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The nickel isotope evolution of seawater through the Phanerozoic Eon

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Nickel (Ni) isotopes show a homogenous composition in the modern deep ocean [1-4]. This composition is heavier than the main inputs from the continents, controlled by the relative outputs to the competing sinks, with the output to Mn-rich sediments being the main lever that drives the modern ocean to its heavy value [5]. It has recently been [6] shown that the $d^{60}Ni_{auth,}$ the $d^{60}Ni$ obtained from the authigenic fraction, of modern ocean sediments in upwelling regions records the $d^{60}Ni$ of contemporaneous seawater. Thus, measurements of ancient upwelling sediments have the potential to track the secular evolution of whole-ocean $d^{60}Ni$.

Here we investigate high TOC (>3%) shales of different ages spanning the Phanerozoic Eon. We present bulk sediment $d^{60}Ni$, corrected for its detrital component, to track the secular changes to $d^{60}Ni_{auth}$, and thus contemporaneous seawater. Our results show a relatively constant $d^{60}Ni_{auth}$ of around +0.7‰ from the late Cambrian through to the Mesozoic-Cenozoic boundary. This value is similar to the modern value of the dominant riverine input to the oceans [1]. In the early Cenozoic $d^{60}Ni_{auth}$, and thus contemporaneous seawater, increases to the modern value of around +1.3‰. The most likely explanation for this change is an increase in burial of Mn-oxide-rich pelagic sediments in the early Cenozoic. We explore these changes in the context of changing biogeochemical and redox conditions of the deep ocean during the Phanerozoic.

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