International Association of Sedimentologists

The Belgian Sedimentological Group

Katholieke Universiteit Leuven

IAS

9 th European Regional Meeting Abstracts Leuven - Belgium

Sept. 1988

KU LEUVEN Permanente Vorming

Edited by

R. Swennen

9th IAS Regional Meeting of Sedimentology - Leuven 88

DEPOSITIONAL ENVIRONMENTS OF THE KEUPER HALITE DEPOSITS OF LORRAINE (EASTERN FRANCE)

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Within the Lower Keuper series ("Marnes Irisées Inférieures") of the Lorraine Triassic, the halite deposits have a maximal thickness of about 150 metres and are subdivided into 4 or 5 units, with variable NaCl contents, called from bottom to top L to P-Q (Marchal, 1983). A specific combination of halitic and other facies (sulphated - carbonated - argillaceous) characterizes each of these units.

The industrial production of salt, by mining or dissolution, in the eastern suburbs of Nancy, is limited to the units N to P-Q. In the mine of Varangéville, only the bottom of the unit N is worked (4,5 m out of about 22 m) ; but the galleries cut across the whole of the unit N and allow the observation of sedimentary structures that are mostly difficult or impossible to recognize in the cores.

Some of these structures are precious guides in order to characterize the depositional environments ; they can be classified in four types.

1 - Solution and erosional surfaces

They are very numerous and more or less marked. The most significative for our research have a large horizontal extension and are covered by a thin (millimetric to centimetric) argillo-sulphated layer ; but their erosive nature is only clear when they smooth down the minor reliefs due to the formation of mounds (See 3 and 4).

2 - Synsedimentary deformations in anhydrite layers

Some salt beds (5-20 cm thick) with a perfectly plane stratification at bottom and top show interbedded sulphates forming centimetric, more or less irregular, contorted or broken layers. Slumping, gypsokinesis, crystal growth and/or desiccation are the possible origins of these structures.

3 - Tepee structures

Single or superposed tepees are frequent at some levels of the unit N. The vertical dimension of these structures can reach 1 or 2 metres.

4 - Fractures and fracture filling

The smaller cracks range from few centimetres to several decimetres in height, sometimes more ; the filling is essentially a secondary clear halite. These fractures often display a polygonal pattern, with a decimetric size of the polygons, like mud cracks.

The larger polygonal fractures are V-shaped, well developed in several stages during the sedimentation of the unit N. They have the following measurements : up to 4-5 m in depth and 1 m in width at the top ; about 10 m for polygon width. The filling, vertically banded and generally symmetrical with respect to axial plane of the fracture, is made of an argillaceous deposit in which early-diagenetic halite, anhydrite and quartz grew abundantly.

The structures 2, 3 and 4 are the expression of repeated emersions and desiccations of the basin during more or less important periods. Exactly the same structures exist in recent and present deposits : - for example, Type 2 in the supratidal facies of the coastal sebkhas of the Sheikdom of Abu Dhabi (Shearman, 1979 ; Butler *et al.*, 1982) ; - Type 3 in Holocene coastal salinas of South Australia (Warren, 1982) where "tepee zones are sites of preferential groundwater overflow" ; - Type 4 (larger fractures in playas of Great Basin (SE USA) (Neal *et al.*, 1968) during periods of intensified aridity.

In the unit N, these structures are often associated and occur at four horizons; they are almost absent in-between. This allows to follow precisely the sequences of depositional environments at the margin of German Sea : several times, a shallow basin with marine brines changed into a progressive drying out coastal sebkha.

The solution and erosion surfaces emphasized by an overlying detritic layer (structures of Type 1) indicate the beginning of a progressive immersion of the basin.

The same type of environmental evolution is certainly valid for the other units of the halite deposits of Lorraine.

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