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Petrographic and Granulometric analysis of Miocene Reservoir Sandstones in a part of Assam-Arakan Basin

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ABSTRACT: The objective of this study is to acquire knowledge of the mineralogical composition, texture and depositional environment of the Miocene reservoir sandstones in a part of Assam-Arakan Basin. Sandstone properties like mineralogy, grain shape, packing, grain size, sorting, controls the grain-pore relationships and pore-throat characteristics. Study on mineralogical composition of sandstones and their textural characteristics helps to determine the provenance, tectonic settings and environmental conditions of deposition and reservoir properties of the rocks under study. Grain size distribution has a fundamental relationship with the physical forces involving mechanism of transport and deposition of sediments. In-depth studies by Friedman (1967), Moila and Weiser (1968), Sahu (1964) Passega (1957, 1964) and others on a global scale have established the correlation between size frequency distribution and depositional processes and shown the possibility of identifying depositional environment, by selection and combination of statistical parameters.

KEYWORDS: Assam-Arakan basin, Miocene, Grain size distribution, Mineralogical composition, Provenance, Tectonic settings.

I. INTRODUCTION

Petrographic study deals with the identification of minerals, diagenetic changes, sorting and their textural relations using thin section slides observed under Petrographic microscope. Petrographic study expands our understanding of the geologic history, can contribute to the question of provenance, indicate probable source rocks as well as source areas, can contribute to environmental discriminations, provide insight into the nature of the rock fabric and pore system and shed light on its diagenetic changes – including compaction and cementation, changes that gives alteration on porosity and permeability of the rock. Besides these, it may give information of the sedimentary rocks, altered by post depositional environment. Sandstone can be classified with the help of proper identification of framework grains. Moreover, it provides information on the climate and tectonic history of the source area. Of late petrographic study of sediments, become an organized discipline and widely used tool in geological research work.

Granulometric study is the most important characteristics of clastic sediments. It has a fundamental relationship with the physical forces involving mechanism of transport and deposition of sediments. In depth studies by Friedman (1967), Moila and Weiser (1968),

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Sahu (1964) Passega (1957, 1964) and others on a global scale have established the correlation between size frequency distribution and depositional processes by selection and combination of statistical parameters. It is possible to identify environment of deposition.

