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Potential Mechanisms for the Deposition of Halite and Anhydrite in a Near-critical or Supercritical Submarine Environment

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5. Potential Mechanisms for the Deposition of Halite and Anhydrite in a Near-critical or Supercritical Submarine Environment

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The formation of geologic salt deposits has long been an area of concern for creation geology. Uniformitarian geology has pictured these deposits as forming due to the evaporation of seawater, hence their designation "evaporites". Both creationist (Nutting, 1984; Williams, 2003) and uniformitarian (Hardie and Lowenstein, 2004) literature have noted problems with evaporation models and creationist literature has suggested a hydrothermal model as a more likely mechanism for evaporite formation (Nutting, 1984; Williams, 2003). This contribution will review some hydrothermal mechanisms for rapid deposition of these salts and discuss possible evidence that could be used to identify these mechanisms in the geologic record.

Submarine hydrothermal fluids possess significant salinity. At near-critical temperatures (~400°C and 250-290 bars), hydrothermal fluids undergo a phase separation into a vapor and NaCl-rich brine, containing higher concentration of NaCl than the original fluid (Von Damn et al., 2003). Salt will be concentrated in this brine and as it is pushed upward, it will both cool and be placed under lower pressure, leading to halite (NaCl) precipitation (Berndt and Seyfried Jr., 1997). Creationist models assume extensive hydrothermal activity at the time of the Flood, so this mechanism would have the potential to deposit a significant amount of salt. Deposits formed in this way would be expected to be primarily composed of halite; anhydrite ($CaSO_4$) is significantly insoluble in high-temperature water (Hovland et al., 2006). Any anhydrite present would have precipitated before the halite and therefore would be found stratigraphically lower than it in the geologic record. Furthermore, near-critical hydrothermal fluids have been noted to contain unusually high Fe/Mn ratios (Von Damn et al., 2003); the presence of similar ratios in fluid inclusions in the halite might indicate it formed under these conditions.

Another mechanism for "evaporite" formation is suggested by Hovland and coworkers and involves both sub-critical and supercritical processes (Hovland et al., 2006). Hovland's mechanism requires a source of extremely high heat , such as a magma chamber, below a porous seabed. In Hovland's model, the sediment primarily serves to protect the halite from redissolution; during the rapid sedimentation of the Flood, capping by newly deposited sediments could achieve the same protection. In either view, the saline water is heated by the magma chamber, leading to the precipitation of anhydrite in areas of less intense heat and supercritical conditions leading to halite precipitation in the most intense heat (405°C and 300 bars), directly above the heat source (Hovland et al., 2006). In a supercritical environment, water behaves like a non-polar liquid; therefore it will be a far better solvent for organic compounds than salts and will precipitate any halite it contains. This entire process would be expected to generate halite deposits directly above the heat source, with anhydrite deposits flanking the halite (figure 1).

Geologic salt deposits have likely formed by a variety of mechanisms. There is not one simple answer for their origin. However, if a thorough understanding of the mechanisms for rapidly precipitating salts and criteria for determining which mechanism was responsible for a given deposit are developed, it should be possible to understand these features on a case-by-case basis. This contribution is a step towards developing those mechanisms and criteria.

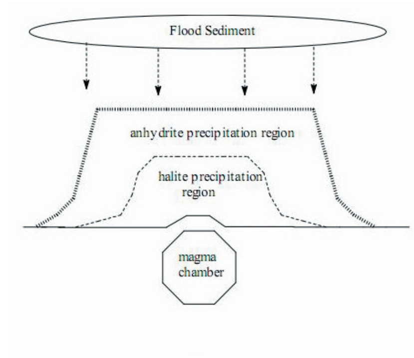

Figure 1

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6. Dinosaur Tracks, Eggs, and Bonebeds Explained Early in the Flood

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Despite being able to explain many big-picture observations of the rocks and fossils, there are still a few hundred earth science challenges to the Flood model of earth history. One of these challenges is the existence of billions of dinosaur tracks, millions of dinosaur eggs, and scavenged bonebeds on thousands of feet of Flood strata. Such observations seem to imply too much time to have happened early in the Flood before dinosaurs were all dead by Day 150.

However, a closer examination of the bonebeds, tracks, and eggs indicates many unusual features for a uniformitarian environment. Unique features of bonebeds include the observations that some dinosaur graveyards are huge, monospecific, and lack babies and young juveniles. Unique features of dinosaur tracks are that practically all trackways are straight, tracks are always on flat bedding planes, and baby and