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Spectrophotometric Measurements of the Carbonate Ion Concentration: Aragonite Saturation States in the Mediterranean Sea and Atlantic Ocean

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Measurements of ocean pH, alkalinity, and carbonate ion concentrations ($[CO_3^{2-}]$) during three cruises in the Atlantic Ocean and one in the Mediterranean Sea were used to assess the reliability of the recent spectrophotometric $[CO_3^{2-}]$ methodology and to determine aragonite saturation states. Measurements of $[CO_3^{2-}]$ along the Atlantic Ocean showed high consistency with the $[CO_3^{2-}]$ values calculated from pH and alkalinity, with negligible biases (0.4 ± 3.4 μmol·kg^{-1}). In the warm, salty, high alkalinity and high pH Mediterranean waters, the spectrophotometric $[CO_3^{2-}]$ methodology underestimates the measured $[CO_3^{2-}]$ (4.0 ± 5.0 μmol·kg^{-1}), with anomalies positively correlated to salinity. These waters also exhibited high *in situ* $[CO_3^{2-}]$ compared to the expected aragonite saturation. Their very high buffering capacity allows the Mediterranean Sea waters to remain over the saturation level of aragonite for long periods of time. Conversely, the relatively thick layer of undersaturated waters between 500 and 1000 m depths in the Tropical Atlantic is expected to progress to even more negative undersaturation values. Moreover, the northern North Atlantic presents $[CO_3^{2-}]$ slightly above the level of aragonite saturation, and the expected anthropogenic acidification could result in reductions of the aragonite saturation levels during future decades, acting as a stressor for the large population of cold-water-coral communities.