Canadian Arctic Geo-tectonic Study to exploration proposals

Wasim Paracha, Calgary

2004 CSEG National Convention

Abstract

The Canadian Arctic studies is very important with regard to un-earth and identify, after applying most useful modern computer modeling, seismic/sequence stratigraphic interpretation techniques, the new of oil producing high potential regions. This paper summarizes the same object based on available public seismic data, well data, reports collected from NEB and GSC public domain libraries. Canada, with its highly active tectonics has more attraction to the geoscientists and researchers and oil industries and especially in the frontiers lands. One part of this frontier land starts from the north-pole and terminates in the Arctic Circle. It is this region which has been divided into low relief of ~>200m "Lowland Arctic" and high mature relief of ~<1000m "Highland Arctic" regions. In this presentation, we shared with both regions. The lowland area is in the south-southwest of studied area while highland lies in the north and separated due to change in geological structure and age by the Arctic Platform shows mobile Franklinian Belt in the north and Canadian Shield in the south (Fig. 1). The Arctic zone of Canada lies in the northernmost part of the Canadian territory. The study area lies between N140°0'0"-E66.6°0'0" and N60°0'0"-E80°0'0" encountered region between North Pole and Arctic Circle of Canada including small islands within it also.

The Arctic Archipelago is composed of Arctic Platform, Boothia Uplift, Franklinian Geosyncline, Sverdrup Basin, Prince Patrick Uplift and Arctic Coastal Plain. The Arctic Coastal Plain here referred as Zone-1, the Sverdrup Basin as Zone-2 and the Arctic Platform as Zone-3 areas have been studied in detail because of more hydrocarbon prospecting zones in Upper Paleozoic (Devonian) and Middle-Lower Mesozoic (Jurassic-Triassic) sequences of Sverdrup Basin. A generalized stratigraphic column of the area has been produced showing the most possible successions in the area. The litho-seismic stratigraphic changes revealed to evaluate the key horizons in the prospecting zones of the studied area. A combined geophysical and geological study concluded the importance of hydrocarbon potential and structural setting of the area.

The seismic interpretation conclude that within the three divided zones of Arctic Islands to Arctic Lowlands, the central Sverdrup (Zone-2) showed more oil-bearing potential structural features while other zones (Zone-1 Banks Island area and Zone-3 Baffin Island area) have shown other kind of hydrocarbon (gas/mineral) attraction. In the southern Zone-2, there have been good hydrocarbon potential available mainly due to high maturation level of the Mesozoic sediments especially after the work of Upper Triassic sources. The migration of oil might have been taken place probably after Late-Early Cretaceous time. A few selected 2D seismic profiles about

30 years older data have been studied/interpreted through Cretaceous-Triassic with Devonian age. It has been observed during study that all three zones have different tectonic style which also changes the stratigraphical approaches also.

The study of Canadian Arctic here also deals A) to re-evaluate the possible high hydrocarbon potential zones for attract oil industries with the help of new techniques of interpretation and primary objective B) to study this particular area is to identify the key horizons in most potential high areas remaining to cover since previous time and to convince that proposed blocks can be one of the better hydrocarbon rich zone to investigate in future in Mesozoic (Cretaceous-Triassic referred mainly as probable King Christian Island Formation and probable Borden Island Formation) and the Paleozoic (Devonian referred as probable Blue Fjord Formation) deposits.

Seismic interpretation is based on reflection identification, seismic attributes, reflectors ties, seismic configuration and also seismic anomalies. The study also considers that in the Zone-1 one seismic offshore line in the southern Arctic Coastal Plain intersected with east of Amundsen Gulf area showed dykes/sills pull-up anomaly in its northern part that has been confirmed by the structural study, also the nature of structural high and its hydrocarbon potential reserves of Zone-2 central Sverdrup area in the King Christian Island area, S-SE of Edmond Walker Island, Grosvenor Island and Patterson Island (south Lougheed Island), the nature of structural high and its hydrocarbon potential reserves of east Zone-3, S-SW Buckingham Island area. The seismic data acquired in 70's mostly are of wriggle's variable area type and being older technology based data, they had a number of noises, diffraction, multiples, unclear pull-ups and some un-interpretable anomalies in it.

In the west, the Zone-1 area mostly comprises upper Mesozoic age. Triassic is absent in Banks Island area while in the Sverdrup Zone-2 comprises or Early Carboniferous-Late Cretaceous age. The Zone-1 Cretaceous strata are well developed in southern Banks Island with thin coal bedded Isachsen Formation, Beaufort Sea and also in western Amundsen Gulf areas. In the Zone-3, the most eastern area showed no interval between Upper Devonian and Tertiary which may be seen after Tertiary sand angular unconformity over older deposits. In the Zone-1, the geologic structural study could reveal that the tectonic occurred with association of Caledonian (the Late Silurian-Lower Devonian), Variscan (Early Upper Devonian), Hercynian (Pennsylvanian) and Laramide (Late Cretaceous-Early Tertiary) orogeny. The geological and tectonic setting in the Paleozoic, the lower part (Silurian-Early Carboniferous) has been discussed by Trettin, GSC, and DNAG-3 project 1991 explaining the deformational phases. The Arctic Platform area is mostly covered with the low tectonic activity by the Precambrian Basement. The Lower Ordovician-Upper Silurian mostly is composed of carbonate strata with numerous beds of argillaceous and arenaceous sediments. The Upper Ordovician also has some bio-clastic and shelf carbonates deposits. The Devonian in some parts of the study area is of clastic nature which may be derived either from Silurian carbonates or Ordovician clastic.