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Present day Nd isotopic composition of seawater and sediment leaches from the Pacific sector of the Southern Ocean.

M. Molina-Kescher, M. Frank, D. Nürnberg, R. Tapia

mmolina-kescher@ifm-geomar.de, mfrank@ifm-geomar.de, dnuernberg@ifm-geomar.de, rtapia@ifm-geomar.de

IFM-GEOMAR   Bundesministerium für Bildung und Forschung   Leibniz Gemeinschaft

INTRODUCTION

The Southern Ocean has played a key role in the climate evolution of the Earth, nevertheless its largest part, the Pacific sector, has been poorly investigated in comparison to other regions in many paleoceanographic aspects. Some of them are subject of the SOPATRA Project (SOuth PAcific TRAnsects).

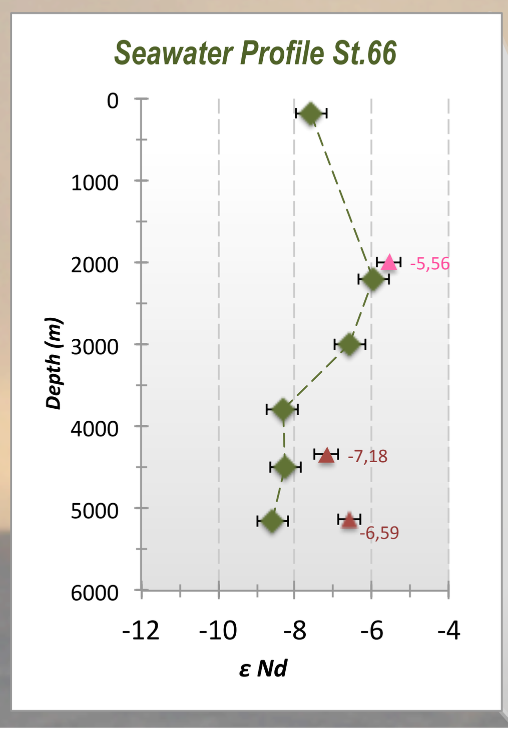
Here we present the first Nd isotope (εNd) water profiles from this region, as well as εNd data extracted from Fe-Mn hydroxide coatings of bulk sediments in order to gain first insight into the dissolved Nd isotope distribution in the Pacific sector of the Southern Ocean and its relationship to hydrography and to develop an effective method to obtain a reliable signal of this water mass tracer from the sediment in later downcore studies for this region. **(1)**

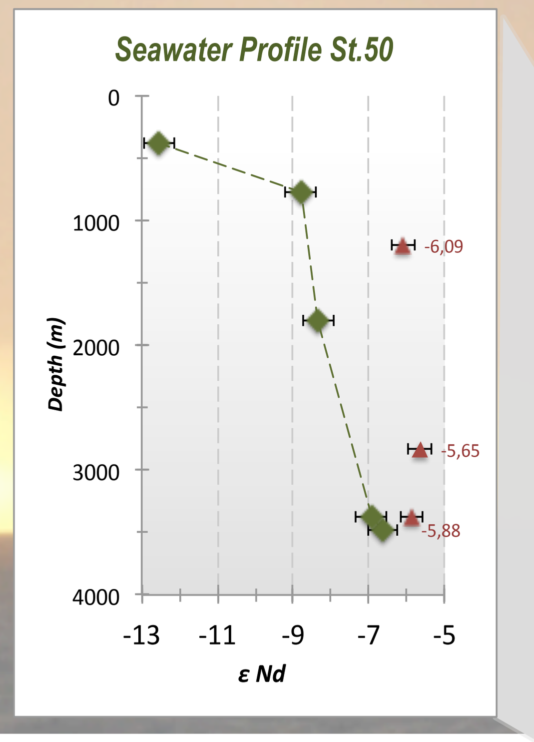
I) SEAWATER PROFILES AND SEDIMENT LEACHES

