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Dynamic topography, endoreism, and the 87Sr/86Sr curve

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The trend of the 87Sr/86Sr ratio in oceanic waters displays two maxima during the Cambrian and present-day, and a minimum during the Jurassic, overprinted by shorter wavelengths oscillations ($\sim$40 Myrs). Those variations are interpreted as a direct proxy for the flux of continental sediments into the oceans associated to orogenic events. We interpret the frequent mismatch between theory and observations by the sequestration of sediments into continental basins, which consequently starves the ocean from 87Sr rich sediments. Not only the short-term, but also the long-term (Phanerozoic) evolution of the 87Sr/86Sr curve could evidence endoreic/exoreic cycles controlled by the dynamic deflection of the topography of continents above subduction zones. During endoreic phases, the erosional product is only partially, if any, redistributed in the global oceans. It is instead sequestrated in the form of widespread continental deposits. Conversely, during exoreic phases, the sedimentary flux into the oceans cumulates the contribution of the erosional product of the relief (which is directly exported into the ocean) and the release of the sediment load that was sequestrated during endoreic phases. Such cycles modulate the isotopic composition of the ocean waters accordingly.

The dynamic deflection of the topography that is associated with orogenic cycles provides a good explanation for periods of short-term (20-40 Myrs) endoreism: widespread hinterland basins due to the dynamic topography above the subducting slabs that are associated to mountain building. Such basins are capable of storing tremendous amounts of sediments, a process that is further reinforced by the sequestration of sediments in intra-mountainous basins. This cycle is well illustrated by the foreland stratigraphy during the Variscan orogeny. The long wavelength of the 87Sr/86Sr trend is that of the Wilson cycle. During supercontinental aggregation, centripetal subductions zones promote the widespread development of dynamic basins above the slabs, in the center of Pangea. These basins have no outlet to the ocean, and thus starve the ocean from 87Sr rich sediments. Conversely, exoreism is expected to increase during continental breakup, as corroborated by the isotopic record. The 87Sr/86Sr ratio is thus a proxy for endoreism at various time scales, and as such shall not be regarded as an indicator of continental erosion.