1) INTRODUCTION

The South Pacific and the Southern Ocean have played an important role for the global climatic evolution. Despite its enormous extent the Late Quaternary palaeoceanography of the South Pacific has been poorly investigated in comparison to other regions, which is partly due to its limited accessibility.

Therefore, one of the main targets of the SOPATRA Project has been the reconstruction of the past deep water circulation of the South Pacific using radiogenic isotopes. Here we present Nd and Pb isotope time series of past deep waters obtained from two sediment cores recovered near the East Pacific Rise at 45°S covering the past 250 ka. Additionally, the Nd isotope composition of the water column of the South Pacific is shown for calibration of the downcore record.

2) PRESENT DAY DISSOLVED Nd ISOTOPE COMPOSITIONS (submitted to GCA)

Dissolved Nd isotopes (fig.2) in the intermediate to deep-water column of the open mid-latitude South Pacific overall confirm the reliability of Nd isotopes as water mass tracer in this region given that their variations closely reflect changes in oxygen concentrations, which in the Pacific generally better track the advection of different water masses: Pure circumpolar waters (AAIW and LCDW), εNd∼-3, occupy the shallowest regions. Pacific-derived water dominates mid-depths with North Pacific Deep Water (NPDW) and South Pacific Fyre derived Deep Water (SPFDW), reflected by εNd signatures of -5,9 (average) and -6,0, respectively, and thus replace Upper Circumpolar Deep Water (UCDWW) except above the East Pacific Rise. The presence of NADW in the South Pacific, represented by low nutrient concentrations and high salinities (not shown here), is also clearly reflected in the Nd isotopic signatures (average εNd∼-9,7).

3) LATE QUATERNARY RECONSTRUCTION OF CIRCULATION FROM Nd AND Pb ISOTOPES

The Nd isotope data set obtained from dissolved ‘uncleaned’ foraminifera for core SO213-59-2 (fig.3), reveals systematic changes of the deep water Nd isotope signatures following major glacial/interglacial cycles. The Nd isotope signal varied between interglacial εNd values near -6 and more radiogenic εNd values near -5 during glacial periods documenting a diminished contribution of unradiogenic NADW to Circumpolar Deep Water. These preliminary results support reduced NADW production during cold climatic stages documented in sediment records from the Atlantic sector of the Southern Ocean (Piotrowski et al., 2005).

While the εNd signature in the Atlantic sector of the Southern Ocean varied by 2 to 3 εNd units between glacial and interglacial stages, our record reveals amplitudes near 1 εNd unit, consistent with higher dilution of the Atlantic-derived waters during advection. Although the εNd values are still higher than correspond to εNd -6 of surface waters. This is possibly due to the limited sedimentation rate or the lack of δ18O values for 50 to 70 ka.

The εNd changes are supported by similar variations of the δ18O signal, which show more negative values during cold periods, indicating larger contributions of old, nutrient-rich water masses from the deep Pacific to circumpolar waters, while during the interglacials, younger and nutrient-depleted water masses, such as NADW, played a more important role for the mixture of waters of theantarctic Circumpolar Current (ACC).

On fig. 5, Pb isotopes obtained from sediment leachates of cores 59 and 60, also show variations between glacial and interglacial cycles. Although small, the variations occurred in accordance with the εNd variations, with lower 206Pb/204Pb and higher 207Pb/204Pb values during glacial periods, and thus higher contributions of Pacific Water.

4) RELIABLE EXTRACTION OF εNd SIGNATURES FROM THE SEDIMENTS AND DETERITUS PROVENANCE VARIATIONS.

We compared the results obtained from non-decarbonated bulk sediment leaching (see Wilson et al. 2012) and ‘uncleaned’ planktonic foraminifera (after Roberts et al. 2010) to εNd signatures from the detrital fraction of the sediment (after Gutjahr et al. 2007) to verify the reliability of the Nd isotope composition obtained from Fe-Mn coatings, which carry the authochthonous deep water circulation signal in the leachates of the authochthonous fraction of the bulk sediments as well as of the ‘uncleaned’ planktonic foraminifera.

Core 60 does not show significant differences between the three phases, presenting similar values to present day bottom waters at the sediment surface. On the other hand, on core 59, the detrital signatures present more radiogenic values with respect to ‘uncleaned foraminifera’ along the entire record. By comparison to the more reliable results of ‘uncleaned’ foraminifera, non-decarbonated leachates from core 59, show similar values between 0 and 120 kyr, while the interval from 120 to 240 kyr, the signatures are shifted towards more radiogenic values, similar to those of the authochthonous fraction, indicating detrital contamination of the older samples during the extraction of the Fe-Mn coatings.

The analysis of the detrital fraction also allows to track changes in the provenance of lithogenic material to the South Pacific. Detrital εNd signatures on core 59, are generally more negative during glacial periods, therefore, a major dust contribution to central South Pacific during glacial stages can not be confirmed, as the shift in the Nd IC’s should thereby occur in the opposite direction, which should indicate less radiogenic values originating from dust particles transported from Australia and New Zealand by the dominating Westerlies. The variations towards more radiogenic values in this case could be produced by increased particle transport from Antarctica during cold periods, either by ice rafted debris or via enhanced Antarctic Bottom Water (AABW) flow.