A NEW HALOGENETIC MODEL FOR THE MIOCENE "SALINITY CRISES" OF THE EASTERN CENTRAL PARATETHYS AND MEDITERRANEAN BASINS

Jerzy LISZKOWSKI

Institute of Geology, A.Mickiewicz's University, Makow Polnych Str.16, 61-606 Poznan, Poland

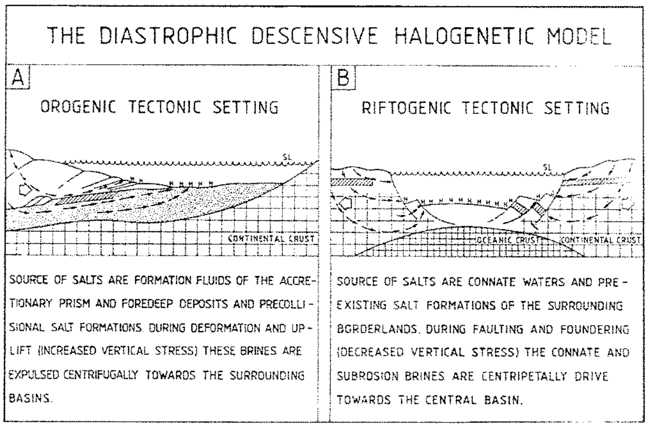
Thick Miocene salt formations are known from two areas of Europe mainly : from the eastern Central Paratethys Basins of the Carpathian region and the West and East Mediterranean Basins of the relict Neotethys. The first are of Lower to early Middle Miocene (Late Egerian- Eggenburgian, Karpatian and Middle Badenian) age, the second - of Upper Miocene (Messinian) age. The first occur in foredeep and back arc structural basins of the Carpathian thrust belt and are syn-collisional deposits, the second occur in deeply foundered extensional basins between the circum-Mediterranean Alpine thrust-belt chain and are mainly early post-collisional deposits. For both an evaporitic origin was and is up to now postulated, i.e. it is assumed that their deposition was climatically controlled. For the first a marine shallow water shallow basin to sebkha depositional model is mainly accepted, for the second, a dessicated marine shallow water deep basin depositional model proposed by HSU *et al.* (1973) is still accepted . In both cases the accepted evaporative genetic model and the proposed depositional models needs revision.

For the time of Lower and Middle Miocene salt deposition within the eastern Central Paratethys Basins of the Carpathian region paleobotanic, both macro- and micro- floral, and paleozoological data suggest a warm and humid, sometimes even wet Cfa, occasionally Cw (*sensu* Koppenen) climate, with precipitations exceeding evaporation; this excludes the possibility of extensive evaporitic salt deposition (LISZKOWSKI, 1989). The author also documented that the geologic setting, facies associations and internal fabric of the salt formations point for deep water depositional environment and that their lithofacies distribution, mineralogy and geochemical composition are in many respect quite unusual and do not fill the rules of the evaporitive genetic model. A new orogenic descensive halogenetic model was proposed for the salt formations discussed (LISZKOWSKI, 1989).

For the time of Upper Miocene (Messinian) salt deposition within the West and East Mediterranean Basins only in latest time GREGOR (1990) documented on the basis of both intensive and extensive analyses of macrofloral assemblages from many Miocene localities all around the European hinterland that : (1) no changes in floral composition in pre-, syn-, and post-Messiniam times occured, (2) there are no signs of arid or dry phases in the floras, meaning lack of "steppic", savanna - type or Mediterranean - type elements, and (3) the climate in Messinian time was wet, probably a certain Cw-climate (dry winter, wet summer), markedly different from the Recent Cs-climate of the Mediterranean area. He concluded, that the Messinian Salinity Crisis need another explanation.

The following genetic model for the Messinian salt formation of the Mediterranean Basins is proposed : as the result of the strong and rapid, collapse-like subsidence (foundering) of the basins and the rising thrust-belts surrounding them, a strong topographic and pressure gradient developed directed towards them. They acted as large-scale wells or sinks for groundwater flow. The drained groundwaters were very probably highly mineralized saline formation waters and brines with salinities up to 350 kg m^{-3} and more and mostly of the Cl-Na hydrogeochemical type. These dense and warm subsurface brines accumulate at the bottom of he basins. Precipitation of halite starts as the result of cooling and progressively continued in time. The salt precipitated start as deep-water deposits and only at the final stages the depositional environment probably changed into an shallow water one. No dessication of the Mediterranean basins occured. Simple mass bilance calculations for a wide range of realistic values of drawdown, hydraulic gradients, rock permabilities and groundwater salinities confirm the proposed model.

