A Sr isotope survey of a marine terrace chronosequence: equilibrium interrupted.

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A well studied marine terrace chronosequence north of Santa Cruz, CA affords an ideal natural laboratory for the investigation of established cation pool equilibrium dynamics. The soils mantling the 5 terraces have developed in sediments derived locally from the Miocene Santa Margarita sandstone, the Purisima formation, and Salinian granites. Each of the terraces were extensively instrumented and sampled. Soils, vegetation, surface and soil pore waters, and precipitation have been sampled at various intervals. Sr isotopes ($^{87}Sr/^{86}Sr$) and cation chemistry have been utilized to investigate sources, cycling and behaviour of Sr and other base cations within each terrace soil horizon. Measured values of $^{87}Sr/^{86}Sr$ in the samples range from 0.706 in deep soil water and soil exchange extracts to 0.710 in surface waters and soil digests. Analysis of precipitation samples average 0.7095. Previous work has demonstrated establishment of similar Sr isotope trends with depth at terraces 1,2,3 and 5. $^{87}Sr/^{86}Sr$ ranges from 0.709 at the top of the profile toward 0.706 at 6 meter depth. Decreasing $^{87}Sr/^{86}Sr$ values with depth imply a precipitation influence at the top of the profile and an increasing mineral weathering signal at depth. Also evident in the depth profiles at these sites is apparent isotopic ($^{87}Sr/^{86}Sr$) equilibrium between ammonium-acetate exchangeable Sr and soil water Sr at equivalent depths. Sr isotope measurements at terrace 4, however, have demonstrated neither trend nor equilibrium. The contrast between behaviour at terrace 4 and the remaining terraces is the subject of this study. $^{87}Sr/^{86}Sr$ measurements of soil pore water at terrace 4 show an essentially fixed value (avg. 0.7088) from the top of the profile to >6 meter depth. Preliminary work on ammonium-acetate exchangeable Sr have yielded $^{87}Sr/^{86}Sr$ values averaging 0.7095. Comparatively, bulk water and soil chemistry are not unusual at terrace 4. Evidence for anthropogenic activity at the terrace 4 sampling site was not obvious at time of site selection. Absence of an A horizon at the site and nearby charcoal bearing mounds suggest small scale charcoal manufacture. Stripping of the Sr exchange pool may have been accomplished by pyroligneous acids interacting with terrace 4 minerals and the subsequent reset to precipitation like values (0.7091).

Dissolved iron in the Southeast Pacific Ocean: OMZ to the gyre

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Dissolved iron (dFe, <0.4μm) samples were collected in the Southeast Pacific Ocean during the C-MORE Big RAPA cruise aboard the *R/V Melville* in December 2010, which sailed from Arica, Chile, to Easter Island. Full depth profiles are presented from three stations: one near the Chilean coast in the oxygen minimum zone (OMZ), one in the subtropical gyre, and one halfway between these two points. Four additional profiles to 1000m are also presented, two between each of the full depth stations, in order to provide higher geographic resolution of surface dFe dynamics.

This dataset provides a unique opportunity to examine dissolved Fe cycling in a transect with a wide biogeochemical range. Conncentrations of dFe were in excess of 3nmol/kg in the OMZ where oxygen concentrations fell below 3μM. In contrast, in the oligotrophic gyre where atmospheric deposition of Fe is very low, dFe is over an order of magnitude lower, near 0.1nmol/kg at the surface and throughout the upper ocean. In this transect are also recorded the first deep ocean dFe concentrations ever measured in the southeast Pacific Ocean.

This dFe distribution provides insight into the major sources of dFe to this understudied region, Fe:nutrient relationships, and the scavenging behavior of dFe from the OMZ into the gyre. This transect will also be of particular interest to participants in the upcoming US Pacific GEOTRACES cruise, which will occupy a similar biogeochemical regime along a nearby transect.