

Cs⁺ cation exchange wash for marine clay clarifies provenance signal & assesses cation exchange capacity

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The geochemical and radiogenic isotopic composition of terrigenous clays from marine sediments can provide important information on the sources and pathways of sediments. When preparing marine sediment, the application of a wash to remove cations bound to sediment surfaces is common. We assess the effects of a Cs⁺ cation exchange wash on radiogenic isotopic (ϵNd , $^{87}\text{Sr}/^{86}\text{Sr}$, K/Ar age), major, and trace element measurements on the clay fraction of marine sediment using a control (unwashed) and test (washed) group.

The exchange wash displaced elements that have relatively high concentration in seawater: 75% of Na, 25% of Ca, 12% of Mg, and 25% of Ba. Furthermore, correlations between measurements, especially for the radiogenic isotopes, improved in the test group. This suggests that the Sr and Nd held on the clay surfaces is not from the same source as the clays, and their presence thus obscures the chemistry of the structurally bound elements, which reflect the source.

Cation exchange capacity (CEC), a quantity often used to assess soil fertility, reflects the variable ability of a particle to hold ions on its surface. This quantity can be computed simply using the concentration of Cs in the washed sample. CEC varies with the sample's clay mineral constituents, controlled by the relative abundances of kaolinite (low CEC) and smectite (high CEC). Because clay minerals are formed on the landscape and have a relationship to annual precipitation and soil flushing, CEC measured on the clay mineral fraction might have potential to indicate terrestrial chemical weathering.