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Osmium isotopic composition and Platinum Group Element abundances of mantle xenoliths from the Adige valley, northern Italy

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The alkali basalts from the Adige Valley represent the westernmost volcanic products of the Tertiary Veneto Volcanic Province (VVP). The magmatic activity of the VVP is interpreted as the result of the partial melting of a metasomatised mantle. In Tertiary time, the lithospheric mantle beneath the VVP has been involved in the Europe-Adria collision after the subduction of the Jurassic Liguria-Piedmont Ocean.

Spinel-bearing xenoliths of the Adige Valley are anhydrous lherzolites and harzburgites. They show protogranular texture and mineral chemistry indicates equilibration between 856 and 956 ˚C. Whole-rock major element composition is consistent with variable degrees of melt depletion while cryptic metasomatism produced LREE enrichment (La_N/Yb_N = 2.7 – 17.3).

Pentlandite, pyrite, chalcopyrite and Ni-sulphides were mostly identified in the altered parts of mafic mineral phases such as olivine and pyroxene. Pyrite and chalcopyrite have stoichiometeric composition whereas pentlandite ($Fe_{27.5}$ $Ni_{24.3}$ $S_{48.2}$ – $Fe_{17.6}$ $Ni_{33.1}$ $S_{49.3}$) and the Ni-enriched sulphides ($Fe_{0.4}$ $Ni_{44.5}$ $S_{52.1}$ – $Fe_{1.1}$ $Ni_{56.5}$ $S_{42.4}$) show chemical variation.

The PGE concentrations and ratios are relatively constant and chondritic. Notable exceptions are three samples with subchondritic Pd/Ir ratios (Pd_N/Ir_N = 0.5). These are the samples with the lowest $^{187}Os/^{188}Os$, which is consistent with their melt-depleted nature. Osmium isotope data from spinel-peridotite xenoliths from the Adige Valley provide constraints on the age of mantle partial melting. The $^{187}Os/^{188}Os$ isotope

compositions vary from 0.1185 to 0.1308 and are positively correlated with the Al_2O_3 concentrations. The y-axis intercept in the $^{187}Os/^{188}Os$ vs. Al_2O_3 diagram suggests that a partial melting event occurred during the Proterozoic ($\sim$ 1.2 Ga).

Overall, our data indicate that the partial melting age of the local mantle column fall within the range of 1–2 Ga as inferred from spinel-peridotite xenoliths and peridotite massifs from worldwide localities. The PGE patterns and the relative unradiogenic Os isotope composition indicate that the local LREE-metasomatism had no influence on the Os isotopic composition.