

Syn depositional textures and depositional setting of Moroccan Early Mesozoic layered halite-rock

M. Et-Touhami

Univ. Mohamed I, Département de Géologie, GVBS, 60 000 Oujda, Morocco.
Email: touhami@sciences.univ-oujda.ac.ma

The deposition of evaporites was an important phase in the Early Mesozoic sedimentation in the North Atlantic rift. Under this extensional regime, which persisted through Triassic time, a complex network of chiefly northeast-trending half-grabens developed across northern Morocco (Laville and Piqué, 1991) (Fig. 1).

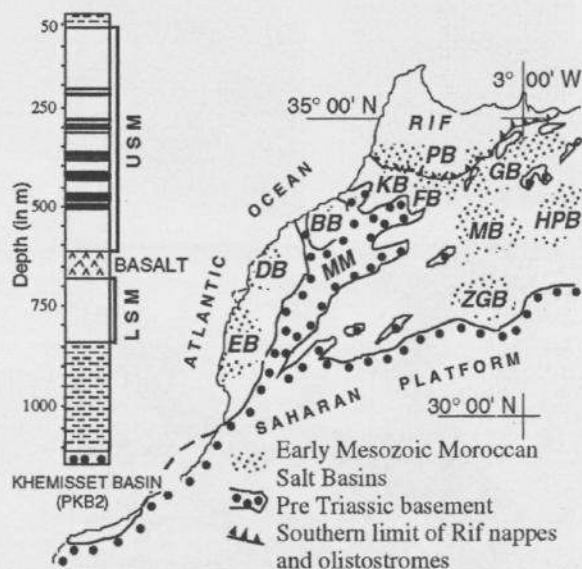


Fig. 1. Location of major Lower Mesozoic Moroccan Salt Basins.

Key: BB: Berrechid Basin; DB: Doukkala Basin; EB: Essaouira Basin; FB: Boufekrane Basin; GB: Guercif Basin; HPB: Haut-Plateaux Basin; KB: Khemisset Basin; LSM: Lower Salt Member; MB: Moulouya Basin; MM: Moroccan Meseta; PB: Prerif Basin; USM: Upper Salt Member; ZGB: Ziz-Guir Basin.

These basins were filled with terrigenous clastics and evaporites, which are found to overlie and underlie basaltic rocks. The Lower Salt Formation (Fig.1) consists of thin siliciclastic mudstone and siltstone beds, anhydrite, polyhalite, muddy halite, halite, and in some basins potash

salts (sylvite and carnallite); whilst the Upper Salt Formation is composed of generally flat-lying beds of halite, muddy halite, and siliciclastic mudstone and siltstone. These rocks grade from salt-dominant facies confined to the more subsiding axial part of the troughs to red beds with intercalated evaporites along the margins (Et-Touhami, 1999).

The fabrics of halite crystals in undeformed layered halite-rock and associated deposits (Fig. 2B and 2C), especially in Berrechid, Khemisset, and Boufekrane basins, contain syn depositional textures and abundant clear halite cements. They include (1) accumulations of hopper and raft structures that formed at the brine/air interface (Arthurton, 1973; Lowenstein and Hardie, 1985) (Fig. 2A and 2B), (2) vertically elongated halite crystals containing or not relict growth surfaces defined by variations in abundance of minute fluid inclusions (chevron and cornet-shaped zoning) that formed at or above the sediment/brine interface (Shearman, 1970; Lowenstein and Hardie, 1985) (Fig. 2A and 2B), (3) detrital halite composed of material reworked from (1) and (2) that sometimes defines ripples (Logan, 1987) (Fig. 2C and 2D), and (4) displacive halite crystals formed within bottom sediment (Fig. 2E). To summarize, sedimentary accumulations of halite from Early Mesozoic of Morocco have four modes of occurrence: (1) subaqueous cumulates, (2) subaqueous bottom precipitates, (3) intrasediment precipitates, and (4) clastic particles.

The halite-rock is regarded as having formed in shallow brine bodies, an assumption supported by the irregular shape of bromine profiles (Et-Touhami, 1996), while planar dissolution and polygons observed in mines point to periodic emergence. These features support that Moroccan Early Mesozoic evaporites accumulated in marginal marine basins near the axis of the rift, or in intertidal-supratidal sabkhas and salines on the flanks.

