

Fractionation of highly siderophile elements, selenium and tellurium in peridotites from the Baldissero and Balmuccia peridotite massifs, Ivrea Zone (Northern Italy)

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Peridotites from the Ivrea Zone (Northern Italy) are known for their excellent preservation and absence of low temperature alteration features. We have determined abundances of highly siderophile elements (HSE), Se and Te, and $^{187}\text{Os}/^{188}\text{Os}$ in depleted and fertile spinel lherzolites and a harzburgite (loss on ignition <1 %) from the Balmuccia and Baldissero massifs in order to study the behaviour of elements such as Au, Re, Se and Te that are otherwise easily affected by alteration processes. The lherzolites ($\text{Al}_2\text{O}_3=2.0\text{-}3.1$ %) have absolute and relative abundances of Os, Ir and Ru ($\text{Os}/\text{Ir}=1.13\pm 0.04$, $\text{Ru}/\text{Ir} = 2.02\pm 0.08$, $n=10$), consistent with typical mantle lherzolites. Incompatible HSE are relatively depleted (e.g., $\text{Re}/\text{Ir} = 0.04\pm 0.02$, $\text{Au}/\text{Ir}= 0.30\pm 0.10$, $\text{Pd}/\text{Ir}=1.90\pm 0.40$). Balmuccia peridotites show limited variation and Baldissero peridotites larger scatter, with a harzburgite showing the lowest abundances of incompatible HSE and chalcophiles. All samples show a systematic depletion pattern in CI chondrite normalized diagrams with $\text{Pd} > \text{Au} > \text{Re}$, but no systematic variation with lithophile tracers exist. Se concentrations of lherzolites range between 54 and 89 ng/g and Te contents from 12 to 18 ng/g, resulting in Se/Te (4.2-7.3) below CI chondrite values. Initial $\gamma\text{Os}_{(300\text{Ma})}$ (-2.3 to +2.0) are consistent with the notion that the last partial melting event occurred during the Phanerozoic. The data on lherzolites can be explained by moderate degrees of partial melting and control of partitioning by sulphide-silicate equilibrium with $D_{\text{Re}} < D_{\text{Au}} < D_{\text{Pd}}$ and $D_{\text{Se}} < D_{\text{Te}}$.

In situ stable isotopic detection of anaerobic oxidation of methane in Monterey Bay cold seeps via integrated cavity output spectroscopy

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Anaerobic methane oxidation (AOM) plays an important role in the global methane cycle by governing the release of CH_4 from anoxic sediments into the global ocean and ultimately the atmosphere. Thus, gaining an accurate understanding of both the distribution of CH_4 sources and the occurrence of AOM as well as the spatial and temporal variability of cycling pathways is critical. Environmental analyses of methane stable isotopic composition ($\delta^{13}\text{C}_{\text{CH}_4}$) provide just such an indicator of CH_4 source, whether biogenic or thermogenic, as well as a spatial and temporal integrator of microbial cycling pathways, such as AOM. Here we present results from several deployments of a newly developed *in situ* methane stable isotope analyzer (Off-Axis ICOS) capable of measuring $\delta^{13}\text{C}_{\text{CH}_4}$ to full ocean depths. Deployments to cold seep environments (960m) in Monterey Canyon (California) revealed a distinct separation between $\delta^{13}\text{C}_{\text{CH}_4}$ in advecting fluids relative to sediment pore fluids. Multiple visits to two sites revealed $\delta^{13}\text{C}_{\text{CH}_4}$ in advecting fluids ranging from -70.2 to -63.8‰, while fluids sampled from adjacent pushcore holes exhibited higher $\delta^{13}\text{C}_{\text{CH}_4}$ (-64.2 to -50.2‰). While advective flux of CH_4 from the central seep orifice is substantial, these data implicate the importance of AOM in consuming a minimum of 57 to 70% of the diffusive flux of CH_4 in the surrounding sediments.