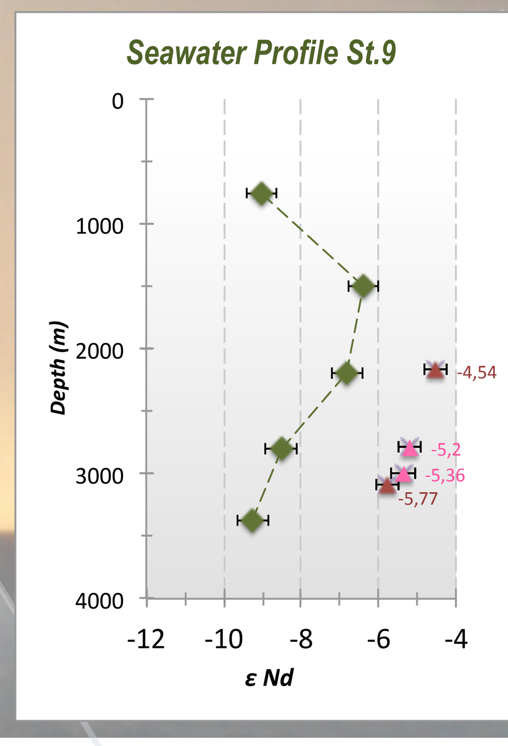
The data shown represent the first complete dissolved εNd seawater profiles for the South Pacific (taken during cruise SO213).

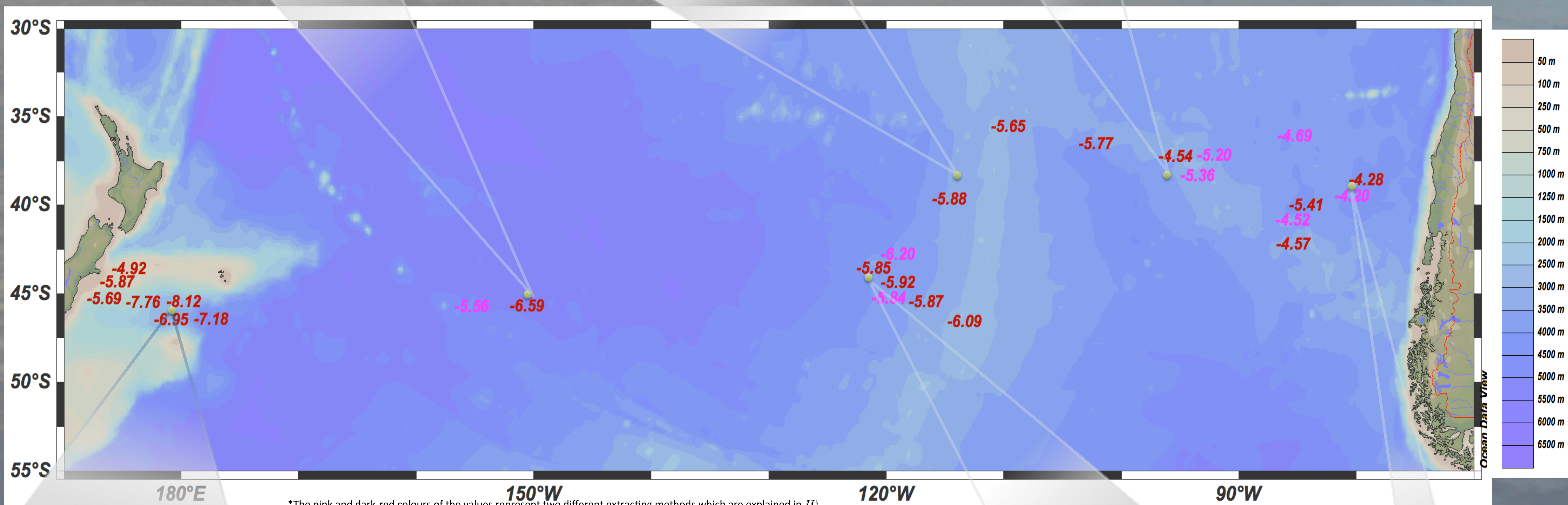
A big εNd variation with depth is present in most of the stations. Westernmost station (66) clearly reflects the inflow of unradiogenic LCDW and AABW, between 3500 and 5200 meters. At stations 50 and 54, LCDW is apparently mixed with North Pacific Deep Water (NPDW) giving a more radiogenic signal. The highly unradiogenic values of deep water on St. 9 can only be explained by intrusion of Ross Sea Water which would be unable to cross the ridge so that this is not reflected in εNd deep water values of St. 22. AAIW, between 700 and 1400 m, has an average εNd signal of -8 in all stations and many shallow samples show not expected unradiogenic values around -11.