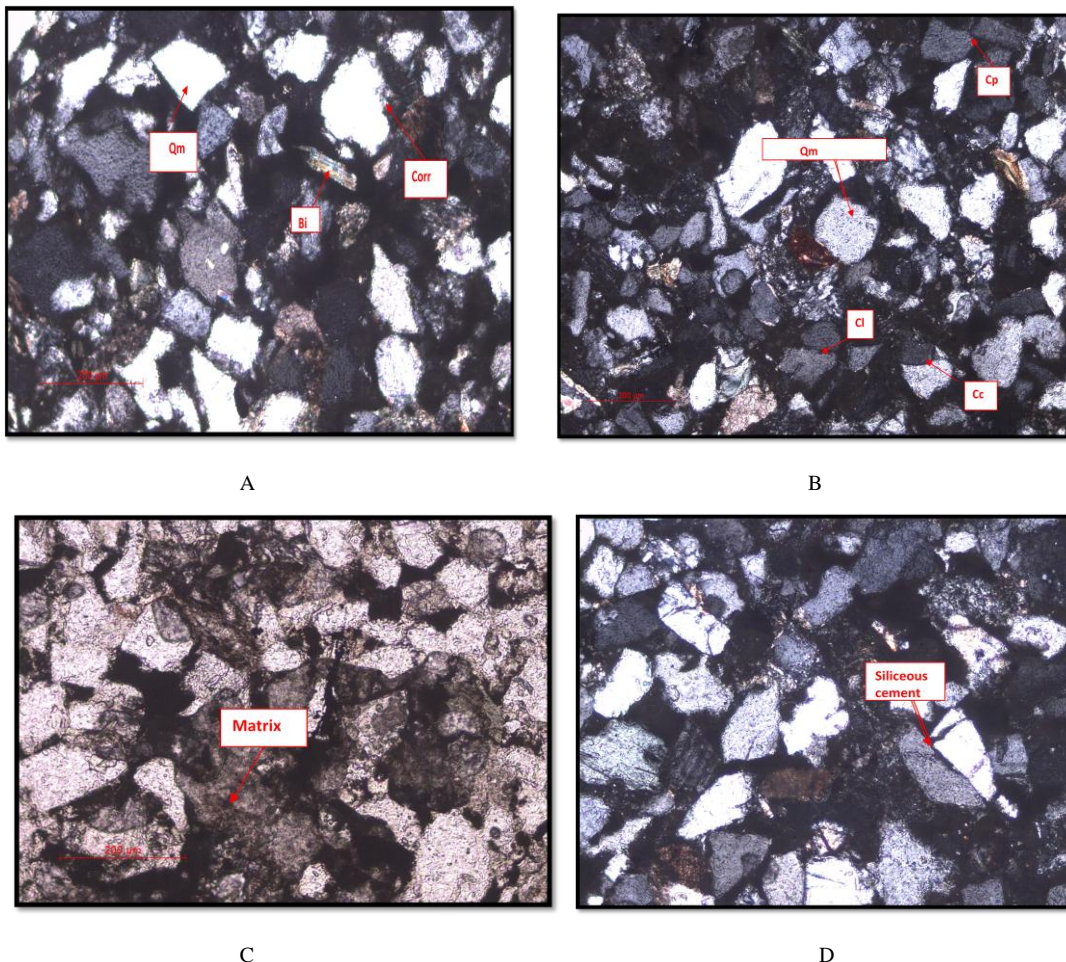
II. RELATED WORK

- Objective:** The objectives of the present study are as follows:
 - Study on mineralogical composition of sandstones thereby to evaluate the reservoir characteristics of the rocks under study.
 - Study on the granulometric distribution of the sandstones to evaluate textural characteristics and environment of deposition.
- Methodology:**
 - Collection of subsurface rock samples.
 - Preparation of rock thin sections for petrographic analysis.
 - Formulation of depositional environment with the help of granulometric study.
- Study area:** The study area falls under the jurisdiction of ONGCL In a part of Assam Arakan Basin.

III. EXPERIMENTAL RESULTS

1. Petrographic analysis results:

PLATE 1:



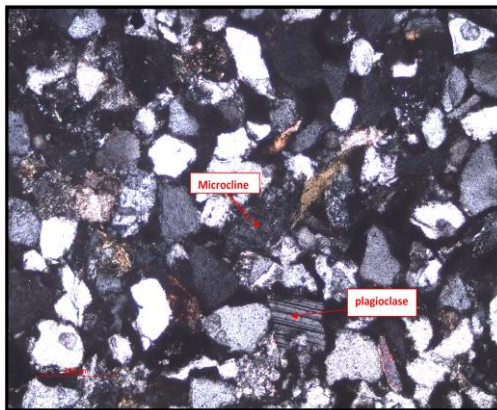
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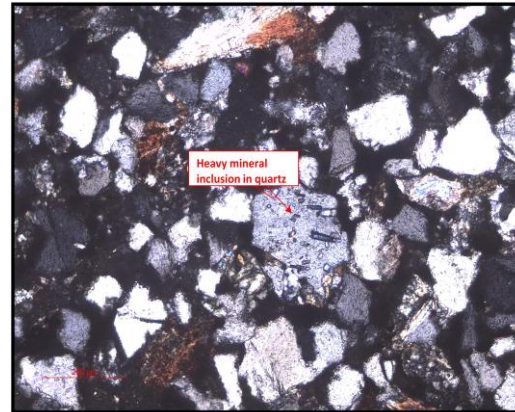
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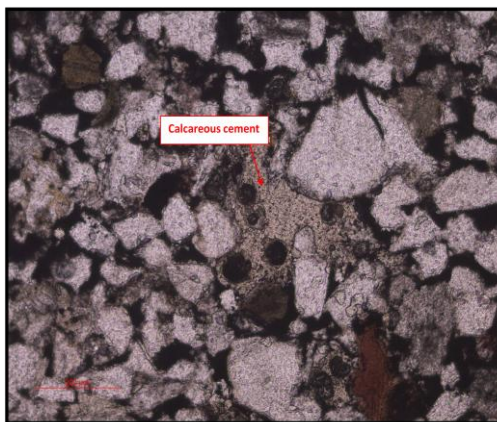
PLATE 2:



