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Marine influx hits Caspian Sea at the Pleistocene transition

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Landlocked basins like the Caspian Sea are highly sensitive to changes in their hydrological budget, especially at times of disconnection from the global oceans. Modifications to the balance of river runoff, evaporation and precipitation are hence transferred quickly to changes in water lever while subsequent reconnection to open marine conditions may result in complete environmental turnover. Here we reconstruct hydrological and environmental changes in the Caspian Sea basin, using compound-specific hydrogen isotope (δD) data on excellently preserved long chain n-alkanes and alkenones. These biomarkers were extracted from Pliocene to Pleistocene successions, including the Productive Series, Akchagylian and Apsheronian (as in the regional Caspian Basin nomenclature). Terrestrial plant wax long chain n-alkanes δDvalues reflect continental hydrological changes in the region surrounding the Caspian Sea. δDvalues of long chain alkenones, in contrast, are derived from haptophyte algae within the basinal water column and typically reflect changes in δD of Caspian Sea water. The δD valuesof the terrestrial long chain n-alkanes show a variation of 55‰ from as high as -120 ‰ at the base of the sampled section (at $\sim$ 3.55 Ma) to as low as -175 ‰ in the youngest part (at $\sim$ 2.2 Ma). The change towards constant $\delta D_{n-alkane}$ values around -175 ‰ appears to be correlated with the occurrence of alkenones in the sampled section suggesting a newly installed connection of the Caspian Sea with a marine basin at that time. This observation is supported by $\delta D_{alkenone}$ values of around -190 ‰ being similar to age-equivalent $\delta D_{alkenone}$ values recorded in the marine realm. Based on the appearance of alkenones in the Caspian Basin sections and on their δD values we conclude that during Akchagylian, at $\sim$2.5 Ma, the Caspian Sea became connected to the open ocean, permitting the influx of marine biota into the basin.