The values presented on the map represent the Nd isotopic composition extracted from the Fe-Mn hydroxide coatings present in the surface sediment layer in direct contact with the bottom water.

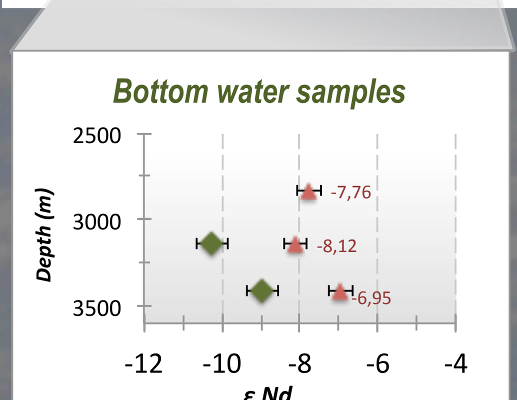


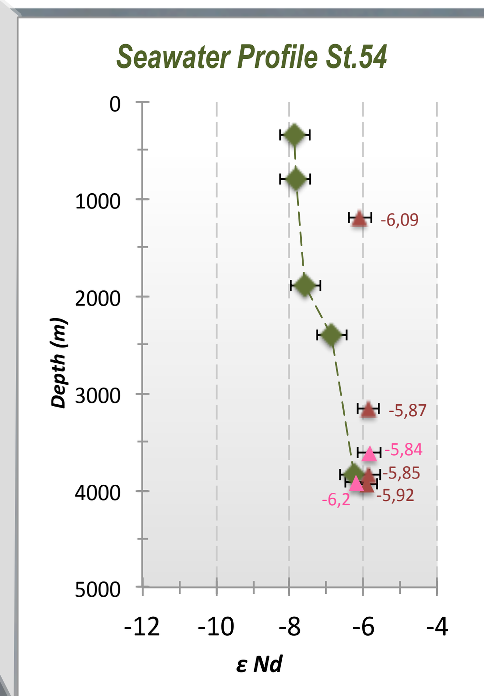


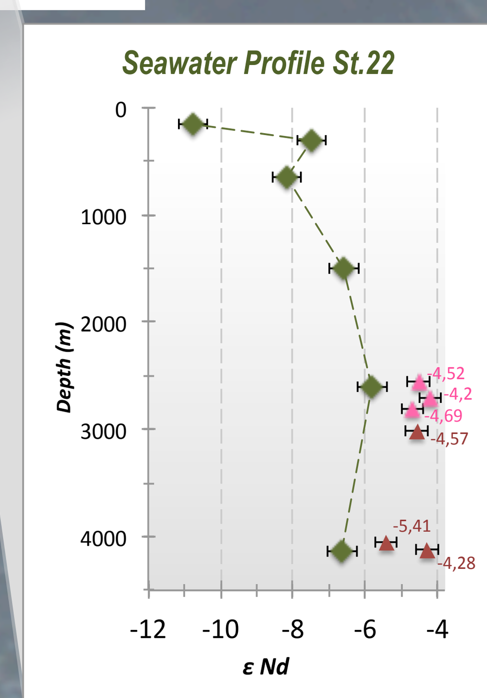




*The pink and dark-red colours of the values represent two different extracting methods which are explained in *II)*.



