UNDERSTANDING THE PROCESSES OF SALT DISSOLUTION AND SUBSIDENCE

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ABSTRACT

Subsidence resulting from human activities is a special case of natural salt dissolution, subsidence, and collapse. Good understanding of natural processes at a mine site can help the operator to reduce risks by (1) better predicting the geometry and irregularities of the salt body and (2) engineering to compensate for the hydrologic processes active in the permeable strata overlying and adjacent to the salt.

Under natural conditions, less soluble materials within salt strata accumulate as a residue in the areas from which salt is being dissolved. The geometry and textures of these residues provides clues to the timing, rates, and processes by which the salt is being dissolved. In an active area of salt dissolution, a mineralogical profile including salt preservation, anhydrite precipitation, gypsum precipitation, calcite replacement, and gypsum dissolution documents changes in water salinity away from the dissolving salt body. Similarly, examination of the diagenetic sequence can show that a dissolution event is relict, and of minimal concern in the current hydrologic setting. Evidence of subsidence and extension, including passive let-down with minimal fracturing over insoluble residue, open and crack-seal fractures patterns, and collapse breccia provide evidence of the timing and rates of salt dissolution.

Salt dissolution can be focused by conduits. Once dissolution is active in an area, flow through newly-formed insoluble residue, fractures, and collapse breccia focuses continued dissolution in an area.

PURPOSE AND SCOPE

The purpose of this paper is to describe the process and resulting products of salt dissolution in order to help cavern operators recognize and manage areas of active dissolution and potential collapse.

This paper is based on examination of rocks cores, thin sections, and wireline logs from studies of bedded salt of the Permian Basin. This major U.S. salt depocenter is composed of three structural provinces all containing salt: the Delaware, Midland, and Palo Duro Basins (fig. 1). I examined fifteen cores from the Palo Duro Basin in the Texas Panhandle and one core from the eastern part of the Delaware Basin. Five of these cores were collected by the Army Corps of Engineers from areas in the eastern part of the Palo Duro Basin where Permian rocks crop out at the surface as part of a study of sources of