THE DEPOSITIONAL ENVIRONMENTOF THE EVAPORITE MINERAL SERIES AT TUZLA, BOSNIA-HERCEGOVINA

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Evaporites may occur in a variety of environmental settings ranging from coastal intertidal and supratidal zones (sebkhas), small coastal or atoll lagoons, deeper marine basins, sub-sealevel basins with marine inflow and non-marine interior basins. The tectonic and palaeogeographic circumstances span continental margins and shelves, interior cratonic basins and rifted continental margins. It is also highly interesting to note that evaporites having the mineralogy of non-marine facies sequences are rather rare in rocks older than Tertiary age.

The Tuzla salt deposit is located in the north-eastern part of Bosnia and Hercegovina and is the largest rock salt reservoir on the Balkan peninsula. The essentially stratified salt-dome type deposit is of middle Miocene age, hosted in a sedimentary series of banded halite and anhydrite. In spite of the rather well known geological setting of the occurence, there is no unambiguous evidence as to the depositional environment in which the evaporites formed. The geochemistry of coexisting brines and their saturation states imply that the formation environment may be interpreted in terms of the mixing-zone model, as opposed to the end-member marine or salt-lake type deposits (BERMANEC *et al.*, 1992). However, the close relationship of the evaporite series and associated dolomitic limestones, and evidence of progressive dolomitization may account for their formation under evaporative, non-evaporative or seepage reflux conditions (HARDIE and EUGSTER, 1971).

The mineral paragenesis of the evaporite series consists of halite, thenardite and anhydrite. The a(H_2O) indicator couple is thenardite-mirabilite. In addition, several accessory minerals are present in varying amounts - the assemblage, as well as possible lithotype indicator minerals are being studied in detail (KNIEWALD *et al.*, 1986; BERMANEC *et al.*, 1992). Moreover, a new mineral with a pentaborate sheet structure has been discovered in the assemblage and was named tuzlaite (BERMANEC *et al.*, 1994). Its formation and stability are as yet unclear, but there are indications that diagenetic changes could have effectuated the nucleation kinetics of the normal succession of borate minerals in the sequence, resulting in the precipitation of tuzlaite.

The textures of the Tuzla anhydrite sequence provide no direct evidence that anhydrite might have grown directly from the brine. Gypsum is largely absent from the main evaporitic series, although some is associated with laterally correlated breccias indicating that the anhydrite-gypsum ratio was equilibrated over a series of metastable phases. Probable burial of an initially formed gypsum series and a consequent temperature rise due to the geothermaol gradient inevitably causes the transition to anhydrite. There is no evidence of ensuing rehydration, except - perhaps - in the case of the breccias described above. These characteristics can hint at the conclusion that uniformly lamellar anhydrite (or sulphate-carbonate sequence) formed in a protected "low energy" environment, usually to be understood in terms of a deep water basin, below the wave base. On the other hand, sharp brine stratification in an evaporite basin can attenuate wave motion at depths less than those expected for a uniform water column. The other type of intermediate anhydrite features irregularities characteristic of clastic sedimentation, such as ripples and cross bedding. In the case of anhydrite textural evidence is still ambiguous or conflicting.

Further studies, particularly involving the isotopes of sulphur and oxygen in the evaporites and limestones, should provide the rationale for a tenable assessment of the depositional setting of the Tuzla evaporite series.

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