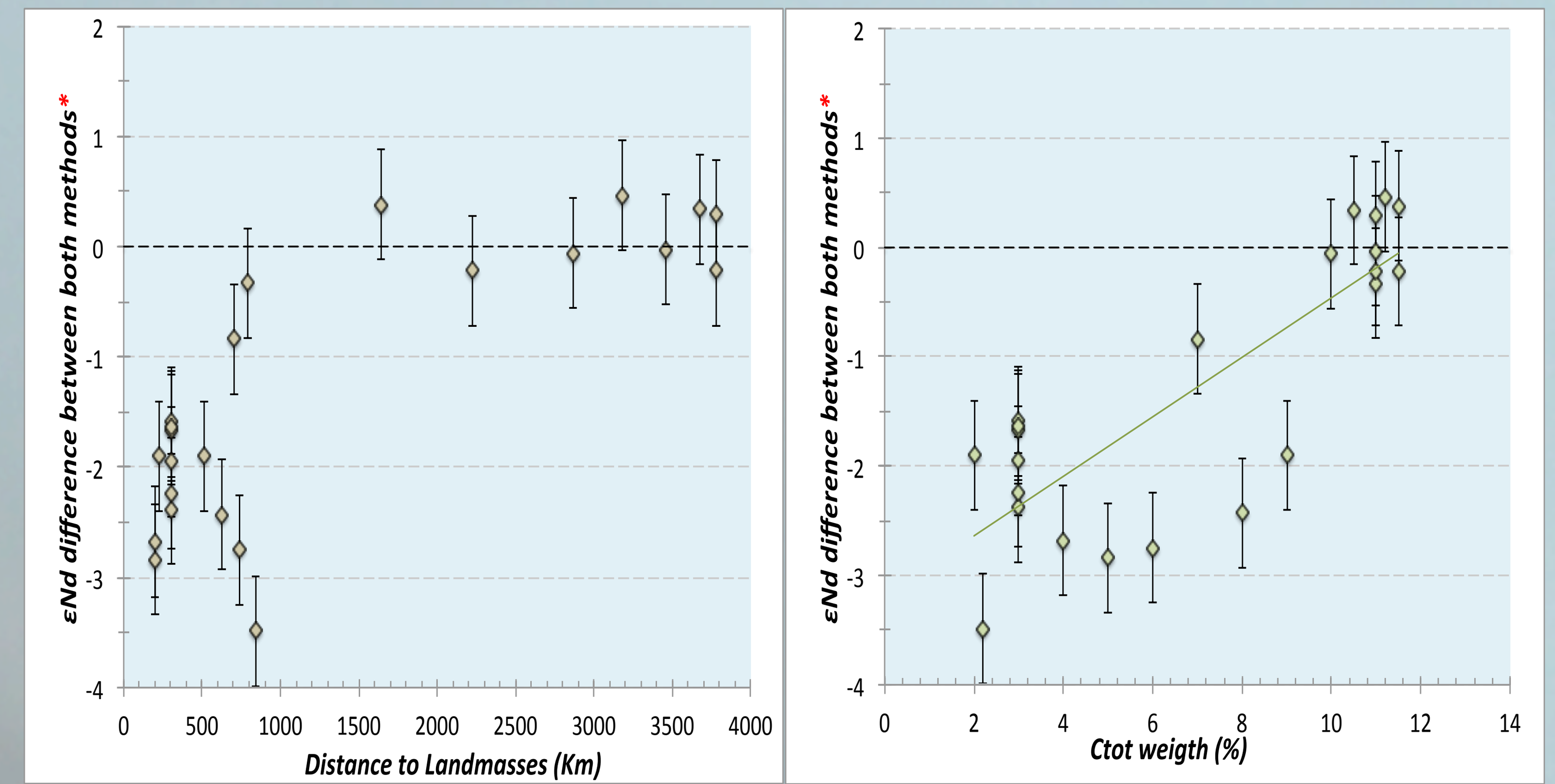




II) COMPARISON BETWEEN DIFFERENT LEACHING METHODS

Two reductive leaching Methods were used to extract the εNd signature from the Fe-Mn hydroxide coatings. One of them has been successfully used in many paleoceanographic studies (*Rutberg et al., 2000; Bayon et al., 2002; Gutjahr et al., 2007*). The second (dark-red values on the map) is basically the same but avoiding the initial decarbonating step. In most of the samples both Methods were applied and compared (see figures on