

Comparisons of lithium, calcium and strontium isotopes in modern stromatolites and abiotic carbonate sediments: implications for reconstruction of the Precambrian seawater chemistry

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The isotopic composition of metal elements in marine carbonates provides valuable insights into past seawater conditions, while vital, depositional and diagenetic effects may have reshaped the original information of marine carbonates. This study explores the behavior of lithium (Li), calcium (Ca) and strontium (Sr) isotopes in different modern shallow-water carbonates, including stromatolites from Shark Bay, Western Australia, and inorganic carbonate sediments from the South China Sea, to elucidate the mechanisms governing their incorporation during the depositional and diagenetic processes of syn-depositional carbonates. The investigation aims to constrain the isotopic fractionation of Li, Ca and Sr as a function of environmental factors, including temperature, salinity, and microbial activity, in different depositional environments. The results are compared with theoretical models of isotopic behavior in carbonate systems, as well as with existing data from ancient stromatolite deposits. By integrating isotopic data from both modern and ancient carbonates, this study seeks to refine proxy applications of different metal isotopes for the reconstruction of ancient seawater chemistry, particularly during times of extreme environmental conditions. This work will contribute to the development of novel geochemical proxies for understanding the dynamics of Earth's early oceans and the evolution of marine biogeochemical cycles.