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Using extraterrestrial ^{3}He as a new tool to reconstruct terrigenous fluxes and their impacts on primary production and carbon burial during OAE2 in the Vocontian Basin

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The Mesozoic was punctuated by several Oceanic Anoxic Event (OAE) characterised by widespread black shale deposition and global carbon cycle perturbations. Among them, the OAE2 spanning the Cenomanian-Turonian boundary (~ 94 Ma), has been identified as one of the most severe OAE of the Mesozoic. Lasting ~600 ka, this event is marked by a global > 2‰ positive excursion in the $d^{13}C$ signature of both carbonates and organic matter, interpreted as a massive burial of isotopically light organic carbon driven by a deoxygenation of bottom seawater. Previous models suggested that volcanism related to Large Igneous Provinces (LIPs) increased atmospheric and oceanic CO_2 concentrations, thereby increasing nutrient input to the ocean and marine primary production and decreasing seawater oxygenation. However, the role of enhanced weathering and accelerated continental fluxes on marine primary productivity and organic carbon burial during OAE2 remains highly debated. The successive sequences of events of these mechanisms need to be better constrained with better and highly resolved chronologies. In this study, we use new extra-terrestrial ^{3}He ($^3He_{ET}$) measurements from hemipelagic marine samples from Pont d'Issole (Vocontian Basin) to reconstruct carbonate, organic carbon and terrigenous sedimentation rates and fluxes across the OAE2. Our results reveal that over 80 % of the ^{3}He in the analysed samples is extraterrestrial in origin. Assuming a constant flux of Interplanetary Dust Particles [1], the $^3He_{ET}$ concentrations allow reconstructing relatives changes in sedimentation rates at an unprecedented high resolution (every 15 cm). Our preliminary results suggest a nearly constant flux of terrigenous input across the OAE2 across different carbonate-rich and carbonate-poor lithologies, implying that carbonate poor layers correspond to a starving of the carbonate productivity. The implication of our new $^3He_{ET}$ data will be discussed in the context of the debated role of increased detrital input and organic carbon burial during the OAE2.

References:

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