

Primary sedimentary structures in bedded halite – indicators of depositional conditions from the mid-Triassic of the UK

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Solution-mined salt caverns in bedded halite successions of the UK host several operational and planned underground gas storage schemes. The sedimentology and associated engineering behaviour of halite is increasingly recognised as an influence in the planning, design and construction of storage caverns, as the crystal fabric and distribution of non-halite units can affect their morphology, which impacts operational processes (e.g., the operating pressure ranges) and the placement of facilities in the subsurface.

Thick successions of bedded halite, with thin interbedded mudstones are developed in the Mid-Triassic (Anisian – Ladinian), in the Cheshire (Northwich Halite Member) and west Lancashire (Preesall Halite Member) basins of north-west England. Analysis of borehole core from these lateral correlatives allows comparisons to be made between accumulations from different sedimentary basins, and the sedimentary structures to be understood in a modern context. Depositional fabrics within the halite beds include primary laminated halite (with cuboid, chevron and cornet fabrics, dissolution seams and erosional surfaces) and banded halite. The non-halite lithologies include some anhydrite but predominantly haselgebirge through to laminated and structureless mudstone, with evidence of load structures and desiccation. These indicate accumulation in a predominantly shallow setting, with karst structures (pipes and fissures) indicating rare periods of emergence, and the accumulation of cumulate facies in intervals of deeper, stratified of brine. Indicators of flow are rare, restricted to ripple-lamination in mudstones, and re-worked oriented clasts of anhydrite. Diagenetic features influenced by post-depositional halite mobilisation include the development of chickenwire textures and recrystallized zones of halite.

Brecciation of the succession is linked to four distinct processes: penecontemporaneous haloturbation, emergence and desiccation, post-depositional structural processes and the dissolution of halite in the modern freshwater groundwater zone (so-called ‘wet rockhead’). Wet rockhead processes are poorly understood, although relationships between brecciated and laminated zones indicates new models for the development may be required.