Geology and Geochemistry of the Al Lajjun Oil Shale Deposit, Central Jordan

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The Al Lajjun Oil Shale Deposit is located approximately 110 km south of the Jordanian capital of Amman. Al Lajjun is one of 26 oil shale deposits occurring in the sedimentary basins of Central Jordan. Jordan is ranked 8th in the world with identified oil shale resources in excess of 65 billion tonnes; however, to date no commercial hydrocarbon production from Jordanian oil shale has taken place. Jordan has no conventional hydrocarbon resources and relies entirely on imports from neighbouring countries; market and political factors have highlighted oil shale as a potential domestic hydrocarbon source to meet Jordanian demands.

The Al Lajjun Oil Shale Deposit was discovered in the late 1960's by a joint Jordanian-German geological study. In the decades following discovery intermittent exploration activity at Al Lajjun has resulted in 198 drill holes totalling in excess of 11 km of drilling. Recent estimates for the entire Al Lajjun deposit have identified approximately 1 billion tonnes of oil shale resources at a mean grade of 11 wt. % oil (standard Fischer assay).

Al Lajjun is categorized as a Marinite oil shale deposit, hosted by marine sedimentary rocks of the Belqua Group that were deposited as syn-tectonic basin infill within the late Cretaceous to early Paleocene Al Lajjun Graben. The oil shale occurs as massive beds of brown-black, kerogen-rich chalk-marl that comprise the ~30 m thick Lower Member of the Muwaqqar Chalk-Marl Formation (MCM). The Lower Member is overlain by ~30 m of barren chalk-marl known as the Upper Member of the MCM. Differential throw on the graben bounding faults resulted in asymmetric graben floor that is tilted slightly to the west. Strata in the graben are sub-horizontal with dips typically in the 2-4 degree range. Micropaleontological studies indicate the depositional age of the MCM is transitional between Masstrichian to Paleocene, with deposition of the oil shale bearing Lower Member occurring during Masstrichtian to Danian time.

This presentation focuses on reviewing the regional and deposit scale stratigraphic and structural controls on oil shale deposition along with the oil shale geochemical characteristics. The aim is to evaluate the hydrocarbon production potential of the Al Lajjun Oil Shale Deposit via surface mining and pyrolysis processing methods.