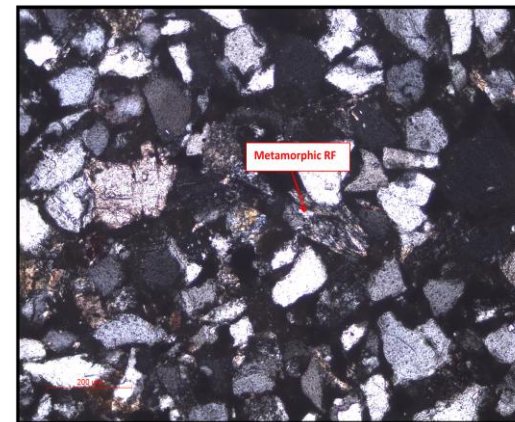
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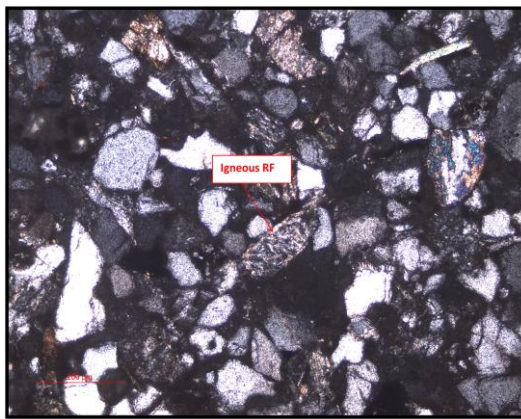
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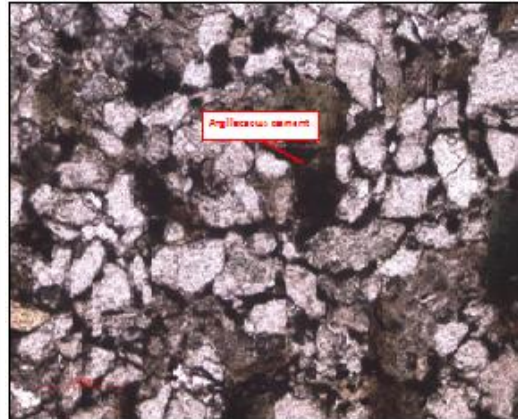
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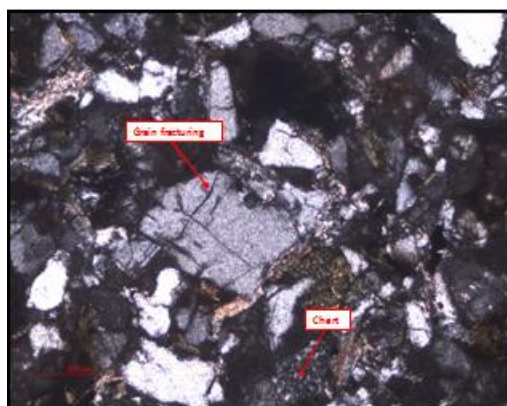
PLATE 3:



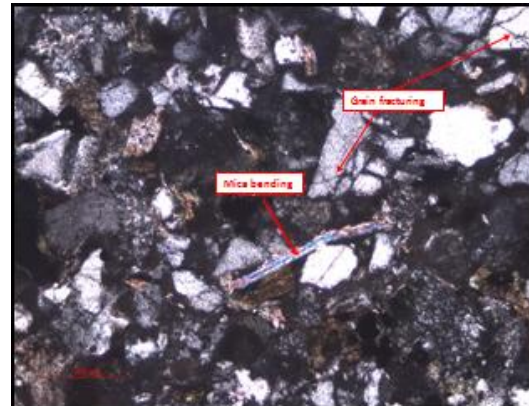
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2. Granulometric analysis results:

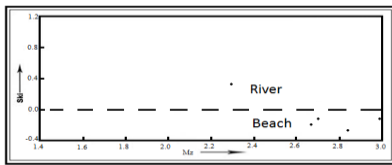


Figure-1: Plot of Skewness (Ski) vs. Mean Size (Mz).

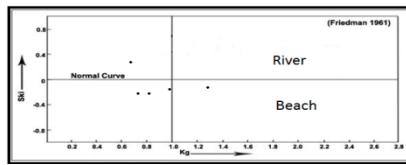


Figure-2: Plot of Skewness (Ski) vs. Kurtosis (Kg)

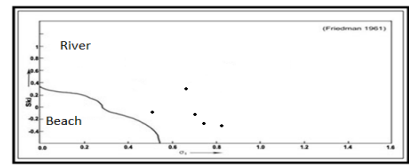


Figure-3: Plot of Graphic Standard Deviation (σ) vs. Graphic Skewness (Ski)

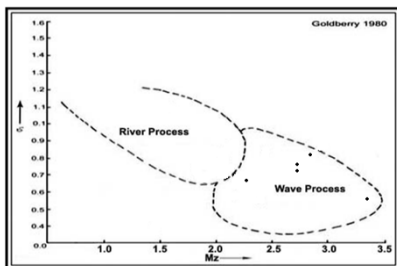


Figure-4: Plot Standard deviation (σ) vs. Mean Size (Mz)

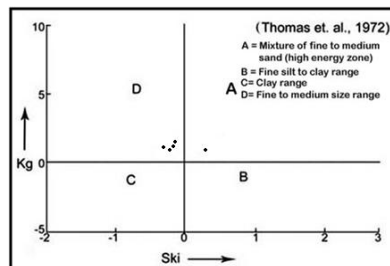


Figure-5: Plot of Kurtosis (Kg) vs. Skewness (Ski)



Figure-6: Plot Standard deviation (σ) vs. Mean Size (Mz)

