The Late Miocene Sorbas basin: precessional variability of $^{87}Sr/^{86}Sr$ and implications for marginal basin hydrologic budgets

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The Sorbas basin (SE Spain) has been studied extensively as it holds key stratigraphic information about the Messinian Salinity Crisis (MSC; 5.969 to 5.333 Ma [1,2]). This catastrophic climate event sequestered 6% of global ocean salt in the Mediterranean and may have impacted global thermohaline circulation. The sedimentary record of the MSC indicates extreme salinity fluctuations resulting in deposition of km-thick evaporites; yet consensus on the causes of these fluctuations has not been reached after more than 40 years of research. In this study, foraminiferal $^{87}Sr/^{86}Sr$ compositions from marls deposited just prior to MSC onset (6.61 to 6.55 Ma) in the Sorbas basin were investigated at sub-precessional temporal resolution. The Sr results are used to reconstruct the hydrologic budget of the basin using numerical box modelling, constrained with results from sub-precessional simulations carried out with a general circulation model.

The $^{87}Sr/^{86}Sr$ record shows precessional cyclicity with ratios more radiogenic than coeval ocean water occuring regularly near insolation minima, while intermediate times exhibit ratios within error of ocean water [3]. Our box modeling indicates Sorbas experienced a positive hydrologic budget during this time in contrast with the Mediterranean's negative hydrologic budget. The model results also demonstrate that restriction of inter-basin exchange is not always the primary control on basin $^{87}Sr/^{86}Sr$. Our results support the hypothesis that a marine transgression [4] may have been synchronous with Lower Evaporite gypsum deposition in Sorbas, and have implications for Atlantic-Mediterranean exchange during the MSC.

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