# Constraining the incorporation of Nd in planktonic foraminiferal calcite using $^{143}Nd/^{144}Nd$ isotopes and comparisons with a N. Atlantic water column profile

*Daniel Ruiz[1], Lepoldo Pena[2], Sidney Hemming[2]*
*[1] University of California, Berkeley*
*[2] Lamont-Doherty Earth Observatory of Columbia University*

Planktonic foraminifera have been extremely useful proxies for examining past oceanic processes due to the incorporation of different elements and isotopes into their calcium carbonate shell. The $^{143}Nd/^{144}Nd$ of seawater varies geographically due to geologic variations in surrounding continental sources. Thus Nd incorporated in foraminifera can potentially be applied to trace past surface oceanic currents. However, there are various limitations to this application such as the postmortem incorporation of $^{143}Nd/^{144}Nd$ that gives deep sea/ocean floor isotopic compositions of Nd, which happens to certain foraminifera species. In order to figure which species of planktonic foraminifera would be ideal in tracing past surface oceanic currents, we sampled seven different species: *G. ruber* (white and pink), *G. crassaformis*, *G. inflata*, *G. sacculifer*, *G. truncatulinoides* (left and right coiling), *O. universa* and *G. aequilateralis*–all which live at different depths (0-200m).
The premise of the experiment was to see from which foraminifera we are able to extract the isotopic composition of the water depth where they lived after elaborate cleaning of the undesired matter accumulated over fossilization. A water profile from the North Atlantic (62.5ºN, 29.62ºW, 4949mbsl) showing different $^{143}Nd/^{144}Nd$ isotopic compositions in respect to water depth was the base which was used to constrain the reliable foraminifera from the not reliable foraminifera. If both isotopic compositions matched, then that would indicate that that certain species can be sufficiently cleaned in order to only measure the Nd incorporated in their habitat during their life. If the isotopic composition of the foraminifera was different from that of its habitat, then that would indicate that that certain species incorporated Nd either as it sank to the ocean floor or at the ocean floor. We performed an elaborate cleaning protocol on the samples including clay removal, oxidative cleaning, reductive cleaning and weak acid leaching in order to rid the samples of any elements that could have lead to misleading results. We made sure to emphasize the reductive cleaning that eliminates FeMnOx since they contain extremely high concentrations of Nd. Due to time constraints, only four samples were analyzed by Thermal Ionization Mass Spectrometry (TIMS): *G. crassaformis, G. inflata, G. sacculifer, G truncatulinoides* (left coiling), all of which gave deep sea isotopic compositions of $^{143}Nd/^{144}Nd$. Since the concentrations of Fe, Mn, Ba and Al were exceptionally low, it is highly unlikely that contamination of other elements was the cause of these results. We believe that there could have been a problem with the readsoption of Nd during the cleaning protocol because the Nd concentrations are anomalously high. Since the reductive cleaning is performed under very basic conditions (high pH), there is a significant chance that the Nd precipitated

and was then re-adsorbed onto the calcite since REE have a tendency to do so. We believe a compromise where the weak acid leaching step would be performed long enough to get rid of the re-adsorbed Nd but not long enough to dissolve too much calcite would resolve this problem.