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Quantifying biogenic versus detrital carbonates on marine shelf: an isotopic approach

Virgil Pasquier (1,2), Sidonie Revillon (2,3), Estelle Leroux (4), Stephane Molliex (2), and Marina Rabineau (2)

(1) Earth and Planetary Sciences department, Weizmann Institute of Sciences, Rehovot, Israël (virgil.pasquier@weizmann.ac.il), (2) IUEM, UMR CNRS 6538 « Laboratoire Géosciences Océan », Université de Bretagne Occidentale, 29280 Plouzane, France , (3) SEDISOR, IUEM, Place Nicolas Copernic, 29280, Plouzane, France (sidonie.revillon@sedisor.eu), (4) IFREMER, Laboratoire Géodynamique et enregistrements Sédimentaires, BP70, 29280 Plouzané, France

Variations of past sedimentary fluxes over Earth history can be used to infer substantial past variations of Earth surface deformation processes or climate change, the relative importance of these factors being a key issue in sedimentology. Accurate estimates of sediment fluxes over various time and space scales are therefore required as a critical input factor to numerical stratigraphic models. Offshore sediment sequence volumes take into account siliciclastic accumulation by removing the carbonate fraction, considered only as in-situ biogenic production (i.e. $CaCO_3$). Here we propose a new geochemical Sr-isotope based methodology to quantify the potential amount of detrital carbonates in comparison to in situ produced biogenic carbonates. This isotopic approach enables taking into account the export of detrital carbonates, and investigates its effect. We tested our approach on the Gulf of Lion sediment budget relying on on a 300 m long sediment borehole located at the shelf break and covering the last 500 000 years (i.e. 5 glacial-interglacial cycles). Our 86Sr/87Sr isotopic data (0.70809 to 0.70858) are significantly less radiogenic than modern seawater (0.7092) and show fluctuations in agreement with stratigraphic and climatic variations. These results suggest an unsuspected high export of detrital carbonates from the catchment area during both glacial (between 55 to 85% of the sedimentary carbonate fraction) and interglacial (between 30 to 50%) conditions. Thus, not only do detrital carbonate fluxes need to be factored into sediment flux calculations, but these results also suggest that detrital carbonate components could potentially have a strong influence on carbonate-based 86Sr/87Sr seawater records when obtained from bulk sediments, such as the entirety of the Precambrian Sr chemostratigraphic record.