

Tectonic Controls on Carbonate Production and Facies Architecture: Examples from Indonesia

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Carbonate build-ups that form along active margins (fore arc/volcanic arc and back arc environments) are under constant threat of extinction from volcanic and tectonic activities. Reef growth surrounding active and inactive volcanoes, such as in the Sunda Strait in Indonesia, is frequently interrupted by volcanic eruptions, which introduce ash, pumice, and lava into otherwise stable ecosystems. Carbonate systems are also affected by major destructive volcanic eruptions (e.g., Krakatau explosion 1883) and tectonic uplift during earth quakes (e.g., Banda Aceh 2004).

In back-arc settings, unimpeded growth of build-ups and platforms is more favorable although not guaranteed. Sub-surface back arc carbonate buildups studied in the North Madura Oligo-Miocene platform, offshore Central Java, are perfect examples of carbonates forming in a volatile tectonic environment. However, carbonate platforms and build-ups only survived for about 10 million years, forming relatively small and isolated reservoirs, compared to the giant carbonate fields of the Middle East. There, under stable tectonic conditions, nearly 200 million years of carbonate growth are locally recorded.

In tectonically active settings, studies of modern analogs, outcrops, and seismically imaged carbonates are crucial for understanding the controls on initiation, growth, and demise of carbonate systems. Three-D seismic visualization also provides insights into the distribution, size, shape, and evolution of carbonate build-ups and the tectonic events influencing their growth and demise.