Origin of authigenic carbonates from the NW continental margin of Madagascar (Marine expedition Pamela-MOZ01): a mineralogical and geochemical investigation

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Authigenic carbonates may form near cold seep areas as the result of increased alkalinity associated with the oxidation of methane. This often occurs under anoxic conditions (i.e., Anaerobic Oxidation of Methane) via anerobic pathways such as sulfate reduction. This combination promotes pyrite formation near the Sulfate-Methane Transition Zone, and leads to the formation of morphologically distinct carbonates such as concretions, chimneys, plates and nodules. In order to define their nature and origin, we studied the mineralogical and geochimical properties of diverse authigenic carbonates from the margin of Madagascar smapled during the oceanographic expedition Pamela - Moz 01. The oceanographic expedition Pamela-Moz01 (http://dx.doi.org/10.17600/14001000) was co-funded by TOTAL and IFREMER as part of the PAMELA (Passive Margin Exploration Laboratories) scientific project

We present here the results of an electron microscopy, trace and rare earth element, and C and O isotope study on Majunga Basin's carbonates. We found two contrasting morphologies with disctinct geochemical signatures. Massive carbonate conduits, show $\delta^{13}C_{carb}$ values between -53.4‰ and -61.2‰, with $\delta^{18}O_{carb}$ values varying between +3.7‰ to +6.1‰. They present low concentrations of U and Mo but are enriched in Ni. Smaller concretions (1 to 2 cm in diameter) bear an isotopic signal that is heavier in carbon (between -40.5‰ and -48.1‰ and lighter in oxygen (between +2.4‰ and +4.2‰). The concretions are also characterized by higher U and Mo concentrations. We suggest that the contrasting morphologies and geochemical signatures of these carbonates relate to differences in their local environment of precipitation (depth in the sediment, methane flux).