

Evolution of strontium isotopes in seawater during the middle Miocene : High resolution $^{87}\text{Sr}/^{86}\text{Sr}$ results from ODP site 758A

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Abstract : The $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of seawater has increased significantly over the last 40 Ma. This increase was marked by very high rate of increase in $^{87}\text{Sr}/^{86}\text{Sr}$ and almost zero growth rate. The Miocene is extremely important because of the considerable changes reported in the strontium input into the oceans through rivers as a result of variations in continental weathering rates and Himalayan uplift. During the early Miocene, the rapid increase in $^{87}\text{Sr}/^{86}\text{Sr}$ has been attributed to the high rates of chemical weathering and dissolved riverine fluxes to the oceans. However, during much of the middle Miocene the stratigraphic resolution is poor because of the scarcity of high resolution $^{87}\text{Sr}/^{86}\text{Sr}$ data from these sections. This study tests and improves on previously published strontium isotopic records for this period.

We report here 34 high precision strontium isotopic analyses of well preserved planktonic foraminifera from Ocean Drilling Program (ODP) site 758A in the eastern Indian Ocean. This site was selected because of the high quality magnetostratigraphy, suitable sedimentation rate (0.3 to 1.5 cm/ka) and excellent preservation of calcareous microfossils in sediments. Samples studied represent the period from 15.2 Ma to 10.3 Ma with approximately one sample per 100-200 ka.

The results show that the seawater $^{87}\text{Sr}/^{86}\text{Sr}$ ratio during this period increased from 0.70881 to 0.70892. The rate of increase in $^{87}\text{Sr}/^{86}\text{Sr}$ during 15.2 Ma to 14.3 was $\sim 31 \times 10^{-6}/\text{m.y.}$, whereas $^{87}\text{Sr}/^{86}\text{Sr}$ increased significantly ($\sim 66 \times 10^{-6}/\text{m.y.}$) from 14.3 to 12.8 Ma. High rate of growth in seawater $^{87}\text{Sr}/^{86}\text{Sr}$ during this time interval indicates exceptionally high rates of continental weathering. However during 12.8 to 10.3 Ma the growth in $^{87}\text{Sr}/^{86}\text{Sr}$ of seawater remained almost constant with an average value of 0.708918. This constant value may be due to decrease in weathering rates of continents as a result of extensive glaciation. It is suggested that the tectonic uplift and denudation of Himalayas coupled with climatic changes have resulted in the variations of seawater strontium isotopes during this period. The inflection points in the curve may be used as event marker for stratigraphic correlation of marine sediments.