

# STUDY OF THE LATE CRETACEOUS NIOBRARA FORMATION AND ASSOCIATED PETROLEUM SYSTEM, SOUTH DAKOTA (UNITED STATES) FROM WELL LOG DATA

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**ABSTRACT:** The Niobrara Petroleum System is a developing petroleum resource play. It is present over most of the Rocky Mountain region until the Great Plains, and has many prospective areas for oil and gas production. As a petroleum system it is a self-sourced system where source and reservoir are contained in the same formation. The Niobrara Formation occurs in South Dakota, but the different geological context such as different stress regime, natural fracturing, burial depth and diagenetic processes in the area of the Rocky Mountain Region has led to different configurations than the configurations found in South Dakota. In the eastern extension of the Niobrara Formation that includes South Dakota, which the reservoir consists mainly of low permeability chinks, shales and siltstones. Niobrara Formation is divided into two members: the upper member that is known as Smoky Hill Member, a chalky-shale unit of Santonian Age and the lower member consisting of a limestone known as the Fort Hays Member, dated as Coniacian Age. This unit is overlain by the Campanian Pierre Shale and underlain by the Turonian Carlile Shale. The petroleum production and available data in the Niobrara Formation is greater in the Rocky Mountain region than in South Dakota, even though both areas were parts of the same Western Interior Seaway in the Cretaceous Period. Porosity is a critical parameter for petroleum production, and better porosity information is needed to adequately evaluate the Niobrara Formation in South Dakota. This work has as its main goals to present the results of porosity well logs analysis from the Niobrara Formation mostly in South Dakota to compare and interpret values of petroleum productive areas to non-petroleum productive areas based on porosity. Also is intended to observe the spatial distribution of porosity across the study area. Scanned images from well logs in the State of South Dakota that are already available are used to acquire needed information about porosity and lithology. The use of Density Logs helps to reach porosity values. Density logs measure the density of the rocks and their pore fluid by measuring the electron density of a rock. The electron density is very closely related to the rock density expressed in g/cm<sup>3</sup>. If known the density of the minerals ( $\rho_m$ ), the bulk rock density ( $\rho_b$ ) and the fluid density ( $\rho_f$ ) (oil, gas or water) are known, the porosity can be calculated: Porosity ( $\phi$ ) =  $(\rho_m - \rho_b) / (\rho_b - \rho_f)$ . Geostatistical analysis are applied to image porosity spatial distribution. Porosity values in the Niobrara Formation range from 30% over 40% but can be severely dropped to an average 6%. The greater values of porosity are related to the chalk intervals and the smaller ranges of porosity are due to intervals made of chalky-shale.

**KEYWORDS:** Niobra Formation, Petroleum System, Well Logging.