G-II12

A NEW UPPERMOST LIMIT OF SAPROPELIC SEQUENCE DEPOSITION IN THE AEGEAN SEA

G.C. ANASTASAKIS

National Centre of Marine Research, Aghios Kosmas, Hellinikon (Greece)

Previous work Anastasakis and Stanley (1986) has established the isodepth lines below which the uppermost, basin-wide Eastern Mediterranean sapropel (-lic) sequence S1 was deposited across the entire basin.In the Aegean the , up to date, data suggested an uppermost limit of S1 deposition of around 250m , which was located in the North Aegean Sea.Newly recovered cores from the Aegean revealed a new uppermost limit of S1 deposition in this marginal sea.

Cores recovered from the North Aegean Thermaikos gulf shelf-break region (cores T_1 and T_2 in Fig. 1) and the Saronikos shelf (core SAR-1 in Fig.1) revealed the existence of sapropelic sequences at much shallower depths than previously known. Both the Thermaikos gulf cores display a similar sapropelic sequence development: a greish mud passing into a yellow grey organic ooze becoming darker upward and seperated from the overlying olive-grey sapropelic sediment by a more or less pronounced sharp contact. The latter member ,in turn,is topped by a light greenish- grey ooze and a pale yellowish orange oxidised layer.Cores T_1 and T_2 were recovered from water depths 182m and 236m respectively.This lithofacies associations belong to one of the types of sapropelic sequences described by Anastasakis and Stanley (1984).Core SAR-1 which was recovered at water depth of 187m from the Saronikos gulf revealed a similar seaquence development.

The newly established uppermost depth of S1 deposition, of around 180m, further suggests that during S1 deposition, bearing in mind the low sea level, the oxygenated waters water lowest limit would have been around 100m in the Aegean Sea.The other interesting point is that both the sapropelic sequences from the gulfs of Thermaikos and Saronikos display the same sequence development and similar organic carbon contents

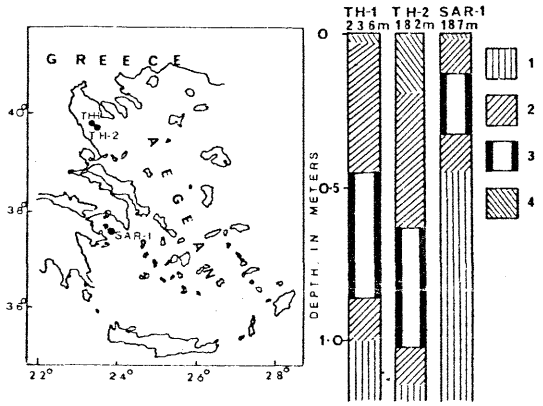

Fig. I ; Location map and core logs of the , up to date, shallowest recovered cores containing the uppermost basin-wide sapropelic seqence S1.The numbers along the margin of the legend indicate the basic lithofacies-members of the sequences: 1=grey hemipelagic mud, 2= organic booze, 3=sapropelic mud, 4= oxidised layer.

despite the fact that they are located in areas with different oceanographic regimes: The Thermaikos gulf has received ,during the deglaciation an increased fresh water supply from both ,the important river outflow from the north and the infered Black Sea outflow.However the Thermaikos gulf sapropelic sequence is quite similar to its Saronikos gulf equivalent which was further away from any important fresh water outflow.

References

Anastasakis, G. and Stanley, D. J. 1984.Sapropels and organic rich variants in the Mediterranean:Sequence development and classification. In; D.A.V. Stow and D.J.W.Piper (editors),Fine grained sediments, Deep water Processes and Facies. Geol. Soc. London Sp. Publ,15:497-510

Anastasakis, G. and Stanley, D.J. 1986. Uppermost sapropel in the Eastern Mediterranean:Sedimentological approach for interpreting paleogeography and stagnation.Nat. Geographic Soc. Research Reports, in press.

