

Calcareous nannofossil biostratigraphy of the late Oligocene to early Miocene Lubuagan Formation (western Cagayan Valley Basin), Kalinga Province, Philippines

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The Cagayan Valley Basin is an archipelagic sedimentary basin (Tamesis, 1981) that is situated in the northern part of the Philippines. It is one of the country's largest offshore basins, and there are a number of studies on its general geology (Corby *et al.*, 1951; Vergara *et al.*, 1959; Durkee & Pederson, 1961), hydrocarbon potential (Tamesis, 1981; BED, 1986), and archaeological importance (Acabado, 2010). Detailed calcareous nannofossil biostratigraphic studies, however, are relatively few despite the recognized significance of such a study in establishing a comprehensive geologic history for the area. This study aims to establish a calcareous nannofossil biostratigraphy for sedimentary units in the Cagayan Valley Basin, starting with samples from the late Oligocene to early Miocene Lubuagan Formation.

Samples were collected from exposures of the interbedded sandstone-mudstone units of the Lubuagan Formation in Kalinga Province (western Cagayan Valley Basin) and were analyzed for calcareous nannofossils. For most samples, the nannofossil abundance and diversity were low. The nannofossils were well preserved, except for the discoasters, which were mostly fragmented. Nannofossil taxa that were observed in the samples include *Cyclicargolithus floridanus*, *Sphenolithus abies*, *S. heteromorphus*, *S. moriformis*, and *Reticulofenestra pseudumbilicus*. Based on the presence of *S. heteromorphus*, nannofossil Zone NN4-NN5 was recognized, suggesting an early middle Miocene age for the younger deposits of the Lubuagan Formation. The older sections (i.e., Oligocene) of the Lubuagan Formation, on the other hand, were recognized based on the presence of *Sphenolithus ciperoensis*.

The ultimate goal of this study was to resolve the conflicting age assignments of the Lubuagan Formation as reported in various research studies. Maac (1988) assigned the Lubuagan Formation to the early-middle Miocene based on foraminiferal analysis. The study of Billedo (1994) assigned a late Oligocene-early Miocene age based

on nannofossil analysis of samples from the southeastern part of the Cagayan Valley Basin. The stratigraphic column proposed in the PNOG-EC (2003) report restricted the age assignment to the middle Miocene.

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