



Ce/Mo and Molybdenum isotopes as tracers of sediment recycling into the mantle

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The geochemical composition of igneous rocks is strongly related to geodynamic settings in which they formed. Subduction zones have always been considered as one of the most intriguing environments: here the lithosphere is subducted and recycled into the Earth's interior, modifies the geochemical budget of the mantle and, in the last part of the cycle, affects the geochemical signature of orogenic magmas. Trace element and isotope compositions represent a unique tool to investigate the role played by the different components involved (i.e. crust vs. mantle), and the nature of the material (i.e. sediment melts vs. fluids) recycled into the mantle. Our contribution to this topic consists in the application of Mo elemental and isotopic systematics, as a new tracer to subduction-related igneous rocks, to the Italian potassic and ultrapotassic magmas of Tuscany (lamproite-like rocks) and Mt. Vesuvius (leucite-bearing rocks). The mantle sources of these rocks are clearly dominated by recycling of sediments with different lithologies (carbonate-poor vs. carbonate-rich), which is highlighted by the extreme enrichment in trace elements and peculiar radiogenic isotope compositions. The resulting Mo isotope compositions of these two rock suites are similar, at odds with the significantly different trace element and radiogenic isotope signature, and are also among the isotopically heaviest recorded so far in subduction-related magmas. This suggests the involvement of recycled sediment components with originally heavy Mo isotope composition. What is significantly different is the elemental behaviour of Mo in the two suites, in particular when other trace elements, such as Ce and Nb, are considered. This can be explained by the role of different accessory phases (i.e. sulphides, rutile vs. epidote) occurring as residual phases to sediment melting, which are able to fractionate these elements in opposite ways (i.e. high and low Ce/Mo and Nb/Mo). To further investigate this process, we present a model to set constraints on the elemental fractionation able to reproduce the melt components responsible for mantle metasomatism of the studied rocks. This approach reveals that the direction of elemental fractionation depends on both the residual mineralogy (retaining/releasing Mo, Ce, Nb) and the lithology of the subducted sedimentary material undergoing melting, which controls the stability of a residual phase over another.