Isotopic biogeochemical signals in sediments from the Ross Sea

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Abundances and isotopic compositions of sterols have been determined in 18 samples of surface sediments and in two cores from the Ross Sea. Polytopic vector analysis of relative abundances resolves four distinct components. Two are associated with producers (diatoms vs. the community dominated by *Phaeocystis* and characteristic of the Ross Sea Polynya). Two are associated with consumers (aerobic heterotrophs vs. microorganisms). Abundances of total sterols relative to total organic carbon range from 2 to 1200 ppm. The exceptionally low concentrations are associated with anomalously high radiocarbon ages, which can be explained only by dilution with radiocarbon-dead debris or by reworking of sediments (probably associated with consumption or alteration of sterols). Details of the correlation between abundances and radiocarbon age favor the latter.

Abundances of ^{13}C in organic matter are zoned geographically. Values of δ are near -23‰ along the western margin and average -27‰ in the central Ross Sea. This parallels a frequently observed biological zonation in which diatoms and dinoflagellates are more abundant along the western margin and *Phaeocystis* is dominant elsewhere. Isotopic analyses of the sterols, however, show that all producers, including *Phaeocystis*, are isotopically enriched in the west and all producers, including diatoms, are isotopically depleted everywhere else.

Accordingly, the isotopic zonation is not related to species effects and must be explained either by differing growth rates or by varying concentrations of dissolved CO_2. Field observations exclude the former. Rates of growth are, if anything, higher in the central Ross Sea than along the western margin, thus opposing the variation required to explain the isotopic signal in terms of growth rate. Partial pressures of CO_2 along the western margin are low, apparently because less-saline surface waters (derived from melting ice) inhibit transfer of CO_2 from deeper waters during times of peak algal growth. In fact, plots of ε_P vs $1/P_{CO2}$ confirm that the isotopic zonation can be entirely explained by drawdown of CO_2 in western waters.