

Sedimentary Infill as a Response to Tectonic Inversion in the US and Canadian Arctic, Identified by Regional 2D Geomechanical Restoration

Jordi Franques-Faixa, Irene Gomez, Robert Gruenwald, Manuel Gutierrez, Xavier Legrand, Raul Rodriguez, Gonzalo Ruiz, and Ricardo Veiga

RepsolYpf, Paseo de la Castellana 280, 28046 Madrid, Spain

Geomechanical driven restoration, using the "Finite Element Method", honors the physical laws which govern the rock deformation. This new approach has significant potential for petroleum applications as compared to usual geometric restoration based on the surface conservation. An example in the US-Canadian Arctic area illustrates how faults and reservoir compartmentalization, hydrocarbon migration pathways, and hydrocarbon traps can be understood in a context of complex tectonic processes. This understanding can be exploited in decision making and reducing risk.

2D Geomechanical reconstructions based on regional seismic interpretation along three regional cross-sections from West to East (Chukchi Sea, Beaufort Sea and Sverdrup Basin), well data and geochemical data were used to investigate and compare the influence of the tectonic activity on the sedimentary infill of the Arctic Alaska Plate and the Sverdrup Basin.

This study shows analogies between pre-rift and Early Jurassic rift phases until Upper Jurassic. Changes in depositional style in the post rift sequence (post Jurassic) overlying a regional unconformity, are related with basin characteristic tectonics.

Counterclockwise opening of the Canadian Basin results in a diachronous deformation of the Arctic Alaska Plate. A positive structural inversion occurs from Late Jurassic in the western part, propagating eastward during Early Cretaceous time. Then a continuous infill of the Colville Foreland Basin overrides the Proto Barrow arch and leads to a northward deepening of the Beaufort Sea in a basin inversion process. At present day, the burial of a Lower Cretaceous source rock to the north east of Barrow Arch defines a secondary petroleum system in the Beaufort Sea.

Key Words: Geomechanic Restoration, Arctic, Petroleum System, Finite Element Method