

## **How seawater sulfate concentration affects foraminifera biology and CAS incorporation**

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Since the early Carboniferous (~359 Ma), a major part of carbonates formed in seawater are foraminifera tests. Herein, some of the conditions encountered by the living foraminifera can be reconstructed from carbonate proxy analysis. Such information can only be considered reliable if the mechanistic basis of these proxies as well as the occurrence of vital effects exerted on it, are constrained. Recently, S isotopic composition of carbonate associated sulfate ( $\delta^{34}\text{S}_{\text{CAS}}$ ) has been used to reconstruct past seawater sulfate  $\delta^{34}\text{S}$ , using calibrations made on modern species. However, seawater sulfate concentration variations might have affected calcification, CAS incorporation and associated isotopic fractionation. In order to determine how such variation can affect  $\delta^{34}\text{S}_{\text{CAS}}$  record, we performed culture experiments of benthic species of foraminifera reproducing in artificial seawater with different sulfate concentrations (from 0 to 120mM). Foraminifera reproduction rate was highly sensitive to small variation in seawater sulfate concentration. S concentration in the test also varied proportionally to culture medium concentration until reaching a plateau. Despite this high sensitivity, the  $\delta^{34}\text{S}_{\text{CAS}}$  is stable, with a constant fractionation to seawater characteristic of each foraminifera species. Our results confirm that  $\delta^{34}\text{S}_{\text{CAS}}$  use in foraminifera, despite seawater sulfate concentration variations through geological times, constitutes a good proxy for seawater  $\delta^{34}\text{S}$ . The study however illustrates how changes in seawater chemistry, by affecting the biology of some organism, can affect carbonate accumulation in sediments.