

Sr isotopes at the onset of the Ice Ages

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The radiogenic $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratios are used to trace sources of Sr to the oceans. Temporal variations of the marine $^{87}\text{Sr}/^{86}\text{Sr}$ ratios were reconstructed by analyzing marine macro- and microfossils (e.g. brachiopods and foraminifera). The recent research on stable $^{88}\text{Sr}/^{86}\text{Sr}$ isotope ratio (expressed by $\delta^{88/86}\text{Sr}$ notation) opened new ways to constrain the Sr budget of the oceans. So far $\delta^{88/86}\text{Sr}$ data are available for limited intervals of the oceans history. Here, we set to examine the behavior of radiogenic and stable isotopes of Sr during the time interval of the Pliocene to early-Middle Pleistocene – upon the onset of Ice Ages in the northern hemisphere. We collected marine fossil mollusks (gastropods, pectinids) and brachiopods from outcrops of Stirone River in the northern Apennines, Italy. The outcrops expose the sedimentary section that was deposited between ~ 5 to 0.9 Ma within the PaleoAdriatic Sea. We determined the fractionation factors for the gastropods and pectinids to be $\Delta^{88/86}\text{Sr} = -0.15 \pm 0.02\text{‰}$ and used $\Delta^{88/86}\text{Sr}_{\text{brachiopod}} = -0.21\text{‰}$ for brachiopods (Vollstaedt et al. 2014). The fractionation factors were used to calculate $\delta^{88/86}\text{Sr}$ in seawater using the $\delta^{88/86}\text{Sr}$ values of Pliocene to mid-Pleistocene fossils. While there is a distinct rise in $^{87}\text{Sr}/^{86}\text{Sr}$ ratio, the $\delta^{88/86}\text{Sr}$ ratio in seawater remained virtually constant ($0.38 \pm 0.02 \text{‰}$) during the studied time interval.