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δ13 C in the benthic bivalve shells as indicators of sedimentary organic carbon accumulation – A case study from the Western Continental Shelf of India

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Paired analysis of δ13Cinorg and δ13Corg was carried out in the surface sediments of the western continental shelf of India (WCSI) collected during late summer monsoon (LSM) and spring intermonsoon (SIM). The δ13Cinorg was obtained by analysing the benthic bivalve shells of < 2mm size and δ13Corg was analysed after removing the inorganic components in the sediment by acid treatment. During LSM, the study region experienced upwelling and seasonal suboxia with greater accumulation of organic carbon in the surface sediments. During SIM, shelf waters were oligotrophic and oxygen saturated. Our observation shows isotopically lighter δ13Cinorg for samples collected during LSM than during SIM. The average δ13Cinorg during LSM and SIM was 0.29‰ and 0.80‰ respectively. The higher sedimentary organic carbon promotes greater microbial activity causing the pore-waters to be depleted in 13C which leads to the depletion δ13C of the inorganic benthic bivalve shells as well during LSM. The observed dissolved inorganic phosphate concentrations and ΔB (i.e. δ13Corg - δ13Cinorg) during the two sampling periods were used to simulate pCO2 in surface water following the relationship given in Kump and Arthur (1999). The estimated pCO2 showed a seasonal pattern with higher values during LSM compared to SIM which agrees with the seasonality in pCO2 values of the surface waters documented from the region. However, the range in the variability of the predicted pCO2 during the two sampling periods was higher than the reported values. This may be due to the mixing of the sedimentary organic matter with those from the terrestrial sources. The negative excursions observed in δ13Cinorg along the western continental shelf indicate the potential of it being used as a proxy for sedimentary organic carbon accumulation observed especially along the hypoxic/anoxic zones.

Reference: Kump, L.R., Arthur, M. A., 1999. Interpreting carbon-isotope excursions: carbonates and organic matter. Chemical Geology 161, 181 – 198.