REFERENCES

1. E. Laville and A. Piqué, La distension crustale atlantique et atlasique au Maroc au début du Mésozoïque: le jeu des structures hercyniennes. *Bull. Soc. géol. Fr.*, 162 No. 6 1161 1171 (1991).
2. M. Et-Touhami, Lithostratigraphy and depositional environments of Lower Mesozoic evaporites and associated red beds, Khemisset Basin, northwestern Morocco, *Zbl. Geol. Paläont. Teil III Heft 7-8* (1999) (in press).
3. R. S. Arthurton, Experimentally produced halite compared to Triassic layered halite-rocks from Cheshire England, *Sedimentology*, 20 145 160 (1973).
4. T. K. Lowenstein and L. A. Hardie, Criteria for recognition of salt-pan evaporites. *Sedimentology*, 32 627 644 (1985).
5. D. J. Shearman, Recent halite rock, Baja California, Mexico, *Trans. inst. Min. and Metall.*, 79 155 162 (1970).
6. B. W. Logan, The MacLoad Evaporite Basin, Western Australia - Holocene environments, *Sediments and Geological Evolution*, Mem. Am. Assoc. Pet. Geol., 44 140 (1987).
7. M. Et-Touhami, L'origine des accumulations salifères du Trias marocain: apport de la géochimie du brome du sel du bassin de Khemisset (Maroc central), *C.R. Acad. Sci. Paris*, 323 591 598 (1996).

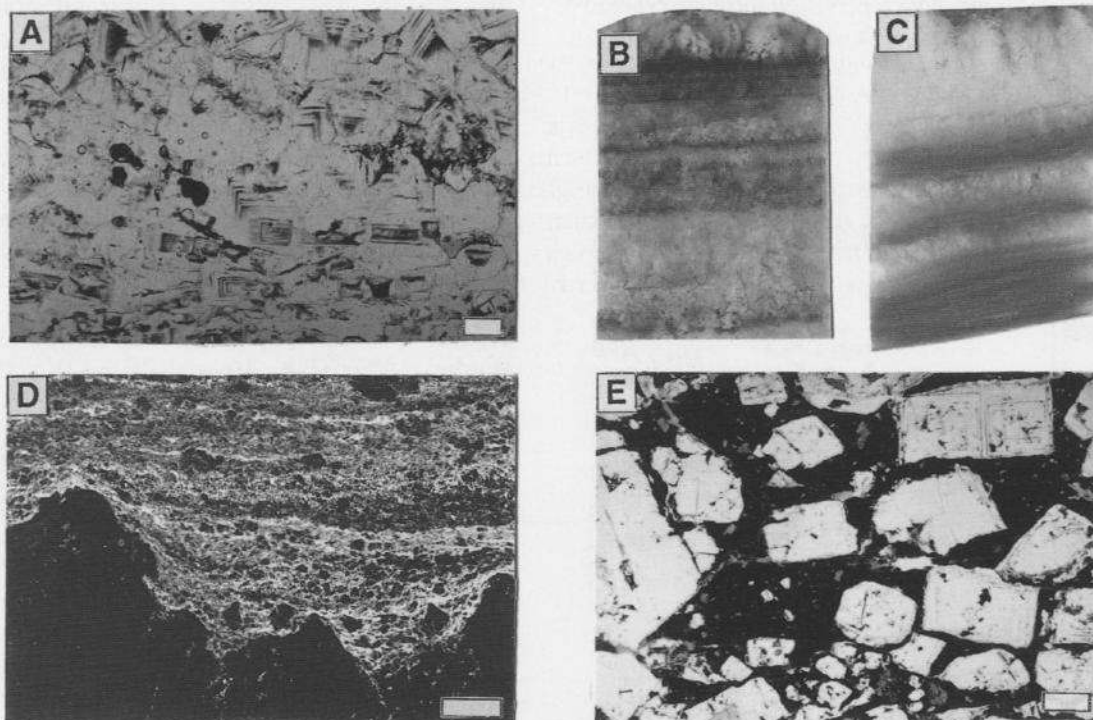


Fig. 2. Thin section photomicrographs of halite and cores slabs of some banded-salt facies from Early Mesozoic of Morocco. (A) Rafts which are composed of millimetre-sized rectangular- and square-shaped halite crystals linked together are generally oriented oblique to the bedding (lower part of the photo), implying that these crystals originally grew at the brine-pool surface before they sank. They are overlain by vertically elongated halite crystals containing relict growth surfaces defined by variations in abundance of minute fluid inclusions (chevron- and cornet-shaped zoning) that formed at or above the sediment/brine interface. (B) Horizontal colour-banded halite showing well developed bands of translucent to cloudy halite with vertically oriented chevron crystals. (C) Interbedded detrital halite (dark) and vertically elongated halite crystals (light). (D) Detrital halite consists of fine crystals of halite (dark) in a matrix of anhydrite (light) which defines lamination. Detrital halite is probably originated as material reworked from bottom-growing elongated halite crystals. (E) Chaotic mixture of mudstone (dark) and euhedral cubes or anhedral masses of halite (light). Some of halite crystals are incorporative (zoned). Scale bar is 1.5 mm and cores are 6.5 cm in diameter.