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On the origin and geological type of the Tuzla salt deposit in Yugoslavia.
2. Trace element geochemistry of lithotype indicator minerals

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Since the pioneer studies of Van't Hoff (1912), evaporitic salt deposits of marine origin - particularly their mineral parageneses - have been the subject of much detailed investigation. The commercial importance of these deposits and the complex geochemical relationships of their formation have warranted extensive surveys with regard to the genetic implications of their geologic and geodynamic setting (Braitsch, 1971).

The rock salt deposit of the Tuzla basin in the central part of Yugoslavia comprises the central salt body of the Tušanj area and the recently discovered salt stock lense of the nearby Tetima area. The essentially stratified salt-dome type deposit is of middle Miocene age and is hosted by a sedimentary series which consists primarily of banded marls with anhydrite. The whole salt formation forms part of the Majevica range horst, which was a prominent feature of an archipelago in the Miocene sea. However, there is yet no unambiguous evidence as to the geological origin of the deposit (Kniewald et al., 1986). There are three possible formation models:

1. the mixing-zone model (which is of an estuarine or shallow lagoon type, implying temporary contact with the open ocean)
2. the hypersaline lake/lagoon model
3. the marine evaporitic deposition model

As dolomitic limestones are found closely associated with the salt beds, the mixing-zone model could account for dolomitization under non-evaporative, evaporative or seepage reflux conditions.

The principal minerals of the salt deposit are halite (rock salt), thenardite and anhydrite, the a(H_2O) indicator pair being thenardite and mirabilite. The other classic indicator couple gaylussite-pirssonite is however missing from the stratigraphic column. The assemblage comprises also several comparatively rare minerals - nahcolite, probertite, bradleyite and northupite.

Earlier investigations on the feasibility of northupite as a marine lithotype indicator have shown that this mineral is unsuitable for the purpose, probably due to its strong adsorptive properties as well as diagenetic transformations which have been observed on megascopic northupite crystals from the salt deposit (Kniewald et al., 1986). Halite was shown to be a considerably better indicator, but variations in the trace element contents biased rigorous correlation procedures. Thus, subsequent determinations of trace elements in samples of halite and assemblage minerals was performed and the results are given in Table 1.

Table 1. Trace element concentrations (ppm) in halite and assemblage minerals, obtained by inductively coupled Ar-plasma atomic emission spectrometry (ICP-AES). Seawater values are given as mol kg^{-1} (Bruland, 1983)

	Fe	Zn	Ni	Cu	Pb	Ca	Sr
Thenardite	0.75	1.00	0.32	0.16			0.016
Nahcolite	10.00	2.00	3.00			80.00	0.57
Halite 1	10.00	75.00		30.00	25.00		
Halite 2	10.00	80.00		20.00	25.00		
Halite + Thenardite	0.75	1.14	0.23	2.43			
Seawater	$1x10^{-9}$	$6x10^{-9}$	$8x10^{-9}$	$4x10^{-9}$	$1x10^{-13}$	$1x10^{-2}$	$9x10^{-5}$

Again, results for northupite and thenardite display no pronounced correlation with average trace metal levels in open ocean waters. Values for halite and nahcolite are somewhat representative of an enrichment factor of the order of magnitude of $0.5-2.0x10^3$. This could be taken as argumentation for the marine type or mixing-zone model with respect to the formation of the Tuzla salt deposit. Nahcolite, essentially $NaHCO_3$, is probably a convenient indicator mineral species, and its trace element content and distribution will be a matter of further research.

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G-IV1

Geophysical Investigation of Saros Bay and Its Implications

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On the basis of deep multi-channel seismics, shallow 40 cubic-inch airgun data and sonobuoy refraction studies, the structural and sedimentary sequence of the Saros Bay, and the area between the Gelibolu Peninsula and the island of Gökçeada have been elaborated including the results of available gravity and magnetic data in the area. The study area is situated at the northeastern corner of Aegean Sea (Figure 1). It is well known fact that the Aegean Sea comprises a set of back-arc basins (the Northern Aegean Basin including the Saros Bay), a volcanic arc and an inter-arc basin (the north Cretan basin) over the structural framework which is relatively young, and superimposed on older structures of an orogenic belt of Alpidic origin which can be traced from the Dinarides and Hellenides in the west, into the the Taurides and Anatolides in the east (İzdar,1975 ,Biju-duval et al,1979,and Şengör and Yılmaz,1980).

The Saros Bay area is not exactly in the isostatic equilibrium showing -50 mgal free-air anomaly minimum with +20 mgal (north) and +50 mgal (south) levels on the adjacent areas. Bouguer gravity anomalies indicate a positive anomaly zone extending in the northeast direction from Limni, Gökçeada and the Gelibolu peninsula on the south side of the Saros Bay which has a negative anomaly zone. No regular magnetic anomalies are exist in the Saros area(the Northern Aegean in general) besides the several lineations related to tensional tectonics and magmatic intrusions. The Ganos fault joins the North Aegean Basin to the Marmara Sea which appears as the prolongation of the North Anatolian strike-slip fault changing in this area into extensional strike-slip movement for the creation of these basins.

Five main structural features have been described from the Bouguer gravity anomalies and seismic studies as: (i)Dardanelles Graben (ii)Gelibolu Horst (iii)Saros Graben (iv)Semadirek High, and (v)Enez Graben. Semadirek High and the Gelibolu Horst are pre-Miocene anticlinal structures. Enez and Saros grabens have been developed in the synclines between the anticlinal areas. Dardanelles Graben is over an anticlinal structure. Three sedimentary sequences were described by Saner(1985) in the area separated by erosional surfaces of (i)Upper Cretaceous-Lower Eocene sequence, (ii)Middle Eocene-Oligocene sequence, and (iii)Mio-Pliocene-Quaternary sequence.

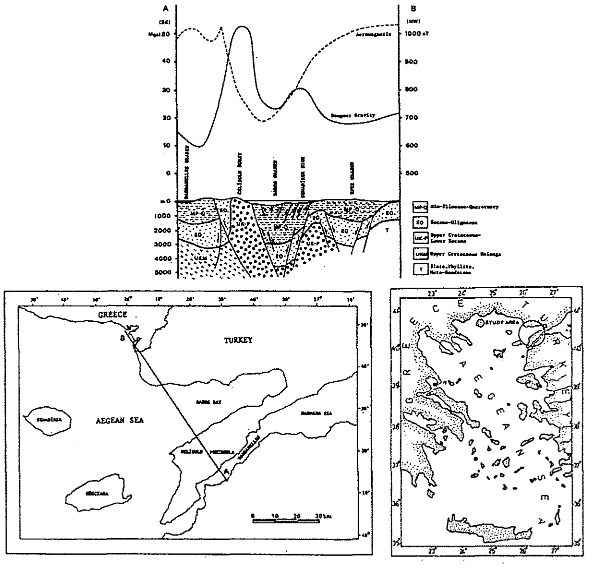

Figure 1: Location map of the investigated area and the interpreted section (modified from Saner, 1985).

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