The proposed genetic model of Messinian salt deposition within the Mediterranean Basins as well as the postulated orogenic descensive halogenetic model for the Miocene salt formations of the Carpathian Paratethys Basins stress the active role of the tectonic and somewhat drop the importance of the climatic factor for giant salt deposition. Both models are end members of a more general diastrophic descensive halogenetic model (Figure). But they do not imply that the classic evaporative model is incorrect !



REFERENCES

GREGOR H. J., 1990. Contributions to the Late Neogene and Early Quaternary Floral History of the Mediterranean. *Palaeobotany and Palynology Review*, 62 : 309-338.

HSU K. J., CITA M. B. and RYAN W. B. F., 1973. The origin of the Mediterranean evaporities. *In*: Ryan W. B. F., Hsu, K. J. *et al.*, Initial Reports of the Dead sea Drilling Project., v.13, Washington, US Gov. Printing Office, p.1203-1231.

LISZKOWSKI J., 1989. A new halogenetic model for the origin of Lower and early MiddleMiocene salt formations of the Carpathian region eastern Central Paratethys. (*In* Polish, with Engl. and Russ. res.) Prace Naukowe Uniw. Slaskiego w Katowicach n°1019, Katowice 102 p.

DETAILED MICROPALEONTOLOGICAL STUDY OF THE DEEP-SEA CORE TTR3-80G FROM THE OLIMPI MUD-DIAPIRIC AREA (EASTERN MEDITERRANEAN)

Anna A. LOTOTSKAYA, Ekaterina M. IVANOVA

Paleontology Department, Moscow State University, Vorobjevy Gory, Moscow 119899, Russia

A dynamics of changes in the foraminifera and nannoplankton assemblages during the Quaternary are in common use as a key for an interpretation of climatic fluctuations and biostratigraphy of the Mediterranean region.

Detailed calcareous nannofossil and planktonic foraminifera quantitative analyses were carried out on 51 samples from the deep-sea core TTR3-80G. The core was raised from the Mediterranean Ridge plateau (to the south of Crete) at 33°39.00'N, 24°34.72'E, at a water depth 1877 m. This hemipelagic core includes "marker-bed" (manganese-rich thin black layer, dated as 4 kyrs B.P.), tephra layer Y-5 (40 kyrs B.P.) and 3 sapropels identified by their assemblages of planktonic foraminifera and calcareous nanofossils as S-1, S-5 and S-6.

The stratigraphic time framework is provided by correlation of isochronous lithologies and nannofossil biostratigraphy. The core sediments are represented by two biozones: *Emiliania huxleyi* and *E. huxleyi Acme*. The beginning of the *E. huxleyi Acme* Zone is calibrated with isotope/faunal stage 4 (53-54 kyrs B.P.).

Planktonic foraminifera were studied in a fraction greater than 125 m. For a quantitative analysis the samples were split to appropriate size, and about 300 specimens were identified and counted in each of the samples. In total 26 species of planktonic foraminifera were identified. Two main groups can be determined for the studied area on the basis of their ecology; "cool-water" assemblage includes such species as : *N. pachyderma, T. quinqueloba, G. bulloides*; "warm-water" assemblage : *Gs. ruber, Gs.acculifer, Gs. tennelus, G. rubescens, Gl. aequelateralis. N. dutertrei* was used as an index of surface water refreshing (law salinity index).

Changes in abundance of different calcareous nannoplankton species or pairs of species gives the opportunity to reconstruct the fluctuations between glacial and interglacial conditions over the last 200 kyrs : Riss glaciation (approximately 200-127 kyrs B.P.), Termination II (127-104 kyrs B.P.) and Wurm glaciation (approximately 104-10 kyrs B.P.). A short return to the warm conditions during the Riss glaciation is about 164-150 kyrs B.P., and during the Wurm glaciation - around 40 kyrs B.P. These boundaries are estimated using the rates of sedimentation (2.2-2.5 cm/kyr during the Pleistocene).

All recovered sapropels reveal peculiar assemblages of planktonic foraminifera and calcareous nannofossils. Sapropels S-1 and S-5 are represented by "warm-water" fauna and flora. On the contrary, sapropel S-6 contains "cool-water" assemblage, for planktonic foraminifera consisting of only 5 species. The productivity of foraminifera in that interval is about 10 times higher than in the rest of the core. It is also possible to determine warm - and cool - water intervals inside the sapropels.

The core reveals a great abundance of redeposited miocene-pliocene calcareous nannofossils probably originated from Moscow mud volcano. The absence of this material in sapropel layers shows that sapropels were deposited under the stagnant anoxic conditions.

G