

Significant Miocene larger foraminifera from South Central Java

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Abstract

The Gunung Sewu area of South Central Java, Indonesia during Mid Miocene, Langhian-Serravallian (Tf1-Tf2), was deposited in a large area of warm, very shallow-marine water. Coralline algae and abundant larger benthic foraminifera dominate the carbonate lithologies. Larger benthic foraminifera from previously unstudied sections in South Central Java are described and figured. They have led to an understanding of sequence stratigraphic and facies relationship of Miocene carbonates in Indonesia. Thirteen larger foraminifera species are described and illustrated. A detailed biostratigraphical studies of The phylogeny *Katacycloclypeus annulatus* - *K. martini* and the gradual evolution from *Austrorillina asmariensis* into *A. howchini* are recognised. Analysis of the larger benthic foraminifera has allowed accurate dating of the carbonate sections studied using the East Indian Letter Classification.

Key words

Larger foraminifera, Mid-Miocene, biostratigraphy, phylogeny, South Central Java.

I. INTRODUCTION

Larger benthic foraminifera were widely distributed in Tertiary carbonates in South Central Java. The larger foraminifera of the Netherland-East Indies have been the subject of a number of early works concerning their systematics, stratigraphy and biostratigraphy (e.g. MARTIN, 1880; OPPENOORTH, 1918; VAN DER VLERK, 1924, 1925, 1928; SCHEFFEN, 1932; TAN SIN HOK, 1932, 1935, 1936; VAUGHAN & COLE, 1941; TODD & POST, 1954).

Although the new evidence from Java confirms these earlier findings, our new contribution allows:

1. The recognition of the phylogeny of the taxa and their distribution in the palaeoenvironment represented by the studied samples.
2. An accurate stratigraphical correlation with an assessment of the controls on larger foraminifera occurrences. This, in turn, allows the true significance of biofacies to be established and understood.
3. This work has also enabled the recognition of a refined biostratigraphical correlation. Lines of evolution in larger foraminifera should be studied rather than simply relying on first and last occurrences. These lines of evolution allowed palaeoenvironmental specialisation into separate biocenoses and particular palaeoecological niches. Such evolutionary sequences have previously been established for *Lepidocyclina* (BOUDAGHER-FADEL & LORD, 2000) and *Miogyopsina* (BOUDAGHER-FADEL *et al.*, 2000a), and are here clearly

demonstrated in the sequence from *Austrorillina asmariensis* to *A. howchini* and from *Cycloclypeus* to *Katacycloclypeus annulatus* and then to *K. martini*. Thus these evolved taxa must occur in the same sequence regardless of whether they were sampled from Papua, Indonesia or the Philippines. Prior to this research previous records of these species have been out of stratigraphic sequence.

Therefore, in distinguishing between the indicators of palaeoenvironments and biostratigraphical horizons we are able to trace an accurate stratigraphical correlation that is independent of biofacies.

II. STUDY AREA AND SAMPLES

In this study, larger benthic foraminifera have been analysed from five logged sections in the Gunung Sewu area of South Central Java, Indonesia (Fig. 1). This extensive Miocene carbonate platform developed in close proximity to an active volcanic arc (LOKIER, 2000). The deposits associated with these events include the volcanoclastic Jaten and Wuni Formations, the siliciclastic and carbonate Nampol Formation, and the dominantly carbonate Kepek and Wonosari Formations.

The lower Mid Miocene Nampol Formation outcrops at the periphery of the area under investigation. The Nampol Formation is conformably overlain by, and grades upwards into, the contemporaneous pelagic-

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