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MEETING PAPER

SURFACE SUBSIDENCE RELATED TO SOLUTION EXTRACTION OF SALT

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ABSTRACT

Many sedimentary basins contain great thicknesses of bedded salt where extraction of the soluble minerals, whether by natural or man-induced processes, can result in localized land-surface subsidence. Flow of water or undersaturated brine in contact with a salt bed creates cavities in the salt through leaching of soluble minerals. Density layering of the brine tends to concentrate solutioning along the roof of the void, often resulting in a "morning glory" shaped cavity. Continued dissolving of the salt can enlarge the roof span of the opening to the strength limit of the overlying rocks and cause downwarping or failure in the overlying beds. Where disintegration of overlying rock is sufficient and space is available to store falling rock, stoping or chimneying can progress upward and produce ground subsidence.

In natural subsidence, cavities form in salt by the dissolving action of fresh ground water or undersaturated brine flowing through enclosing permeable beds, along faults or other discontinuities in surrounding rocks, or by leaching of caves in exposed salt beds adjacent to lakes and streams. Spectacular subsidence features (10^2-10^3 m^2) have resulted from natural solutioning. Artificial or man-induced solution subsidence usually is caused by mining, drilling, or construction activity and generally results from the introduction of fresh water or undersaturated brine into a salt bed. Examples of man-induced solution subsidence are those resulting from industrial solution-mining operations, oil- and gas- field drilling activities in salt basins, and construction of dams, reservoirs, and highways which pond water over saline rock. Subsurface-mechanical erosion of beds overlying salt may be an important component of the subsidence process. "Piping" or mechanical transport of sediment from granular beds into deeper salt cavities may form voids in the overlying beds which are then subject to collapse.