

New constraints on the Messinian Salinity Crisis from IODP Expedition 401

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The Messinian Salinity Crisis (MSC; 5.97–5.33 Ma) represents one of the most extreme periods of environmental change for the Mediterranean region. Changes in the flow of water and salt between the Atlantic and Mediterranean, which ultimately led to the accumulation of thick evaporite deposits, may also have had broader, global consequences. High-salinity waters flowing out of the Mediterranean would have influenced the density of North Atlantic Deep Water and impacted global thermohaline circulation, as they do today even with modest levels of salinity relative to those predicted for the MSC. In addition, Messinian evaporites contain a considerable mass of salt relative to the whole ocean inventory, and the impact of the MSC on the calcium budget could potentially alter the balance of calcium carbonate deposition, the carbon cycle, and the climate. To investigate these processes, International Ocean Discovery Program (IODP) Expedition 401 was designed to recover sediment cores that document the history of dense bottom currents and environmental conditions from both sides of the Atlantic–Mediterranean gateway during this dynamic time interval.

We will share some preliminary results from IODP Expedition 401, which took place from December, 2023, to February, 2024, and successfully recovered near-continuous records covering the late Miocene. Among the unexpected findings from the expedition was the discovery of high-salinity interstitial waters at Site U1611 in the Western Alboran Basin. The salinity maximum of 70, showing parallel increases in both chloride and bromide, lies over 1 km below the present-day seafloor and just a short distance below the sediments deposited during the MSC. We interpret these interstitial waters to be the remnants of a Messinian-aged paleobrine that developed during the lead-up to evaporite deposition elsewhere in the Mediterranean. The existence of the paleobrine and the sediments that host it place key constraints on salinity changes within the Alboran Sea, the timing and nature of connection between the Atlantic and Mediterranean, and the possible global influence of the Messinian Salinity Crisis.