

## **Microfacies Analysis, Depositional Environment, and Diagenetic Process of the Antalo Limestone Successions in the Mekelle Outlier (Hagere-Selam, Messobo and Wukro Sections), Northern Ethiopia**

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**Abstract :** Three stratigraphic sections of the Antalo Limestone successions in Mekelle Outlier, northern Ethiopia (at Hagere-Selam, Messobo, and Wukro sections) have been investigated to distinguish their microfacies features, reservoir characterization, and their equivalent depositional environments. The Antalo Limestone successions were deposited in the Mekelle Outlier during the Upper Jurassic period as a result of flooding of the area by the Tethys Ocean toward the southeast direction. This study is based on field description and petrographic analysis to determine the depositional environment, age, and reservoir characteristics of the carbonate units. According to petrographical studies of 100 thin sections and field investigation, 14 microfacies types are recognized. These are grouped into 4 microfacies association of a tidal flat (MFT1-2), lagoons (MFL1-2), shoal (MFS1-4), and open marine environment (MFO1-6). Hence, the Antalo limestone successions are deposited in shallow carbonate ramps with a wide lateral and vertical distribution of facies. The carbonate units in the studied sections are affected by bioturbation, micritization, cementation, dolomitization, dissolution, silicification, and compaction type of early diagenetic alteration. Dissolution and dolomitization affected the type of rock, showing good reservoir quality, while cementation and compaction affected the type of rock, resulting in poor reservoir quality in the Antalo Limestone successions of the Mekelle outlier. Based on the abundant distribution of the *Alveosepta jaccardi* (Schrodt), *Pseudocyclamina lituus* (Yokoyama), *Kurnubia palestiniensis* (Henson), and *Somalirhynchia africana* in the studied sections the Antalo Limestone successions assigned to the Late Oxfordian-Kimmeridgian age.

**Keywords :** Antalo limestone successions, depositional environment, Mekelle outlier, microfacies analysis, diagenesis, reservoir quality

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