Oxygen fugacity vs. mineralogical control on transition metal (Fe, Cr, V) stable isotope compositions of Mariana forearc peridotites

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Controversy surrounds the oxygen fugacity (fO_2) of subduction zones. Emerging redox-sensitive stable isotope systems may provide an independent assessment if their isotopic fractionation can be linked to fO_2. However, other factors such as mineral coordination number can also influence stable isotope fractionation. Here we present the first investigation of combined Fe, Cr and V stable isotope compositions. We investigate peridotites from two forearc seamounts drilled on ODP Leg 125. The studied peridotites have been characterised for major and trace elements, modal mineralogy and fO_2 (ranging from FMQ -0.7 to +1.8) [1]. We find no correlation between Fe, Cr, or V isotopes and fO_2. Iron isotope compositions are generally heavier than the terrestrial mantle [e.g., 2], but show significant scatter. Chromium and V isotopes are positively correlated with V isotopes displaced to heavier values than comparably depleted peridotites [3]. Chromium isotope compositions are within the range published for mantle xenoliths [4]. However, Cr isotopes correlate with modal clinopyroxene in forearc harzburgites. These results suggest that Cr and V isotopes may be more robust to secondary processes than Fe isotopes and that mineralogy may have a greater influence on Cr and V stable isotope fractionation than oxygen fugacity.

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Radiogenic heat potential of the Sardinian Variscan crust

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The ^{40}K, $^{238,235}U$ and ^{232}Th composition of the Variscan crust is derived from *in-situ* radiological characterization using a portable gamma-ray spectrometer [1]. Details about the analytical procedure and statistical processing of spectrometric data is given in [2]. A total of 400 measurements were performed in Sardinia, because of excellent exposure and detailed geologic information on the architecture of the Corsica-Sardinia Batholith and its country rocks [3].

The results of gamma-ray spectrometry measurements indicate that most granitoids have potential heat production rate between 0.49 and 6.92 $\mu W\ m^{-3}$. Both migmatites and low-grade metasediments are characterized by lower values in the range 1.3 – 3.1 $\mu W\ m^{-3}$. The U-Th-K abundances in the Sardinian Variscan crust are 1283^{+340}_{-463} Bq kg^{-1}, 47^{+18}_{-29} Bq kg^{-1} and 67^{+21}_{-31} Bq kg^{-1} respectively for ^{40}K, ^{238}U and ^{232}Th. These values are slightly higher than those typical for the upper continental crust [4]. However, the average heat production rate of the Variscan crust of northern Sardinia is about half of that inferred in the Bohemian Massif [5]. Therefore, we argue that selective enrichment of heat-producing elements in the crust cannot account for early Permian HT metamorphism in this part of the Variscan chain.

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