Messinian records from the Central Balearic depression support a recycled origin for the "Upper Gypsum" of stage 3

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Résumé

During the Messinian Salinity Crisis (MSC, 5.97-5.33 Ma), the Mediterranean domain became a vast saline basin and over one million cubic kilometers of evaporites deposited, with layers exceeding 1 km in thickness in deep basins. Since the 1970s, debate has persisted over the causes, timing, and mechanisms of the MSC. A key issue is due to the complete geological record being only in deep basins, while elsewhere, MSC deposits appear as incomplete sequences, disconnected as they are separated from each other by a widespread erosion surface. Current models however rely strongly on onshore outcrops, especially in Sicily, where the MSC is represented by three phases: Lower Gypsum (Stage 1, 5.97–5.60 Ma), Salt (Stage 2, 5.60–5.55 Ma), and Upper Gypsum with the Lago Mare phase (Stage 3, 5.55-5.33Ma). A major debate surrounds the nature of the Upper Gypsum (whether the origin of its calcium sulfate ions is primary or reworked) with implications for Mediterranean-Atlantic-Parathetys connectivity during the final MSC phase. In this study, we examine the Balearic Promontory, where topographic lows forming perched basins contain well-preserved MSC sequences, especially in the Central Mallorca Depression (CMD), which can be seen as an analog to the Sicilian basin. CMD holds the three MSC phases including gypsum from Stage 1, which originally deposited along basin borders and was later eroded. We demonstrate that this eroded volume matches the amount of material deposited above the salt in the CMD depocenter, forming Stage 3 Upper Gypsum. This supports the idea that no external Atlantic water input is required to explain the origin of Upper Gypsum ions in Stage 3. We propose that the CMD acted as an endorheic basin during part of the MSC: gypsum deposited during Stage 1 was subaerially eroded as water level dropped, and redeposited or reprecipitated as gypsum, above halite, during Stage 3.

Mots-Clés: gypsum recycling, Messinian stage 3, volume balance

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