

## **Shale Oil Potential of the Upper Silurian Fegaguira Formation, Chotts Basin, Tunisia**

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### **Abstract**

Besides their good quality as conventional petroleum source rock, the Lower Silurian “hot shales I” (HSI) deposited during a major anoxic event, are considered also to be the main unconventional resource in the Ghadames Basin of southern Tunisia, Libya and Algeria. Further to the north, in the intracratonic Chotts Basin, the Upper Silurian (Ludfordian) Fegaguira Formation represents deposition of thick, argillaceous mudstones including “hot” shales deposited during a separate anoxic event (HSII). In this paper, the stratigraphy of the Fegaguira Formation is refined and its petroleum potential is assessed based on the analysis of Core, SWC and Cutting samples from six wells of the Chotts Basin and using geochemical (Rock Eval-6 pyrolysis), sedimentological (thin sections, Scanning Electron Microscope (SEM)) and mineralogical methods. The HSII deposits is divided into three units (HSII.1, HSII.2 and HSII.3) which are characterized by high gamma ray response (up to 400API), high organic matter content (up to 17wt. % TOC), and excellent petroleum potential (up to 60mg HC/g rock) with mature Type II marine kerogen. The Fegaguira Formation is characterised by alternative organic-rich and organic-lean interbeds well developed in the HSII.2 and HSII.3 units. The thickness of the HSII deposits ranges between 37m and 100m with a maximum recorded in the eastern Chotts Basin at HBR-1 and BGL-1 wells. Mineralogical analyses and evaluation of the brittleness index together show that the Fegaguira Formation constitute a hybrid reservoir, with brittle limestone intervals and presence of abundant sub-vertical natural fractures. Comparison with proven unconventional reservoirs elsewhere suggest that the Fegaguira HSII deposits may constitute a new unconventional oil play. The HSII.2 and HSII.3 units are considered to be promising shallower targets between 2600m and 3900m in the eastern part of the Chotts Basin. Preliminary reserve estimation based on S1 free hydrocarbon indicate oil-in-place (OIP) range between 115 to 230bbl oil/acre-ft and average total petroleum generation (TPGP) about 1000 boe/acre-ft. The percentage of brittle minerals (quartz, feldspar and calcite) in the Fegaguira Formation mudstones is on average 30%, similar to that in tight oil and gas reservoirs in the US such as the Bakken Formation and Marcellus Shale. The HSII.2 and HSII.3 units have important potential as indicated by the presence of high free hydrocarbons (Sh0+ Sh1) in brittle, fractured organic-poor limestones, similar to the Middle Member of the Bakken Formation in North Dakota.