top-right). Significant εNd differences in samples close to the coast or those having a low carbonate content are found. In those cases the Method avoiding the decarbonating step gave more reliable results.

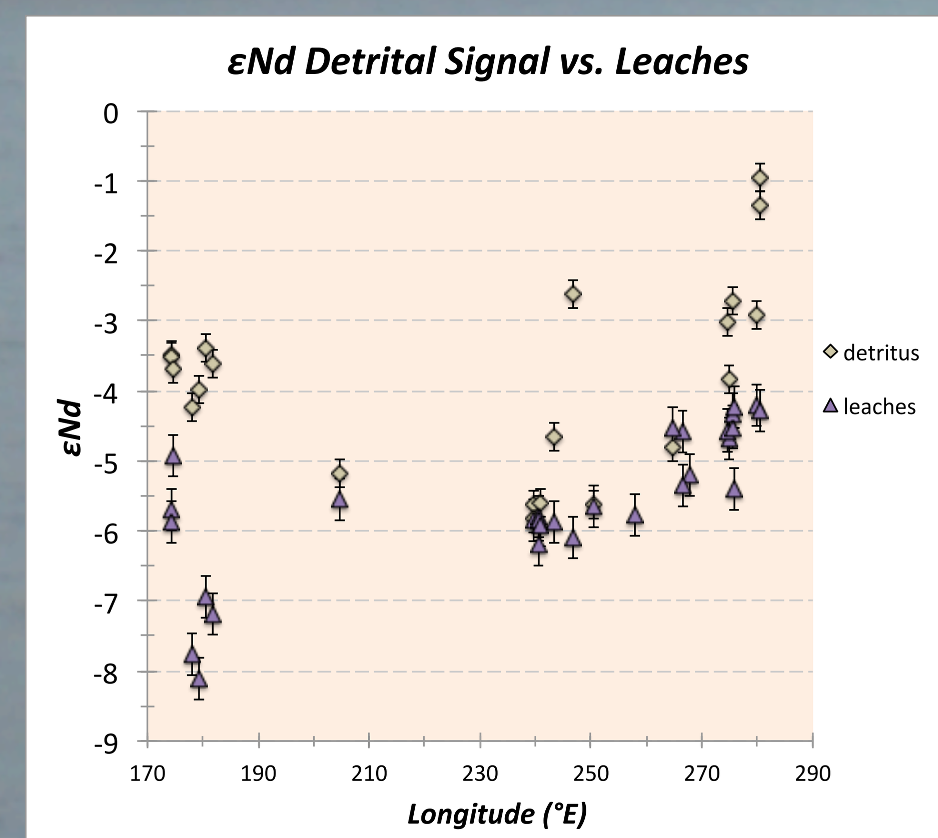
The explanation could be partial dissolution of weathered volcanic minerals or ash particles from the continent which have highly radiogenic signatures. In the presence of carbonates most of the authigenic signature derived from seawater is obviously associated with them.



