The stratigraphy and lateral correlations of the Northwich and Preesall halites from the Cheshire Basin-East Irish Sea areas: implications for sedimentary environments, rates of deposition and the solution mining of gas storage caverns.

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Abstract

The Northwich Halite of the Cheshire Basin and the Preesall Halite of NW England and the East Irish Sea (EIS) are time and lateral equivalent (Anisian: 237-245 Ma), massively bedded halite deposits, with occasional intervals characterised by mudstone. The interbedded mudstone units, three of which attain significant thicknesses, are recognised from Cheshire northwards through Lancashire into the EIS. Onshore, these halite beds have been dry-mined for rocksalt and solution-mined during brine production. They are now also the target for the creation of gas storage caverns, with two sites operational and a number at varying stages of planning or development. Also planned is the Gateway project, offshore in the East Irish Sea.

We describe how detailed sedimentological descriptions of borehole core, geophysical log correlations and measurements on the thickness of halite beds and the interbedded mudstones provide information on the depositional environment of the halite and development of interbedded mudstones. This is important to assessing and predicting the lateral continuity of the halite beds across not just sedimentary basins, but also any particular site for the design and construction of gas storage caverns. Geophysical logs demonstrate that individual halite and interbedded mudstone sequences can be correlated over 150 kms north to south. The interbedded mudstones represent in the main, windblown (loessic) deposits, with the halites deposited in single, perennial, typically very shallow brinepool subject to occasional subaerial exposure. The depositional processes, systems and environments remained very stable for long periods of time over an area of at least 4700 km^2 and possibly pre-erosion, up to 46900 km^2.

Sequences thicken to the NW and offshore and this appears to be mainly as a result of increases in the thickness of halite beds. Preliminary assessments of the main interbedded mudstones are attempted to provide numerical data on the lateral continuity of the mudstones and possible lateral variations in the percentage insolubles of the Preesall Halite. Initial results indicate that subsidence was a major control on the thickness of the mudstones: where greatest, the halite beds are thicker and the interbedded mudstones show splitting. This suggests that increased subsidence rates created accommodation space that permitted increased halite precipitation, which was able to keep pace with subsidence rates, 'drowning' the siliciclastic input. During periods of slowed subsidence or increased sediment supply, deposition of beds of fine-grained siliciclastics (mudstones and fine siltstones) took place.

One potentially important feature is that thick mudstones with only minor halite interbeds seen in the Cheshire Basin and encountered at the Byley site, thicken to the NW by the incoming of number of thin halite beds (up to c. 3 m thick). These split the main mudstones into a number of thinner mudstone beds. They are thus likely to have differing impact on the leaching and cavern development processes.

Key words: Gas Storage, Preesall Halite, Northwich Halite, geophysical logs, sedimentary environments, United Kingdom