Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35982

Coupled $\delta^{18}O$ analyses of lacustrine carbonates and gypsum enable quantitative temperature reconstructions in the southwestern Iberian Peninsula during the early to mid-Holocene transition

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Oxygen stable isotopes of gypsum hydration water (GHW) and carbonate shells in lakes can be used as independent proxies for qualitative paleoclimate reconstructions. However, tandem $\delta^{18}O$ measurements in both minerals, when formed at the same time, permit quantitative paleotemperature estimates. We apply this approach to reconstruct lake water temperatures during the early to mid-Holocene transition from the sediments of Laguna de Medina playa-lake (SW Spain). The $\delta^{18}O$ values of ostracod (*Cyprideis torosa* and *Plesiocypridopsis newtoni*) and foraminifera (*Ammonia beccarii*) shells are combined with the $\delta^{18}O$ values of paleo-lake water reconstructed from GHW. Based on species ecology, ostracod assemblages (9.1 to 7.7 kyr) are interpreted to record warm-season lake water temperatures. In contrast, foraminifera (8.1 to 7.7 kyr), which do not co-occur with ostracods, likely reflect time-integrated, multi-seasonal water temperatures. Our results show that ostracod-GHW-based water temperature from 8.3 to 8.1 cal. kyr BP was 25±2.7°C, suggesting conditions broadly comparable to present-day warm-season temperatures in playa-lakes of southern Spain (27.2±4.6°C), including Laguna de Medina. Foraminifera-GHW-derived water temperature between 7.7 and 7.9 cal. kyr BP was 22.3±2.7°C, similar to that inferred from the same species at 8.1 cal. kyr BP (22.5±1.4°C), indicating no substantial shift in annual temperature associated with the so-called 8.2 ka cooling event. Other terrestrial and marine paleoclimate records from southern Europe indicate a modest cooling by ~1–2°C during this episode that cannot be clearly resolved by using our paleotemperature proxy. These results confirm the limited magnitude of temperature drop in southern Iberia associated with the 8.2 ka event.

Acknowledgments: This study was funded by the PALEOQUANT (P18-RT-871), GYPCLIMATE (PID2021-123980OA-I00), PALEONET (RED24-153734-T) and CLIMGYP (CNS2025-165139) projects of the Spanish Ministry of Science, Innovation and Universities. L.M. was funded by the FPU21/06924 grant of the Spanish Ministerio de Educación y Formación Profesional. J.C.P. acknowledges the Research Teaching Training contract PRE2022-103493 Ministry of Economy and Competitiveness of Spain.