HISTORY OF THE MEDITERRANEAN SALINITY CRISIS

Kenneth J. Hsü, Geological Institute, ETH, Zurich, Switzerland
Lucien Montadert, Institut Français du Pétrole, Rueil-Malmaison France.
Daniel Bernoulli, Geologisches Institute, Universität Basel, Basel, Switzerland.
Maria Bianca Cita, Istituto di Geologia, Universita, Milano, Italie.
Albert Erickson, Department of Geology, University of Georgia, Athens, USA.
Robert E. Garrison, Earth Sciences Board, University of California, Santa Cruz, USA.
Robert B. Kidd, Institute of Oceanographic Sciences, Wormley, U.K.
Frederic Mélières, Laboratoire de Géologie Dynamique, Université de Paris, Paris, France.
Carla Müller, Geologisch-Paläontologisches Institut, Johann Wolfgang Goethe Universität, Frankfurt, W. Germany.
Ramil Wright, Department of Geology, Beloit College, Beloit, USA.

An equatorial ocean was in existence during the Mesozoic between Africa and Eurasia; it was named Tethys. The Alpine Orogeny, culminating in the late Eocene and Oligocene, eliminated much of this ancient ocean. However, the relic Tethys, combined with the newly created post-orogenic basins, still managed to host a Mediterranean Seaway. The link was first broken in the Burdigalian with the collision of Africa and Eurasia along the Middle East front. This event started the gradual changes to cooler and drier climate in regions which were now situated on the west side of a continent.

Middle Miocene movements cut off forever the opening on the east to the Indo-Pacific. Also the Perialpine Depression north of the Alps was raised and the communication between the Mediterranean and the Paratethys was severed. The considerable freshwater supply from Central Europe was now diverted to the Paratethys, and the reorganization of drainages placed considerable strain on the water budget of the Mediterranean. Finally, soon after the beginning of the Messinian stage, the last opening to the Atlantic, the Betic and Rif Straits were closed. Evaporative draw-down of the isolated Mediterranean sealevel, leading to desiccation, became unavoidable, when the evaporative losses considerably exceeded the precipitation and the influx from rivers.

The Mediterranean Evaporite can be divided into two units. The deep-sea drilling did not penetrate the Main Salt or the lower unit. The history of the onset of the salinity crisis and of the early salt-deposition has been told by studies of sections on land. The records in Italy indicate a very sudden change from deep, open marine conditions to environments of shallow-water carbonate-evaporite deposition and of subaerial diagenesis. This first desiccation* was followed by the deposition of the Main Salt. A thick body of salt originated from the evaporation of seawater spilled over from the Atlantic into Mediterranean brine lakes of considerable depths.

An intra-Messinian desiccation led to widespread erosion and recycling of primary halites. The Upper Evaporite deposition followed a marine flooding which may have again filled the Mediterranean to the brim. Evaporative draw-down of the Mediterranean sealevel and the gradual concentration of the brines led to formation of evaporites characterized by the "bull's eye" pattern of saline zonation: Dolomite was the earliest mineral formed, followed by sulphate deposition. Halite was laid down on the bottom of playas, which are now abyssal plains, and the potash salts were restricted to the deepest and the very center of the Mediterranean basins. Repeated flooding and desiccation led to the accumulation of cyclically deposited sediments. Shallow-water diatoms and algal stromatolites proved that the basins were covered by very shallow waters during the flooding stage, and sedimentary structures indicate subaerial exposure during the desiccation stage, of those cycles.

The Mediterranean was underlain by a series of desert and salt lakes towards the end of the Messinian, when the eastern Mediterranean was inundated by brackish water probably from a Paratethys source. A number of lakes known collectively under the name Lago Mare came into existence. Marls, or dolomitic marls with an Ammonia-Cyprideis fauna were deposited in many of those lakes. The western Mediterranean may have remained desiccated before the Atlantic water began to spill over the western portal. The infill began with the deposition of marls with restricted marine, dwarf faunas.

The final and irrevocable flooding of the Mediterranean took place at the beginning of the Pliocene. Normal marine circulations prevailed ever since.

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* This event is considered as uncertain by some of us (L.M.)