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Reef carbonate production in nearshore terrigenous sediment dominated environments: a different part of the carbonate factory producing a different depositional product.

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The concept of the *tropical carbonate factory* is firmly established in the geoscience literature and is associated with the, primarily biologically controlled, carbonate production that occurs in the warm, well-illuminated, low nutrient near surface waters of the tropics and subtropics. Carbonate production in these settings (generally regarded as being between 30^o N and S of the equator) is typically dominated by a range of photosynthetic autotrophs (e.g., green algae) and by animals with photosynthetic symbiotic algae (e.g., corals and foraminifera). These systems are typically characterised by high rates of primary carbonate production (often producing spatially and bathymetrically extensive coral reef structures and reef-related sediment bodies) and by the development of chlorozoan sediment facies. It is increasingly clear, however, that within this broad latitudinal range significant areas of reef development and localised carbonate production also occur in settings where marine environmental parameters approach or exceed the threshold levels for tropical carbonate production. These include areas within the shallow water tropical and sub-tropical seas that are subject to high and low (or seasonally variable) temperature and salinity fluctuations, reduced light penetration (due to high turbidity), and elevated sedimentation rates.

This paper highlights key findings from recent work undertaken at a range of turbid-zone, nearshore, terrigenous sediment dominated settings in north Jamaica, southern Mozambique, and along the central sections of the inshore Great Barrier Reef in Australia. These studies are providing a new perspective on carbonate facies development

in one such sub-optimal part of the tropical carbonate factory system. In particular, the work has focused on the composition of contemporary carbonate producing communities, reef depositional facies and fabrics, framework taphonomy, reef growth histories, and sediment diagenesis. These systems represent one part of what should be regarded as a spectrum of carbonate producing systems in the tropical realm, but which produce rather different types of depositional products.

Despite often high turbidity conditions, restricted light penetration, and the presence of often mobile terrigenous sediment substrates, areas of active coral growth appear to be relatively common under these conditions. These coral communities are associated with true reef development (in the sense that they produce structures that exhibit clear topographic relief and are localised sites of carbonate production and accumulation). Although the spatial and bathymetric extent of reef construction is often restricted, coral cover is often high (60-80% at some sites) and the communities are often in good health (as evidenced by live coral cover, species diversity and population structure). The internal depositional fabrics of these reefs contain a high proportion of coral rubble (little of which appears to be in growth position) and which varies from clast to matrix supported. Much of this coral rubble material often exhibits evidence of significant internal bioerosion (mainly assigned to the ichnogenus *Entobia* isp. and *Gastrochaenolites* isp.). Coral rubble is often sparsely encrusted by calcareous encrusters and there is no evidence of biological binding of the framework. Inter- and intra-skeletal cements are also very rare. The sediment matrix of the reef structure varies between settings but typically comprises mixed carbonate-siliciclastic sands.

The wider sedimentary settings in which these reefs occur is siliciclastic dominated. Carbonate skeletal sediments are restricted to localised production sites and the surrounding sub-tidal and intertidal sediment bodies often contain no sedimentary evidence of adjacent carbonate deposition. This probably reflects both low carbonate production rates as much as the effects of siliciclastic 'swamping' of the environment. Furthermore, there is some evidence to suggest that these sites are characterised by rather restricted carbonate sediment assemblages, with key tropical sediment producers either absent or occurring in low numbers/diversities. Recent work on carbonate settings subject to anthropogenic inputs of Fe-rich (bauxite) sediment have also indicated the potential for terrigenous sediment inputs (where Fe-rich) to shift pore-water chemistry and microbial reactions from bacterial sulphate reduction to iron reduction.

An alternative model of tropical carbonate production under conditions of high terrigenous sediment influence is presented, the key features of which relate to a modification in the way the tropical carbonate factory functions. In addition to representing one alternative state of lower latitude carbonate production, such systems are also important because they provide an insight into how areas of the contemporary tropical carbon-

ate factory may respond to on-going and future environmental (e.g., elevated rainfall, run-off, nutrient loading) and climate-related (e.g., elevated sea surface temperatures, modified aragonite saturation states) change.