The Hartselle Sandstone, Alabama's Oil Sands Resource*

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Abstract

The Mississippian age Hartselle Sandstone of northwestern Alabama has been estimated to contain approximately 7.5 billion barrels of bitumen, with roughly 350 million barrels within 15 meters (50 feet) of the surface. No commercial development of these oil sands has occurred as of yet. With the increased desire for North American energy independence, the Alabama Oil Sands Program (AOSP) was established to provide a comprehensive, up-to-date geological and engineering assessment of oil sands resources in Alabama, as well as a thorough evaluation of legal and regulatory issues surrounding development. The AOSP serves as a focus for oil sands activities and initiatives in the state to conduct complete geological, geochemical, geophysical, and engineering analyses. After a comprehensive review of the legacy data available at the Geological Survey of Alabama and the State Oil and Gas Board, a “fill in the gaps” approach is being used for the AOSP. Previously sampled and tested outcrops have been revisited in order to implement modern testing methods to provide updated information about the hydrocarbons and physical properties of the Hartselle Sandstone. Additional sites have been identified and are being sampled and analyzed. A ground penetrating radar (GPR) survey has been conducted in the area of interest, in order to better define the vertical structure and possible hydrocarbon saturation down to an estimated depth of 200 m within the Hartselle Sandstone. Additional analyses of newly acquired cores and subsequent chemical analyses of the rock and bitumen will help ground truth the GPR survey. With the acquisition of this new data, current reservoir models and reserve estimates can then be recalculated using up to date methodologies. Newer near-surface and in situ extraction technologies are being investigated for their applicability to small- to medium-sized deposits such as the Hartselle in Alabama. Thus, the AOSP will provide a comprehensive assessment of the potential for development of the Hartselle Oil Sands of Alabama.

References Cited


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ABSTRACT

The Hartselle Sandstone, a tactical formation in Alabama, has been identified as a potential oil sands resource. The Alabama Oil Sands Resource Program (AOSP) has been initiated to investigate the potential for commercial development of this resource. The program includes a drilling program, geophysical surveys, and core analysis to better understand the nature and extent of the oil sands resource. The results of this program will be used to develop a comprehensive assessment of the potential for commercial development of the Hartselle Sandstone in Alabama.

ATHABASCA, ALBERTA VS. HARTSHELLE SANDSTONE OF ALABAMA

The Hartselle Sandstone is a potential oil sands resource in Alabama that shares similarities with the Athabasca Sands in Alberta, Canada. Both formations are known for their high content of bitumen and potential for commercial development. However, the Hartselle Sandstone has unique characteristics that distinguish it from the Athabasca Sands, such as its location within the Appalachian Basin and its potential for commercial development.

ORIGIN OF HYDROCARBONS IN THE HARTSHELLE SANDSTONE

The origin of hydrocarbons in the Hartselle Sandstone is thought to be related to the deposition of organic matter in a coastal environment. The sandstone is believed to have formed in a coastal plain setting, where organic matter was deposited and later transformed into oil and gas. The Hartselle Sandstone is known for its high content of bitumen and its potential for commercial development.

CORE HOLE DRILLING PROGRAM

The core hole drilling program is a key component of the AOSP. It involves drilling deep boreholes to access the Hartselle Sandstone and collect core samples for detailed analysis. The core samples will be used to better understand the nature and extent of the oil sands resource and to develop a comprehensive assessment of the potential for commercial development.

REFERENCES


LOCATION MAP

The location map shows the extent of the Hartselle Sandstone in Alabama and its proximity to major areas of interest, such as the Appalachian Basin and the Gulf Coast. The map provides a visual representation of the geographical distribution of the Hartselle Sandstone and its potential for commercial development.

GENERALIZED STRATIGRAPHY OF NORTHWESTERN ALABAMA

The generalized stratigraphy of northwestern Alabama shows the distribution of various geological formations, such as the Hartselle Sandstone and adjacent units. The map provides a detailed representation of the stratigraphic relationships and potential for commercial development of the Hartselle Sandstone.

TECHNIQUE

The technique section provides an overview of the methods used to investigate the Hartselle Sandstone. It includes information on the use of core analysis, geophysical surveys, and other techniques to better understand the nature and extent of the oil sands resource.

GROUND PENETRATING RADAR (GPR)

The ground penetrating radar (GPR) overview section provides an introduction to the GPR technique and its potential for investigating the Hartselle Sandstone. The section includes information on the use of GPR for mapping and the potential for commercial development of the Hartselle Sandstone.
HISTORICAL PHOTOS OF OIL SANDS IN ALABAMA

A – Cherokee Rock Asphalt Company, AL Quarry face showing stratification of asphaltic sandstone.

B – View of the active Cherokee Quarry, showing stripping operation in progress. The steam shovel is standing on the top of the asphaltic strata.

A – Diamond drill testing in the Cherokee Quarry.

B – Plant of the Cherokee Rock Asphalt Company on the Southern Railway at Cherokee.

Margerum Quarry of the Alabama Rock Asphalt Company. Showing the quarry face and physical character of the deposit.

The sand grains of Canadian oil sands are composed of quartz with traces of mica, rutile, zircon, tourmaline, titanium, nickel, iron, vanadium, and pyrite (e.g., Kaminsky et al., 2008). Alberta’s oil sands consist of approximately 55-80 wt% sands (primarily quartz), 4-18 wt% bitumen, 5-34 wt% 

The composition of bitumen in Canada’s oil sands is: carbon, 83.2%, hydrogen, 10.4%, oxygen, 0.94%, nitrogen, 0.36%, sulfur, 4.8%, although individual deposits show some variability (e.g., Starr et al., 1981).

The Hartselle Sandstone in Alabama is primarily a fine-grained, quartzose sandstone that is generally light colored except where impregnated with bitumen. Average composition of bitumen in Alabama’s oil sands of the Hartselle is: carbon, 81.4%, hydrogen, 10.2%, oxygen, 2.5%, nitrogen, 0.8%, sulfur, 1.7% (Wilson, 1987).

Most of the area underlain by the Athabasca has a population of less than 2 people per km², while in the areas underlain by the Hartselle Sandstone (right) where surface extraction might be possible the population density ranges from 2 to more than 1,000 people per km².

Land cover and usage across the area underlain by the Athabasca varies considerably, but is predominantly cropland, whereas areas underlain by the Hartselle are predominantly forested, grassland, and shrubland (USGS, 2012; CEC, 2013).