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Evidence for Late Miocene Mediterranean overflow from bottom current deposits within the Rifian Corridor (Morocco)

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Mediterranean Outflow Water (MOW) through the Gibraltar Straits was initiated around 5.33 Ma [1] and had reached its present strength by the Late Pliocene [2]. The potential impact of Pre-Pliocene ancestral MOW on climatic change has not been considered, because the gateway configuration was different. In the Miocene, the Mediterranean was connected to the Atlantic via two marine gateways, the Betic Corridor in southern Spain and the Rifian Corridor through northern Morocco [1]. These fossil corridors closed during the Late Miocene and have subsequently been uplifted, eroded and exposed on land as a result of Iberia-Africa convergence and westward drift of the Alboran plate.

This work presents a multidisciplinary study showing evidence for sandy-sheeted drift sediments that were deposited between 300 and 500 m water depth. These were generated by a dominantly westward overflow and associated bottom current flowing from the Rifian Corridor (N-Morocco) into the Atlantic in the late Tortonian (7.5-7.2 Ma) and probably during the early Messinian (7.2-6.3 Ma). These are a superb set of sandy siliciclastic contourites and their exposure on land provides an opportunity to explore in detail and 3D, a marine depositional system that previously has only been reconstructed from off-shore seismic, cores and from well-log data. We aim to understand how tectonics controlled sedimentation and in particular how this was expressed in changes of local deposition and structural deformation. Our results are integrated with regional tectonic constraints to evaluate the implications for Late Miocene paleogeographic and global-paleoceanographic evolution.

Potentially, only in the Late Miocene, did the Atlantic-Mediterranean connection become sufficiently restricted to result in a distinct salinity contrast between the two water bodies and initiate overflow. This saline Mediterranean water therefore first started to contribute to global thermohaline circulation during the Late Miocene with progressive strengthening of the overflow as Mediterranean salinity increased. We therefore suggest that paleo-MOW may have been an important driver of climate evolution at a time when ice at both poles was initiated for the first time in over 300 million years.

References:

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