FORAMINIFERAL & CORAL BARIUM AS A PALEO-TRACER.

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Ba and Si distributions are similar in the modern ocean, suggesting that Ba incorporated into the tests of foraminifera might be a tracer of circulation and chemistry of past oceans. Ba determinations are made on foraminifera cleaned by reductive techniques to remove extraneous mineral grains and coatings and a Ba complexing agent to dissolve associated barite. Measurements on clean samples indicate at least some species take up Ba in proportion to its seawater concentration.

4 planktonic species from sub-tropical Atlantic and Equatorial Pacific core tops have Ba/Ca ratios of 0.7±0.2 μmol/mol. Ratios in three benthic species from Atlantic core tops range from 1.8 to 3.3 μmol/mol. The range in Pacific core tops for the same benthic species is 3.2 to 4.2 μmol/mol. The effective Ba distribution coefficient calculated from these values and seawater Ba concentrations is 0.19±0.03 for planktonic species and 0.37±0.1 for benthic species.

Preliminary downcore records of planktonic and benthic foraminiferal Ba/Ca from the Panama Basin demonstrate that while Ba has remained enriched in Pacific deep waters, surface and deep Ba content has varied by up to 25% in the last 20 kyr. A few analyses from the North Atlantic suggest that benthic Ba/Ca at the last glacial maximum was up to 40% higher than it is at the core top.

A record of coral Ba/Ca from the Galapagos Islands indicates a strong correlation between historical sea surface temperature anomalies and coral Ba content. This correlation is apparently due to changes in surface water Ba concentration that accompany fluctuations in upwelling intensity recorded by the SST anomalies. Recovery of Ba/Ca ratios in older corals will facilitate understanding of temporal changes in upwelling in the equatorial Pacific.

GEOCHEMICAL FLUXES IN A THREE DIMENSIONAL MODEL OF THE OCEANIC CIRCULATION

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The present state of a high resolution model (30000 gridpoints) of geochemical tracers in the ocean is dicussed. The tracers are transported with current field provided by a dynamically balanced GCM. Full carbonate chemistry is included from the buffering at the air-sea interface to the location of the lysocline. The biological pump is represented by a simple mechanism of phosphate limited net production. The simultaneous simulation of ^{12}C,^{13}C, and ^{14}C serves as a crucial test of the physical model. With a given inventory of ΣCO_2, alkalinity and phosphate, the atmospheric pCO_2 reacts sensitively to changes in the parametrisation of biological processes, but changes in the circulation field seem to be less efficient. It is difficult to ascribe the glacial-interglacial change solely to the changed circulation. In any case, the range of variability is much less than could be obtained by box models with independent biological and physical fluxes.

^{10}Be and ^{230}Th Stratigraphy in sediments from high latitudes

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The sequence of glacial and interglacial periods influences the concentration and the flux of the radioisotopes ^{10}Be and ^{230}Th into sediments from high latitudes. The maxima and the minima correspond with the extremes of the mid-month-insolation curve. ^{10}Be and ^{230}Th profiles therefore enable stratigraphy with a resolution similar to the $\delta^{18}O$ curve. Furthermore the radioactive decay of the ^{230}Th along the core profiles gives a rough age control. The intensity of bioproductivity in the water column controls the flux of radioisotopes into the sediments. ^{10}Be is enriched in comparison to ^{230}Th because of the 20 times longer residence time of ^{10}Be in the water column. The ratio of the fluxes of ^{10}Be and ^{230}Th gives information of the bioproductivity in the past. We will discuss applications on sediment cores from the Arctic and Antarctic.

FIRST MEASUREMENTS OF FREONS 11 AND 12 IN THE ANTARCTIC ZONE OF THE INDIAN OCEAN

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CFC 11 and 12 were measured at 18 stations in the S.W. Indian ocean during INDIGO 3 cruise (Jan/Feb 1987). The stations were located near the Antarctic continent (66°35 S) and between the Antarctica and South Africa. CFC 11 and 12 were used as anthropogenic tracers of water mass circulation and of anthropogenic CO2 penetration. Three major features came out of these results : 1-a high CFC penetration depth (800 m) in the subantarctic zone associated with high CFC values (1 to 2 pmol/kg for CFC 11). 2-a low CFC penetration depth and rapid extinction of the anthropogenic signal between 100 and 300 m in the Antarctic zone (50°S to 65°S); this trend is accompanied by undersatured surface waters relative to atmospheric CFC concentrations (80 to 50% of the surface saturation concentration). 3-the presence of undersatured surface waters over the continental shelf, for both CFC, (around 50%) and evidence for newly formed water on the bottom. These results together with hydrological analyses show that a major part of the indian Antarctic ocean acts as a barrier for the anthropogenic penetration. The boundaries of this zone, the subantarctic zone and continental shelf, are the major sinks for anthropogenic compounds involving large scale transport. The Δ PCO2 at the surface values shows a correlation with the CFC mean penetration depth.