METEORIC ^{10}BE/^{9}BE RATIOS AS TRACERS OF COASTAL TRACE METAL EXCHANGE

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Ratios of the meteoric cosmogenic isotope ^{10}Be to the stable ^{9}Be provide an excellent and under-utilised trace element proxy within the GEOTRACES context. The power of this system arises because it combines an isotope produced in the atmosphere of which the input rate into the oceans is known ("the clock") with a stable isotope that records the input from continental weathering ("the flux proxy")[1]. In seawater, the ^{10}Be/^{9}Be ratio thus provides actual rates of metal input, release, and exchange. During boundary exchange, mixing of river-sourced trace metals with those from seawater can be exposed by the ^{10}Be/^{9}Be ratio. When measured in the authigenic phase of marine sediments, the ^{10}Be/^{9}Be ratio allows deriving these fluxes in the geologic past.

At an ocean margin site 37°S offshore Chile, we used the ^{10}Be/^{9}Be ratio to trace changes in terrestrial particulate composition due to exchange with seawater. We analyzed the reactive (sequentially extracted) phase of marine surface sediments along a coast-perpendicular transect, and compared them to samples from their riverine source[2]. We find evidence for growth of authigenic rims through co-precipitation, not via reversible adsorption, that incorporate an open-ocean ^{10}Be/^{9}Be signature from a deep water source only 30 km from the coast, thereby overprinting terrestrial riverine ^{10}Be/^{9}Be signatures. As ^{10}Be/^{9}Be ratios increase due to exchange with seawater, particulate-bound Fe concentrations increase, which we attribute to release of Fe-rich pore waters during boundary exchange in the sediment. The implications for the use of ^{10}Be/^{9}Be in sedimentary records for paleo-denudation flux reconstructions are that in coast-proximal sites that are neither affected by deeper water nor by narrow boundary currents, the authigenic record will be a direct recorder of terrigenous denudation of the adjacent river catchments. In contrast at open ocean sites global seawater trace metal fluxes can be reconstructed.

[1]von Blanckenburg, F., Bouchez, J., 2014. Earth and Planetary Science Letters 387
[2]Wittmann et al., 2017. Geophysical Research Letters 44.