Liquid Gilsonite: Understanding a Unique Drilling Hazard in the Uinta Basin, Utah

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Abstract

Mitigation of drilling hazards requires a holistic approach that not only identifies and characterizes a particular risk, but also provides insights into the origin and likelihood of occurrence of such threats in future operations. Anecdotal reports from a variety of sources have suggested that a unique viscous organic substance referred to as "liquid gilsonite" occurs deep within the Uinta Basin. When it is encountered it can disrupt drilling to such an extent that wells must be abandoned or side-tracked. In this study, we present the first documented geochemical evaluation of liquid gilsonite collected from a well in the Bluebell Field of the Uinta Basin, Utah. Gilsonite is an aromatic-asphaltic solid bitumen found in vertical veins along the eastern portion of the Uinta Basin. It is thought to be an early generation product from oil-prone Green River Shale source beds and is similar to low maturity crude oil in composition. The bitumen which solidified as gilsonite veins, likely migrated laterally through a vein-fracture system from more mature downdip source beds to the northwest, rather than from the oil shale deposits directly beneath. Mined areas of gilsonite veins are noted to have occurrences of "gilsonite tar" seeping from the exposed sandstone wall rock. This material apparently represents continued active migration of the viscous bitumen precursor to gilsonite. Likewise, it is thought that the liquid gilsonite encountered in deeper wells as characterized in the current study represents an intersection with the fracture network responsible for continued migration of bitumen from the active source pod. We have undertaken comprehensive geochemical evaluation of liquid gilsonite, solvent extracts of cuttings samples taken at a similar depth within this well (Green River Formation; basal saline facies), and a representative sample of solid gilsonite collected from the Bonanza Vein near Bonanza, Utah. Comparison of these results show that all samples have very similar geochemical fingerprints, however, subtle differences are evident that suggest a somewhat different source facies for the solid gilsonite sample and more extensive biodegradation. In contrast, the liquid gilsonite sample appears to correlate closer with the cuttings sample in terms of source facies but has a slightly different thermal maturity, suggesting an origin from deeper within the pod of active hydrocarbon generation. These downhole samples do not appear to have been altered by biodegradation. Having positively identified and characterized liquid gilsonite, the implications of these findings for drilling hazard risk assessment will be discussed in the context previously reported gilsonite vein geometry in analogous mudrock lithologies.