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Spatial heterogeneity of biogeochemical components at the sediment interface: relations with ecological units in an insular coral reef ecosystem (Moorea, French Polynesia)

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The present study was designed to identify the major sediment types around Moorea and to examine the spatial variability of the biogeochemical composition of surface sediments, in relation to geomorphological units and benthic communities distribution. A total of 35 stations were sampled at 4 sites around the island, on the various geomorphological units identified. Several descriptors were used to precisely determine and characterise the different sediment types: inorganic carbon (IC), organic carbon (OC), nitrogen (N), C/N ratio, hydrolysable organic carbon (HOC), total amino acids (AA), and total carbohydrates (CH).

A strong spatial heterogeneity was found in the biogeochemical composition of surface sediments at the scale of Moorea Island. Four major sediment types, that did not exactly match the geomorphological units of the reef system, could be distinguished around Moorea by the multivariate analyses (PCA and clustering). The first type corresponds to the inner half bay bottoms, and clearly represents the "terrigeneous" influence, mainly characterised by a clear deficit in carbonates and, conversely, by an enrichment in organic compounds (OC, N, AA, CH) that were highly degraded. Two other sediment types were influenced by the carbonated reef system and were highly carbonated (IC around 11 %; i.e. carbonates around 90 %), showing low organic compound concentrations. They were also characterised by high HOC concentrations. These two "reef-characteristic" sediment types can be distinguished by their N concentrations and C/N ratio. The fourth type represents a transition between "reef-characteristic" and "terrigeneous" sediment types. A gradient along the bays was also found, as for other reef communities.

Finally, our study also demonstrates the effectiveness of HOC, total AA and CH to differentiate sediment types in reef systems, together with the more 'classical' descriptors: IC, OC and N. They are reliable descriptors for spatial variability surveys and may be used as indicators of reef "health".