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Coupled high-resolution Ni and Mo isotope evolution of the Late Cretaceous ocean

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Nickel (Ni) isotopes are an emerging tool for understanding the biogeochemistry of the oceans [1,2], in particular the size of the manganese (Mn)-oxide sedimentary sink that removes light Ni from the dissolved pool [3]. But they have yet to be applied extensively to Earth history. Here, we present a new Ni abundance and isotope record for the Late Cretaceous. This period of time saw the Cenomanian-Turonian Anoxic Event (OAE 2), the last major global oceanic anoxic event of the Mesozoic [4]. The OAE-2 was preceded by the Mid-Cenomanian Event (MCE), considered to be a point of no return in the evolution of the Cenomanian ocean and atmosphere [5], and punctuated by the re-oxygenation and cooling of the Plenus Cold Event (PCE) [4]. The record derives from core SN°4 in the Tarfaya Basin, a proto-North Atlantic coastal upwelling region similar to modern upwelling settings [6]. Today, sediments from these settings record the $d^{60}Ni$ of the global ocean, at 1.33‰ [1,2].

Nickel isotopes in organic-rich sediments from the Paleozoic and Mesozoic all suggest a contemporary ocean with a lighter isotope composition than today, implying a smaller light isotope sink to Mn-oxide-rich sediments [7]. The new 3 Myr high-resolution record presented here extends from the Early Cenomanian to the Late Turonian. The sediment data suggest that seawater $d^{60}Ni$, as well as $d^{98}Mo$ [6], increased after the MCE, with relatively constant values of around +1.0‰ and +1.6‰, respectively, during OAE2. During the PCE, however, the data suggest that seawater $d^{60}Ni$ reached the modern value of around +1.3‰ for the first time. We will further explore the potential mechanisms for the observed evolution of seawater $d^{60}Ni$, and the evolution of the Mn-oxide sink for Ni, over the Late Cretaceous.

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