100% Core Recovery in Potassium Salt Layers – Our Experience with $MgCl_2$-Mud-Systems

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A common fluid design in solution mining for drilling through salt formations is a fully NaCl saturated mud system. When facing complex salt structures consisting of alternating layers of Halite and Potassium, uncontrolled leaching of potassium layers will happen due to solubility equilibriums of the present cations. This can lead to wellbore stability issues as well as to potential drilling problems and poor recovery rates when acquiring cores from those formations/layers.

Utilizing a fully saturated mixed-salt mud system (NaCl, KCl) with an accurate equilibrium and to maintain it during operation is often impracticable. Furthermore it excludes the feasibility of performing a Spectral-Gamma-Ray-Logging-Run in the desired section, which can be crucial in complex salt structures for placing the future cavern and for determining the optimal production casing depth. The alternative of using an oil-based mud system may involve a huge environmental impact and can lead to high costs.

In a proactive effort to prevent the aforementioned issues and to ensure an optimal cavern placement UGS-GmbH cooperated with a client in terms of using a Magnesium chloride ($MgCl_2$) saturated, water-based mud for drilling through potassium salt rich formations, particularly when these alternating layers are to be expected. Utilizing this $MgCl_2$-mud system data- and core-acquisition has demonstrated a remarkable improvement in the rate of success when encountering complex soil formations. This method has been used successfully in numerous cavern wells throughout Germany.

The implementation of the fully saturated $MgCl_2$ Mud System, however, has posed some additional challenges. Due to an increased potential for corrosion, as well as a high level of reactivity between the mud and cement, several adaptions of the overall working program and handling of the equipment and materials had to be implemented.

This presentation will give a critical overview of the outcomes, challenges, and lessons learned with the aim of offering a general understanding of utilizing $MgCl_2$ saturated water-based mud when drilling through complex potassium salt formations.