

Siliciclastic and volcanoclastic influences on equatorial carbonates: insights from the Neogene of Indonesia

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ABSTRACT

In active tectonic areas of humid equatorial regions, nearshore shallow-water environments are commonly sites of near-continuous siliciclastic influx and/or punctuated volcanoclastic input. Despite significant clastic influence, Neogene carbonates developed in SE Asia adjacent to major deltas or volcanic arcs, and are comparable with modern mixed carbonate–clastic deposits in the region. Research into delta-front patch reefs from Borneo and fore-arc carbonate platform development from Java is described and used to evaluate the effects of siliciclastic and volcanoclastic influx on regional carbonate sedimentation, local changes in carbonate-producing biota and sequence development. Regional carbonate development in areas of high siliciclastic or volcanoclastic input was influenced by the presence of antecedent highs, changes in the amounts or rates of clastic input, delta lobe switching or variations in volcanic activity, energy regimes and relative sea-level change. A variety of carbonate-producing organisms, including larger benthic foraminifera, some corals, coralline algae, echinoderms and molluscs could tolerate near-continuous siliciclastic or volcanoclastic influx approximately equal to their own production rates. These organisms adopted various ‘strategies’ for coping with clastic input, including a degree of mobility, morphologies adapted to unstable substrate inhabitation or shedding sediment, and shapes adapted to low light levels. Local carbonate production was also affected by energy regime, clastic grain sizes and associated nutrient input. Clastic input influenced the inhabitable depth range for photoautotrophs, the zonation of light-dependent assemblages and the morphology and sequence development of mixed carbonate–clastic successions. This study provides data on the dynamic interactions between carbonate and non-carbonate clastic sediments and, when combined with information from comparable modern environments, allows a better understanding of the effects of siliciclastic and volcanoclastic influx on carbonate production.

Keywords Biota zonation, Borneo, delta-front patch reefs, fore-arc carbonate platform, Java, Neogene, siliciclastic/ volcanoclastic carbonate interaction.

INTRODUCTION

There is a common misconception that significant shallow-water carbonate production does not occur in areas of siliciclastic or volcanoclastic input. However, a growing number of studies of modern environments and ancient sedimentary

rocks indicate that mixed carbonate–insoluble clastic deposits are in fact quite common and varied (e.g. Mount, 1984; Doyle & Roberts, 1988; Woolfe & Larcombe, 1998). Despite new research on modern reefs developed along predominantly siliciclastic shorelines in SE Asia and Australia (Tudhope & Scoffin, 1994; Woolfe & Larcombe,