Molybdenum isotopic fractionation in clastic sediments

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A representative selection of well-characterised, continental-derived clastic sediments (n = 43) have been analysed for molybdenum isotopic composition with the aim of investigating Mo isotopic fractionation in clastic sediments and providing a reliable estimate for the average Mo isotopic composition of the upper continental crust. These sediments are characterised by significant variability in Mo isotopic composition with δ^{98}Mo values ranging from -2.7 to 1.0 ± 0.06‰, which can be ascribed to a variety of processes, such as redox in the depositional setting, Fe-Mo oxides and clay-mineral adsorption, biological activity and post-depositional fluid alteration. The extent of Mo isotopic fractionation in clastic sediments is seen to relate to contemporaneous atmospheric oxygen level with more recent sediments showing greater degree of fractionation than older sediments. The exposed crust, represented by the clastic sediments analysed in this study, is calculated to have an average δ^{98}Mo of -0.29 ± 0.28‰, suggesting supracrutal processes could result in preferential release of heavy Mo to the hydrosphere, leaving behind an isotopically lighter exposed continental crust. The net loss of Mo from the continental crust is suggested to have a δ^{98}Mo of 0.5 ± 0.1‰. Using these sedimentary data, combined with available data for igneous and metamorphic rocks, a weighted average Mo isotopic composition of 0.08 ± 0.09‰ (95% s.e.) is proposed for the upper continental crust.