G-II13

ON THE ORIGIN AND GEOLOGICAL TYPE OF THE TUZLA SALT DEPOSIT IN YUGOSLAVIA. A TRACE ELEMENT STUDY OF NORTHUPITE AND HALITE

G. KNIEWALD[1], V. BERMANEC[2] and D. TIBLJAŠ[2]

(1) Center for Marine Research Zagreb, "Rudjer Boskovic" Institute, Zagreb, Croatia (Yugoslavia)

(2) Department of Mineralogy and Petrology, Faculty of Science, University of Zagreb, Zagreb (Yugoslavia)

Marine saline deposits have been receiving considerable attention, their mineral assemblages in particular, ever since the classic studies of Van't Hoff (1). Deposits of non-marine origin are generally less important from a commercial point of view and have thus been subject to fewer systematic studies.

The Tuzla salt deposit in the central part of Yugoslavia is the largest rock salt deposit in the Balkan peninsula. It is of middle Miocene age and is a good example of the salt-dome type of deposit. In recent years a number of detailed geological, palaeontological, mineralogical and other investigations have been undertaken. However, there is as yet no unequivocal evidence as to the geological origin of the deposit. The three possibilities include: a) a marine type of deposit

b) a salt-lake type of deposit

c) a mixed, shallow-lagoon type of deposit which would presume temporary contact of the lagoon with the open sea

The two latter types are usually defined as non-marine deposits.

In addition to the principal minerals halite, anhydrite, thenardite and carnalite, the assemblage comprises also several rare minerals such as northupite, nahcolite, probertite and bradleyite. Of these, northupite is especially interesting with regard to its origin and formation.

Northupite, $Na_2CO_3.MgCO_3.NaCl$ or $Na_3Mg(CO_3)_2Cl$ is a rare mineral, found in several places only, and Tuzla is one of the classic occurences of northupite. Earlier investigators believed northupite to be a diagenetic feature and hence proposed chemical schemes for its formation. More recent studies have, however, indicated that northupite probably forms by direct precipitation given favourable conditions, and can subsequently be incorporated into lacustrine or marine sediments (2).

In the Tuzla deposit northupite occurs as megascopic octahedral crystals in a greenish-grey marl matrix. The purpose of our study was to establish whether data on the trace metal contents of northupite and halite could provide some indication of their possible formation in a marine environment.

Preliminary determinations of Cd, Pb, Cu and Zn levels and ratios in halite from various salt-beds of the deposit as well as in associated brines displayed a surprising correspondence to the concentrations of these heavy metals in seawater (3). This was regarded as a possible argument for the marine origin of the deposit.

The trace element analysis of northupite and halite was performed by inductively coupled argon-plasma atomic emission spectrometry (ICPAES), this being a very sensitive analytical technique applicable for a wide range of elements. The results obtained are shown in Table 1.

Table 1. Trace metal concentrations in northupite and halite obtained by ICPAES (in ppm), and values for seawater (5)

	Northupite	Halite	Seawater (5)
Ca	720	40	400
Fe	1300	7	0.002
Mn	45	0.5	0.0002
Sr	20	12	80
Ba	10	0.3	0.002
Zn	15	1	0.005
Cu	15	1	0.0005

The results for northupite show no direct correlation with heavy metal concentrations in seawater, the values for halite being somewhat more representative of a K_d factor of approximately 0.5-1 x 10^3, indicating a possible marine or shallow-lagoon origin of the Tuzla deposit. Northupite, a complex mineral containing both the carbonate and chloride in its structure is probably an important adsorption agent for heavy metals in natural waters (4). Another probable cause for the change in trace element distribution in the Tuzla northupite are diagenetic transformation, this being in accordance with observed textural relations best explained by recrystalization after burial.

References:

1. Van't Hoff, J.H. Untersuchungen über die Bildungsverhältnisse ozeanischer Salzablagerungen. Akademische Verlagsgesellschaft, Leipzig, 1912.
2. Kilham, P. and Melack,J.M. Nature (Phys.Sci.Ser.) 238 (1972) 123
3. Brajković, Z. et al. Mineral. 2 (1986) in press
4. Vančina, V. et al. Geochim.Cosmochim Acta 50,87 (1986) in press
5. Brewer, P. Minor elements in seawater. In "Chemical Oceanography", (eds. Riley, Skirrow), Vol. 1, Academic Press, 1975, 416-490