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Petrographic study of Umlatdoh limestone in parts of Meghalaya, north-east India with an emphasis on diagenetic and depositional attributes

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ABSTRACT

Early Eocene Umlatdoh Limestone of Sylhet Limestone Group have been studied to understand their framework constituents and diagenetic processes. Additionally, an approach was made to infer the depositional environment of this limestone based on the abundance of biogenic assemblages. Two vertical profile sections were measured and representative rock samples were collected for petrographic study. The limestones of the study area are classified as wackestone, packstone and grainstone, dominated by calcareous green algae (Dasycladalean algae) and large benthic foraminifers. An open lagoonal to proximal middle shelf environment has been envisaged during the deposition of the studied limestone. The diagenetic overprints of these limestones are characterized by several key diagenetic features, including micritization, cementation, compaction, dissolution and neomorphism. These diagenetic processes occurred in marine phreatic, meteoric phreatic, mixed meteoric phreatic, and burial diagenetic environments. Micritization of allochems, cementation by isopachous and granular calcite, neomorphism, and bioclast recrystallization occurred during meteoric-phreatic diagenesis. Meteoric-vadose diagenesis led to extensive dissolution and the infilling of fractures with sparry calcite. During burial diagenesis, blocky calcite cementation appears to have become prominent.

Keywords: Umlatdoh Limestone, Meghalaya, Petrography, Diagenesis, Depositional environment

INTRODUCTION

The Sylhet Limestone Group is well known for its captivating lithology as developed in the Cherrapunjee area of Meghalaya, Northeast India. Thick alternating carbonate and siliciclastic sequences, ranging in age from Late Palaeocene to Middle Eocene (Tewari et al., 2010a,b; Ghosh and Sarkar, 2013; Sarkar, 2015a,b, 2016) characterize the group. Larger benthic foraminiferal (LBF) assemblages and calcareous algae, dominate the carbonate sequences. Although the larger benthic foraminiferal (LBF) assemblages from Palaeogene succession of Meghalaya have been correlated with both the Tethyan and Indo-Pacific provinces (Jauhri, 1994; Jauhri et al., 2016), very little is known about their palaeo-environmental implications, including enormous development of carbonate build-ups, and large accretion of marine biota (Saraswati et al., 2018; Srivastava and Singh, 2019). Further, abundance of biogenic assemblages in shallow water carbonate depositional systems is substantially influenced by environmental factors like tides, waves, and occasional storms (Boothroyd, 1985; Hallock and Glenn, 1986; Jones and Hunter, 1992; Scoffin, 1993; Li et al., 1997, 1998; Shaghude et al., 2002; Gischler et al., 2003; Beavington-Penney and Racey, 2004; Wilson et al., 2010). The present study aims to identify different biogenic assemblages as well as various diagenetic attributes preserved in the Early Eocene Umlatdoh Limestone (Sylhet Limestone Group), employing microscopic analysis (Adams and MacKanzie, 1998) and their interpretation in terms of diagenetic vis-à-vis depositional environments.

GEOLOGICAL SETTING OF THE STUDY AREA

The study area forms a part of the southern Shillong Plateau and includes localities surrounding Wahrew Bridge of Meghalaya (25°10′50.68′′- 25°10′50.70′′ N; 91°45′52.67′′-91°45′51.57′′ E; Figure 1). The Shillong Plateau is a northeastern extension of the Peninsular India which is bounded by E-W trending Brahmaputra Fault system to the North and the Dauki Fault to the south. The N-S trending Jamuna Fault defines the western limit while eastern margin of the plateau is marked by NW-SE Kopili Fracture zone (Evans, 1964; Desikachar, 1974; Acharyya et al., 1986; Nandy, 1986; Gupta and Sen, 1988; Ray et al., 2011; Nandy, 2017). The Southern Shillong Plateau is covered by Cretaceous and Cenozoic sedimentary deposits forming a raised topography in the foreland of the Himalayas (Nagappa, 1959; Garg and Jain, 1995; Biswas et al., 2007; Kalita and Gogoi, 2015; Najman et al., 2016). Overlying conformably the Cretaceous cover, Southern Shillong Plateau spectacularly exposes the complete Paleocene -Eocene succession (Table 1) (Sarkar, 2020).

The Therria sandstone comprising intercalated sandstone – shale with minor coal units, marks the beginning of Tertiary succession. The Sylhet Limestone Group divisible into lower Lakadong, middle Umlatdoh, and upper Prang Formations conformably overlies the Therria sandstone. The lower and middle divisions of the Sylhet Limestone are comprised of calcareous (lower) and arenaceous (upper) members, while youngest Prang Formation is predominantly calcareous. Further, the three formations of Sylhet Limestone Group are considered to have resulted in response to three successive marine transgressions during the late Paleocene, early Eocene, and the middle Eocene periods respectively. The late Eocene Kopili Formation on the top, marks the closer of Tertiary succession in the region (Jauhri, 1994, 1998; Sarkar, 2020).