Geophysical Research Abstracts
Vol. 20, EGU2018-14790-1, 2018
EGU General Assembly 2018

Pliocene history of Mediterranean-Atlantic exchange

Patrick Grunert (1), Ángela García Gallardo (2), Barbara Balestra (3), Carl Richter (4), Gerald Auer (5), Marlies van der Schee (6), José-Abel Flores (6), Francisco J. Sanchez (6), Farncisco Jiménez-Espejo (5), Carlos Alvarez Zarikian (7), Ulla Röhl (8), André Bahr (9), Stefanie Kaboth (9), and Werner E. Piller (2)

(1) University of Cologne, Institute of Geology and Mineralogy, Köln, Germany (pgrunert@uni-koeln.de), (2) University of Graz, Institute of Earth Sciences, NAWI Graz Geocenter, Heinrichstrasse 26, 8010 Graz, Austria, (3) University of California Santa Cruz, Institute of Marine Sciences, United States of America, (4) University of Louisiana at Lafayette, School of Geosciences, United States of America, (5) Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Department of Biogeochemistry, Yokosuka, Japan, (6) University of Salamanca, Department of Geology, Spain, (7) International Ocean Discovery Program, Texas A&M University, College Station, TX 77845, United States of America, (8) University of Bremen, MARUM – Center for Marine Environmental Sciences, Germany, (9) University of Heidelberg, Intitute of Geoscience, Heidelberg, Germany

Mediterranean Outflow Water (MOW) is a considerable source of heat and salt for today's North Atlantic and is considered to contribute to maintaining the Atlantic meridional overturning circulation (AMOC). There is evidence that MOW intensity varied on glacial/interglacial and stadial/interstadial timescales in the past, and that phases of MOW intensification potentially preconditioned thermohaline circulation for its interglacial mode in the late Pleistocene. Until recently, however, efforts towards a better understanding of MOW behavior through time and potential climatic feedback mechanisms between MOW, the African Monsoon, AMOC, and eustatic sea-level fluctuations have been impeded by the limitation of available sample material largely to the uppermost Pleistocene and Holocene. In 2011/12, IODP Expedition 339 drilled several sites in the Gulf of Cadiz and off the western Iberian Margin, recovering a total of 4.5 km of Pliocene to Holocene contouritic deposits of MOW.
In this paper, we present new findings on early MOW history from IODP Sites U1387 and U1389, specifically its onset after the Messinian Salinity Crisis and its behavior at the transition from the Pliocene warmhouse to Pleistocene icehouse climate. New micropalaeontological and geochemical records suggest that IODP Site U1387 is affected by Mediterranean water shortly after the opening of the Gibraltar Strait and before the onset of contourite drift deposition, representing the first indications of Mediterranean-Atlantic exchange. At IODP Site U1389, a substantially revised and refined age model for the time interval between 3.6 and 2.5 Myrs allows the evaluation of long- and short-term trends in data from XRF core-scanning and stable isotope analyses, and their comparison to proxy records from the Mediterranean and North Atlantic. Cyclostratigraphic analysis of Zr/Al records and grain-size data in well-recovered intervals suggest that the long-term strengthening of MOW at the onset of Northern Hemisphere Glaciation is underpinned by a strong precessional control on bottom current strength. Intensified Mediterranean–Atlantic exchange is further indicated by flat gradients of planktic δ^{18}O for the severe glacial Marine Isotope Stage (MIS) M2 and the initiation of the NHG (MIS G22, G14, G6–104). These periods correlate with the occurrence of ice-rafted debris (IRD) at low latitudes and weakening of the Atlantic Meridional Overturning Circulation (AMOC). Our results may thus suggest the development of a negative feedback between AMOC and exchange rates at the Strait of Gibraltar in the latest Pliocene as it has been proposed for the late Quaternary.
This study contributes to project P25831-N29 of the Austrian Science Fund (FWF) and is financially supported by grants of ECORD and the Max Kade Foundation.