Comparison of Cores from the Siljan and Ames Craters

Richard R. Donofrio, EDGe Research Associate, March 2003

AMES – exceptional reservoir

SILJAN – no reservoir

The above photos show the striking differences in cores from the Ames and Siljan impact craters. Both structures are confirmed complex-type impact craters, and both cores were taken in the central uplifts, albeit off center. Both impact events fractured and uplifted granitic basement rock. Siljan is ~30% quartz, 50% orthoclase (hence the pink color), and 15% plagioclase; Ames is ~30% quartz, 10% orthoclase, and 50% plagioclase (hence the gray color). Minor amounts of other minerals are also present in the granites.

In the case of the buried 13-km diameter Ames feature in Oklahoma, the impact was Early Ordovician; with the exposed ~50-km diameter Siljan structure in Sweden, the impact was Late Devonian. Siljan is younger and much larger than Ames and should have better reservoir rock. But post-impact mineral alteration, erosion, and burial conditions determined the reservoir quality not the impact intensity, dimensions or age of the crater.

The profile of Siljan suggests that up to 1.5 km of the crater was downcut, exposing the substructure (rubble was largely removed by glaciation). The granite in the substructure has porosities ranging from <1 to 5% with permeabilities in the millidarcy range (<= 0.1 md). Although this granite contains abundant fractures, most have been sealed by minerals deposited during post-impact hydrothermal activity and (later) by percolating surface/ground waters. One of these sealed fractures is evident in the core photo. Without open and interconnected fractures this rock cannot function as a commercial hydrocarbon reservoir. This particular core was taken at a depth of 459 m during continuous coring operations at Siljan in 1984. It is from one of seven test core holes and shows the typical reservoir properties, save for small weathered intervals of surface-exposed granite. No improvements in natural reservoir quality were later noted at Siljan either in cores, drill-stem tests or pump/leak-off tests to depths of >6,000 m.

Ames was mildly eroded prior to burial. The reservoir is lithified granite (breccia) having porosities over 25% and permeabilities in the darcy range. Whatever hydrothermal effects may have been present is not a factor because the central uplift rocks were eroded to rubble, buried, compacted, and preserved. This reservoir is analogous to talus on the side of an eroded hill or mountain. It now lies beneath almost 2,700 m of overburden. The Ames core was cut just below this sedimentary–granite interface.

LINKS

Additional Ames and Siljan articles

Hydrothermal factors (see pgs 76-78)

Fluid inclusion evidence for impact heating at Siljan

Impact-induced hydrothermal activity

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Comments: mailto:mcartwright@ou.edu.