Residence times of reef-island sediments constrained by post-mortem precipitates

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The precipitation of carbonate cements is a rapid process in tropical marine environments. Distinct from calcification, the onset of cementation coincides with the termination of 14C uptake within carbonate-sediment forming organisms. Here we show that this relationship presents new opportunities for examining the temporal lag between organism death and deposition in carbonate systems – the prerequisite for reliable depositional chronologies. We dated skeletal constituents collected from discretely stratified reef-island deposits in Indonesia. In each of the strata, internally least cemented segments of the calcifying green alga Halimeda yield the youngest ages. Complementary mesocosm experiments on cementation rates reveal that post-mortem cement growth initiates within months after transport commences. Continuous pore-filling cementation promptly stabilizes the initially fragile Halimeda skeleton. Furthermore, abrasion experiments show that such cementation significantly increases the durability of segments during transport. Implications of these findings are profound in two respects; first, evaluating residence times of skeletal carbonate constituents based on abrasion features is far from being adequate. Second, the absence of cements within sedimentary Halimeda segments signals that post-mortem transport through the intertidal zone occurred quasi-instantaneously. Radiometric ages from such specimens should minimize the temporal lag between organism death and deposition thus making them reliable indicators of sedimentation in supratidal environments.