Microfacies And Diagenetic Features Of The Upper Cretaceous Foreland Basin: An Example From The Muti Formation, Jabal Akhdar Dome, Oman

Abstract

Objectives/Scope: The Upper Cretaceous Foreland basin sediments represented by Muti Formation are exceptionally exposed around Jabal Akhdar Dome in northern Oman. The development of the Oman Foreland basin resulted from the obduction events of allochthonous units on the northernmost margin of the Arabian plate, and the Muti Formation was deposited in conjunction with this obduction event. This study aims to understand the microfacies and depositional system and types and distribution of the diagenetic alternation of the Muti Formation.

Methods, Procedures, Process: Fifteen outcrop sections of the Muti Formation around Jabal Akhdar dome have been studied and sampled. Several techniques were employed to achieve the aims of this study, including conventional microscopic investigation, scanning electron microscopy (SEM), and X-ray diffraction (XRD). For the petrographical study 49 standard thin sections were prepared. The carbonate thin sections were half stained with Alizarin Red S and Potassium Ferricyanide for mineralogical identification. Moreover, 79 samples were used for XRD analysis to identify clay minerals.

Results, Observations, Conclusions: Numerous microfacies were recognized and distributed laterally and vertically. The dominant siliciclastic fragments are silt-size quartz, which is abundant in some units and rare in others. Also, micas and zircon are found within some microfacies. The most predominant bioclasts identified are benthic foraminifera, green algae, calcispheres, and bivalves. Moreover, various diagenetic features were recognized including blocky calcite cement, quartz cement, micritization, physical and chemical compaction (i.e. microfractures and stylolites) and their product of dissolution and porosity. Based on the detailed petrographic analysis of the Muti Formation around Jabal Akhdar Dome, the formation is interpreted to be deposited in the shallow marine environment in the middle to outer shelf settings. The observed vertical and lateral changes in the facies were attributed to topography variations and fluctuating sea levels. The Muti Formation is subjected to a typical sequence of diagenetic episodes, beginning with eogenesis in marine settings, followed by burial diagenesis. Subsequently, the formation is exposed to the telogenetic diagenesis phase.

Novel/Additive Information: The Foreland basin is considered a significant target for exploring and developing petroleum resources. In northern Oman, numerous oil fields are associated with the Oman foreland basin. Limited studies have been conducted on the Muti Formation resulting in an incomplete understanding of its sedimentary distribution and depositional processes and their control on diagenesis. This study will help to understand the hydrocarbon potential and prospects within the Foreland basin.