Organic Geochemistry of Mediterranean Sapropels and Some Paleoenvironmental Implications

Walter SIGL*) and Bernd WENZLOW**)

*) Lehrstuhl für Geologie, Techn. Universität München, W-Germany

**)Lehrstuhl für Geologie, Geochemie und Lagerstätten des Erdöls und der Kohle, RWTH Aachen, W-Germany

Abstract

From the results of organic-geochemical analyses, some implications in respect of sapropel formation in the eastern Mediterranean are discussed.

Résumé

Les résultats d'une analyse organo-géochimique servent de base pour une discussion sur quelques aspects de la genèse des couches de sapropel dans la Méditerranée orientale.

* * *

The process of sapropel formation in the eastern Mediterranean during Plio-Quaternary times is still a point of dispute (1). This concerns the development of a stagnant deep-water body as well as the provenance of the organic material. Results of organic-geochemical analyses of Pleistocene sapropels offer some implications in respect of these problems.

Cores in investigation were taken during METEOR-cruises 17 (1969), 22 (1971) and 33 (1974). In addition, sapropel material from two VEMA-cores and seven RICHARD CONRAD-cores were kindly placed to our disposal by the Lamont-Doherty Geological Observatory, Core Laboratory. The study reported here is part of a larger investigation concerned with sedimentology of eastern Mediterranean cores. Financial support was given by the Deutsche Forschungsgemeinschaft.

Variations of organic carbon content (C_{org}) within sapropel layers are obviously reproducing the former conditions during stagnant periods in the eastern Mediterranean: internal distribution curves of C_{org} are well comparable in layers of the same age from different cores. They could be successfully used for correlation of cores from the Ionian Sea (2). New data from Pleistocene sapropel layer D (3) which was analyzed in 13 piston-cores suggest that this distinct stagnation period was simultaneously starting and comparably progressing through nearly the whole eastern Mediterranean basin. Stability of stagnation obviously increased with greater depth. This is indicated by higher C_{org}-maxima and less undulating C_{org}-values in cores from deeper locations.

Content and distribution of straight-chain saturated hydrocarbons (n-alkanes) have been repeatedly used as indicator of the origin of the organic material in sediments (4). In core 22M48 (Ionian Sea), Pleistocene sapropel layers D and E (3) and adjacent "normal sediment" (1) studied so far show significant variations in respect of alkane distribution. These may be interpreted as changes in the organic supply.

In general, a rather high influx of organic material from land must be assumed during deposition of the studied strata. This is indicated by a significant predominance of odd-numbered n-alkanes in the range between C_{23} and C_{33}, - a pattern which is typical for many land plants. Uranium content and isotopic ratios of C_{org} in the investigated sapropels support this indication (5). In both examined sapropels, the terrestrial influx generally increased during stagnant time and remained rather high in the yellow-brown sediment overlying the sapropels. In the grey basic layer below D, however, an increased contribution of marine organic material is indicated by a concentration of lower-weight n-alkanes in the range C_{16} to C_{22}.

Analyzing the grain-size fractions of three different sapropels in respect of their n-alkane content, we found that the terrigeneously derived material is dominantly linked to the clay fraction. It is well known that clay minerals to some extent are protecting organic compounds by adsorption. This may explain, how organic material from land can be transported and distributed over wide areas of the Mediterranean without being entirely decomposed.

References

(1) SIGL, W., CHAMLEY, H., GIROUD d'ARGOUD, G., MÜLLER, J., and FABRICIUS, F., 1977: Sedimentology and Environmental Conditions of Sapropels. - In: HSÜ, K.J., MONTADERT, L.C., et al., Initial Rep. Deep Dea Drill. Proj., Vol. 42 A (in press).

(2) SIGL, W. & MÜLLER, J., 1975: Identification and Correlation of Stagnation Layers in Cores from the Eastern Mediterranean Sea. - Rapp. Comm. int. Mer Médit., 23, 4a, 277-279.

(3) HIEKE, W., SIGL, W., and FABRICIUS, F., 1973: Morphological and Structural Aspects of the Mediterranean Ridge SW of the Peloponnesus (Ionian Sea). - Bull. Geol. Soc. Greece, T.X., 109-126.

(4) WELTE, D.H., & EBHARDT, G., 1968: Die Verteilung höherer, geradkettiger Paraffine und Fettsäuren in einem Sedimentprofil aus dem Persischen Golf. - "Meteor" Forschungsergebnisse, Reihe C, no. 1, 43-52.

(5) MANGINI, A., & SIGL, W., in press: Allogenic Uranium in Ionian-Sea Sapropels. - Rapp. Proc. Verb. Reunions CIESM, XXV^{o} Congr., Split 1976.