

**TITLE:** The Discovery of an Apparent Brine Pool Associated with Anomalous Closure Patterns and the Eventual Failure of the Retsof Salt Mine.

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### **ABSTRACT**

The Retsof Salt Mine in Livingston County, New York was successfully operated for 109 years. The mine was operated by extracting approximately 12 feet of salt from a gently dipping layer with the use of room and pillar methods. The Retsof Mine initially consisted of three adjacent mines that employed a mixture of small yield and large rigid-pillar methods. These three mines were eventually combined into the more economical Retsof Mine, which relied on the large pillar approach. The large rigid-pillar approach remained the primary method during the past sixty years, but the yield-pillar method was reinstated in the early 1990's to mitigate roof instability beneath a deeply scoured glacial valley. The eventual loss of the Retsof Salt Mine from flooding was initiated on March 12, 1994, with the collapse of a small yield-pillar panel. The mine flooding was associated with an anomalous closure pattern prior to collapse, a magnitude 3.6 earthquake, an initial inrush of gas and brine, and a sustained flow of fresh water until the mine was inundated. The pre-collapse closure patterns initially appeared to correlate with salt extraction; however, the pattern accelerated dramatically during the weeks leading up to the collapse. The anomalous increase in closure appears to suggest a buildup of pressure. The initial brine and gas inflow immediately following the collapse coincided with the apparent relief of the excess pressure. This relief is suggested by subsequent stabilization of closure rates in a yield-pillar panel adjacent to the collapse. These data suggest that the gas and brine were present in a pressurized horizon above the mine prior to the collapse. The potential existence of a pre-collapse, pressurized brine and gas pool above the panels was investigated through an analysis of nineteenth century solution mining data, review of recent salt mine data, and an interpretation of geologic and geophysical data from post-collapse investigations. Published reports from solution mining in the nineteenth century reveal that natural brine and gas pools existed in the region well before mining. Correlation of gamma ray logs with geologic logs from contemporary drill holes and core holes provided a mechanism for interpreting the distribution of those natural brine pools. The investigation indicated that natural gas and brine pools existed within Unit D of the Syracuse Formation approximately 160 feet above the mining horizon. Such brine accumulation apparently formed from the circulation of meteoric water through vertical discontinuities that were connected to overlying fresh water aquifers long before mining began in the valley in the late nineteenth century.