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1 Mediterranean Sea freshwater budget evolution through glacial and interglacial times

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Micropaleontological and stable isotope records from foraminifera have been used to study the changes of sea-surface temperature and salinity of the Mediterranean Sea during the late Quaternary. Results show that the Mediterranean Sea Surface Salinity depends on that of the North Atlantic water crossing the Gibraltar Strait, on the residence time of salt within the basin and on the local freshwater budget. Under modern conditions, the evaporation exceeds the sum of precipitation and river discharge and the freshwater balance for Mediterranean Sea is negative. In the easternmost part of the Sea, surface salinity is higher than that of the incoming Atlantic water by about 3 ‰.

The Mediterranean freshwater budget was however completely different at the time of sapropels formation in the Eastern Mediterranean basin. During these intervals, the surface salinity of the Mediterranean Sea was either equivalent or slightly lower than at Gibraltar Strait. These salinity decrease events, not observed in the Atlantic Ocean, are best explained by an increase in the river runoff and precipitation over the Sea. The freshwater input was therefore able to equilibrate the water loss by evaporation and the Mediterranean Sea has ceased to be a concentration basin. The succession of benthic foraminifera assemblages preceding the apparition of each sapropel indicates that the decrease in the deep water dissolved oxygen content in the Eastern Mediterranean was gradual whereas the surface salinity decrease associated to the enhanced precipitation on the Mediterranean region was abrupt and synchronous with the beginning of organic matter preservation and the deposition of sapropel layer.

During the Last Glacial Maximum, water exchange between the Mediterranean Sea and the North Atlantic Ocean was reduced because of the sea level lowering and the resulting decrease in the Gibraltar sill depth. This increased the residence time of salt in the Mediterranean basin. Thus, glacial surface salinities were higher than today in the eastern basin, without a significant change of the freshwater budget.