Geochemistry of the deep water coral *Isidella*; Intermediate depth and surface ocean chemical recorder

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Geochemical analyses of deep water corals have provided a wealth of data on past ocean circulation and chemical changes. Information obtained from these calcite precipitating organisms generally reflects ambient conditions at the depth of growth. The bamboo coral, *Isidella* sp., belongs to a group of deep water Octocorals that live at intermediate ocean depths (~200-1500m) and produce a calcite skeleton which is divided by proteinaceous gorgonin internodes. Because, the calcite and organic regions of the skeleton are precipitated simultaneously, their chemistries are temporally coupled.

Stable isotope, ^{14}C AMS ages and ^{210}Pb data were obtained from several specimens of *Isidella* that were collected in fishing dredges from the outer continental shelf near Pt. Reyes, CA (estimated collection depth ~220 m). ^{210}Pb analyses on one of the specimens suggests the coral may have died ~80 years prior to collection. δ^{13}C and δ^{18}O data from the calcite skeleton display the typical nonequilibrium covariation that has been described previously, thereby limiting the use of these data in reconstructing environmental temperatures. Although δ^{13}C analyses of the internodes produced typical marine organic values, -16.9 ± 0.1‰ (n=17), δ^{15}N values were unusually high, 13.8 ± 0.4‰. Because the internode geochemistry records the organic chemistry of sinking particulate matter ingested by the coral, the enriched δ^{15}N data reflect the chemistry of local upwelled NO_3 that was strongly influenced by subsurface denitrification.

AMS analyses of the center and outer edge of the skeleton (branch diameter = 2.2 cm) and adjacent organic internodes (growth proceeds from center outwards) yield ^{14}C ages of 2065 and 2000±35 years for the calcite (Δ^{14}C = -226.4 and -220.3‰) and 785 and 765±35 years for the organic node (Δ^{14}C = -93.1 and –90.7‰) respectively. The calcite AMS ages record the ^{14}C reservoir age of upper N. Pacific thermocline waters whereas the organic data record the surface ocean reservoir age during the corals growth. The reservoir age difference is ~1250 years. Comparison of these ages with data from a mussel collected along the Pt. Reyes coast in 1913 (^{14}C age = 710 years; M. Solomon unpub. data) suggest our coral specimen died ~90 years ago. This estimate is consistent with the ^{210}Pb estimate of coral death. These results demonstrate that the bamboo corals are a valuable archive of intermediate and surface ocean chemistry and could prove invaluable for reconstructing combined near surface circulation and ocean chemistry changes in the past.

Eliminating subsurvey bias in multi-parameter geochemical soil surveys

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Assembling a geochemical map from a number of separate geochemical surveys is usually complicated. Of course one should use the same sampling and analytical methods throughout the entire survey, and analytical accuracy should be monitored using standard samples. Still, it is virtually inevitable that small but systematic shifts in concentrations occur between the different data subsets. These systematic shifts are caused by different calibration or performance of the analytical apparatus, especially when there is a large time span between the surveys. Such artificial shifts, even when they are within acceptable analytical precision for individual parameters and individual (standard) samples, may have a negative influence on multivariate relations, such as the covariance structure. Covariances may shift from one subset to another, thereby weakening the relation in the overall dataset. Even artificial relations or groups can result from the analytical artefacts.

In an environmental assessment of background values and multivariate soil characterization of immature clayey soils in the Province of Zeeland, southwest Netherlands, carried out in 5 separate subsurveys over a period of 7 years, elimination of between survey bias appeared necessary. For logistic and financial reasons each survey was performed in a different region, often with a distinct geological and geochemical history. Differences in covariance structure between subsurveys could thus be the expression of true regional features or be analytical artefacts. By using a sample archive a number of samples from previous surveys where analyzed together with the samples of each new survey. These so called *Between Survey Duplicates* (BSD) where used to level the different surveys. It was assumed that differences between these duplicates are the summation of random analytical variance and bias caused by the analytical shift. One subsurvey was taken as the reference and results from all other surveys were corrected by means of shift and multiplier values based on a linear regression equation derived from the set of BSD. The corrected dataset was then used for multivariate analysis and the construction of geochemical maps. Multivariate interpretation of the data greatly benefited from the correction, as true covariance structures were no longer obscured with bias induced variance. Most of the differences in covariance structure between the different data subsets surmised from the uncorrected data appeared to be of analytical origin. Only a few true regional features remained.