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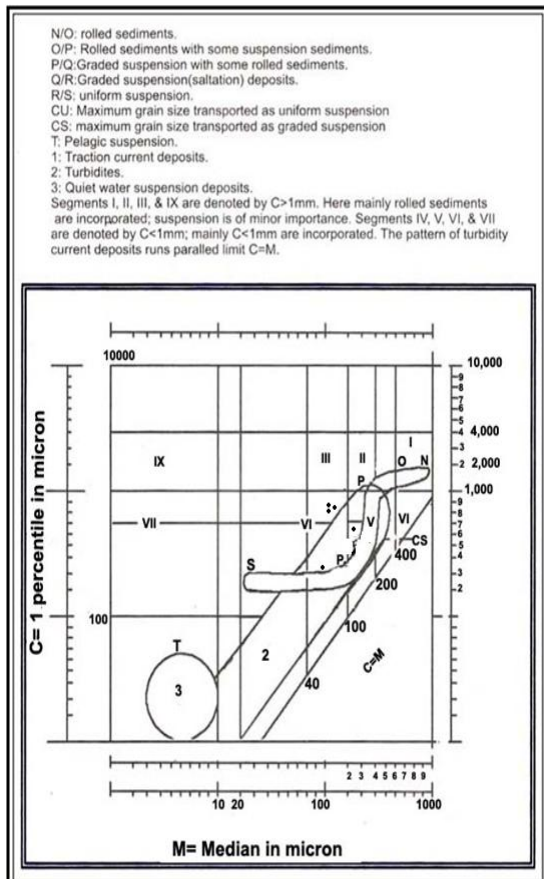


Figure-7: Plot of Cumulative weight % vs. Grain size in ϕ units.

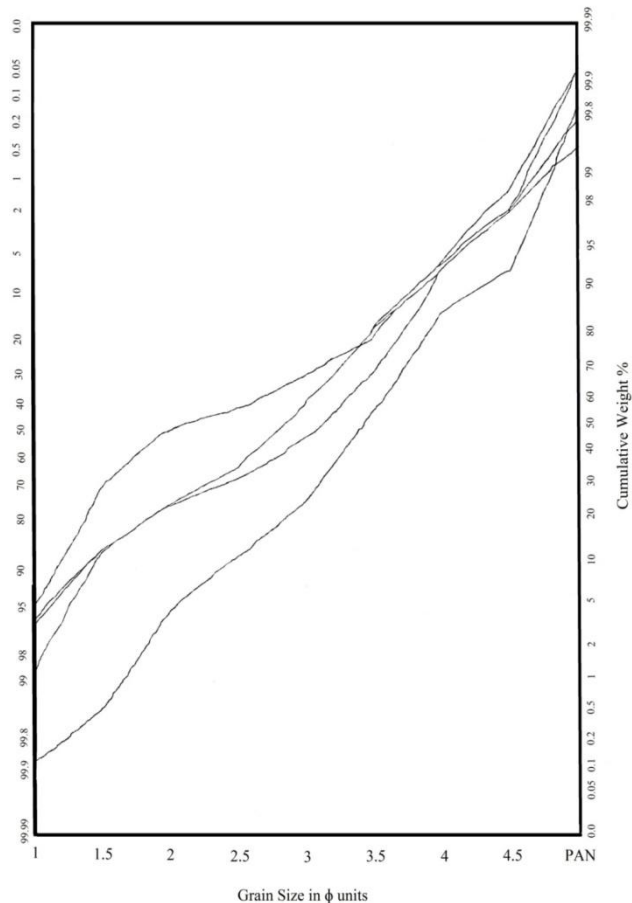


Figure-8: CM pattern i.e., Plot of C vs. M.

IV. CONCLUSION

The petrographic study of the Miocene reservoir sandstones confirmed that the sandstones are quartz dominant followed by feldspar, rock fragment, and mica. Calcareous, siliceous and argillaceous cement were observed in the present study. Heavy mineral inclusions were observed within quartz grain. Different diagenetic signatures in the sandstones were also studied which influences the reservoir characteristics. These include compaction (development of different type of grain contacts, mica bending and fracturing of detrital grains), cementation, dissolution and replacement of detrital grains. Some of these processes reduce the porosity and permeability while some helps generate secondary porosity.

Granulometric analysis revealed that the sandstone sediments are fine to medium grained, moderately sorted, mostly coarser skewed and platykurtic in nature. It is also observed that the samples fall within the river field as well as in the field of beach environment and the energy process discriminant functions of the sediments indicated that they were deposited predominantly by aeolian, shallow marine deposition environment with the influence of turbidity currents. From the CM pattern it can be observed that the sediments were transported by rolling and uniform suspension.

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