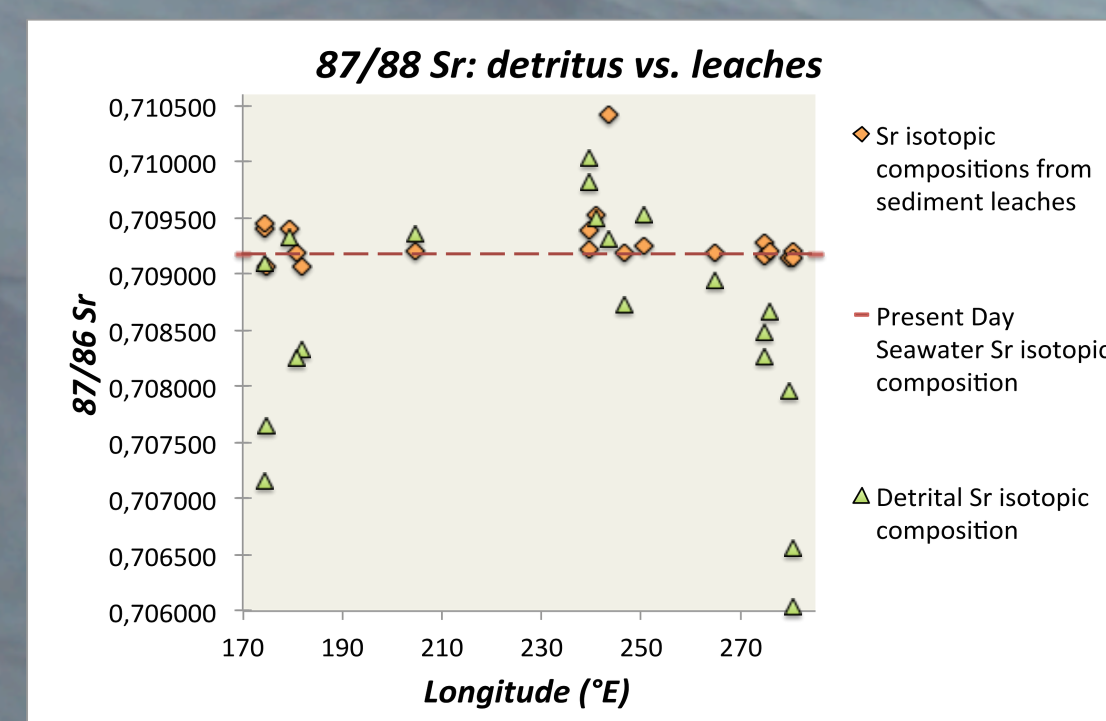
*εNd difference= εNd(decarbonated leach) - εNd(NON decarbonated leach)

III) RELIABILTY OF THE LEACHING METHOD

The isotopic composition of the detrital fraction of the sediment samples was analyzed for Sr as well as for Nd in order to confirm the absence of detrital contamination during the extraction of the Fe-Mn coatings.



The more radiogenic εNd detrital signals compared to the leaches confirm the sediment provenance from South America and New Zealand for the different locations (*Jeandel et al., 2007*) and indicate, compared to the water profiles, that some of the leach signatures were influenced by partial dissolution of detrital particles.



Sr has a homogeneous isotopic signature in seawater of 0.70918. Therefore the leached compositions should not differ significantly from this value. Although this test has been demonstrated to be too strict for Nd (*Gutjahr et al., 2007*), here almost all data confirm this value. However, as demonstrated from comparison of the leached Nd isotope signatures and the deep water data, this can not exclude detrital contamination.

OUTLOOK

Despite that not all the water εNd signatures coincide with the signal extracted from the sediment, it is promising to see that all the leach values present a deviation to more radiogenic values at all locations. Further modification of the leach method, such as extracting the Fe-Mn coatings only from planktonic foraminifer shells where available, will be tested in the near future.

(1) Seawater get its Nd isotopic signature mainly by river discharge, but also from dust input and boundary exchange. Water masses originated in regions where young mantle derived material is weathered have higher εNd values (radiogenic), in contrast, old continental rocks weathering results in most negative (unradiogenic) values. Nd has a residence time in seawater less than the oceanic mixing time, so it can be used as water mass tracer.