far) before the building of the actual volcano.

Differences in trace element ratios between the most recent lavas and the older ones are visible in the most mafic rocks and are not related to differentiation and contamination processes. These variations can be ascribed to changes in the melting conditions in the source or in the source composition.

Further work in Vanuatu islands will allow us to discuss these parameters and to evaluate along-arc source composition variations.