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Mo-isotopes evidence for widespread anoxia during OAE-2

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Widespread deposition of C-org-rich sediments in the Cenomanian-Turonian (C-T) transition is interpreted as evidence of a major decrease in ocean oxygenation, currently known as Oceanic Anoxic Event 2 (OAE-2). The OAE-2 is considered the result of increased plancktic microbiologic activity, though a major decrease in marine benthic and macro faunas is observed; and a rapid rise of the sea level leading to oceanic stratification. The extent of this oceanic oxygen depletion, however, is not yet understood. Because Mo is scavenged out of the ocean by authigenic enrichment in sediments under oxygen deficient conditions, [Mo] have been used to evaluate extent of ocean oxigenation. However Mo incorporation into the sediment may vary according to the lithology, sedimentation rate, extent of C_{org} export to the bottom ocean and water collum [H_2S]

We suggest that Molybdenum (Mo) isotopy represents a valuable tool to evaluate the extent of ocean anoxia. Here we report on .$\delta^{98/95}$Mo $_{(MOMO)}$(MOMO=Mean Ocean Molybdenum) isotope stratigraphy of deepening-upwards sediment sequences in NE Mexico (the Indidura and Agua Nueva Fms) consisting of partially fossiliferous marl and limestone, deposited during the C-T transition. Deep marine carbonates of the Indidura Fm predate the OAE-2 and display .$\delta^{98/95}$Mo$_{MOMO}$values averaging -2.2‰. Up-section, deep marine shaly carbonates and limestones deposited during OAE-2 display .$\delta^{98/95}$Mo$_{MOMO}$values between -1.5 and -1.8‰. Open marine fossiliferous carbonates of the Agua Nueva Fm postdate the OAE-2 and present

.$\delta^{98/95}$Mo$_{MOMO}$values between -2.2 and -2.9. The overlying limestone-marl alternation provides .$\delta^{98/95}$Mo$_{MOMO}$values between -1.8 and -3.0‰. These changes in .$\delta^{98/95}$Mo$_{MOMO}$values reflect major changes in redox conditions, with a deposition of OAE-2 carbonates under anoxic/sulfidic conditions, and carbonates pre and post-dating this event deposited under sub-oxyc conditions. This interpretation is supported by the micropaleontological data. A similar succession of .$\delta^{98/95}$Mo$_{MOMO}$ isotopic values was previously described by Gordon et al. (2005) in black shales of C-T boundary age of the Damera Rise and coeval radioloarian rich sediments at Furlo, Italy. This indicates that authigenic enrichment of Mo during this period of pronounced anoxia and euxinia was independent from the lithology and reflect the extent of ocean oxygenation. Mo-isotopic composition of sediments thus provides a more robust tool to infer changes in the redox conditions of ancient oceans than [Mo] alone.