

# Morphology and sedimentology of *Halimeda* bioherms from the eastern Java Sea (Indonesia)

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**Abstract.** *Halimeda* bioherms, occurring primarily along the western and southern margins of Kalukalukuang Bank in the eastern Java Sea, display a wide variety of thicknesses and shapes. In general, high-frequency forms of the northern bank are replaced by thicker and lower frequency forms along the deeper southern margin. Side-scan sonar data suggest aperiodic reworking of shallow bioherm crests of the northern bank into features suggestive of bedforms. These features are not associated with deeper bioherms of the southern bank. Cores from the bioherms indicate that they consist mostly of disarticulated *Halimeda* plates set in a lime mud matrix composed largely of *Halimeda* fragments and foraminifera tests. Carbon-14 dating shows that, with exception of some deep southern bank examples, bioherms are actively accreting. Results of mineralogy and elemental chemistry on piston core PC-12 suggest cyclic variations in Mg-calcite (cement in *Halimeda* utricles), which may be related to periodic excursions of cold Pacific throughflow water onto the bank. Composition of the Mg-calcite (8.6 mole-%) suggests a temperature of formation of about 22 °C, which is 7 °C below average surface water temperatures. The carbon and oxygen isotope compositions of both aragonite and Mg-calcite phases are remarkably homogeneous, but were inconclusive with regard to the cold-water intrusion hypothesis. However, a lack of reef-building corals below a depth of ~15 m, abundance of *Halimeda* bioherms on the western margin of K-Bank, where upwelling is predicted, extensive boring of sedimentary particles by endolithic boring algae, and high nutrient values of water at the thermocline (50–70 m deep) all support the incursion of cold, nutrient-rich water onto the bank. Upwelling and nutrient overloading are suggested as explanations for remarkable algal growth at the expense of reef-building corals.

modern and actively accreting *Halimeda* bioherms were found. The purpose of this cruise was to study the sedimentary architecture of the Sunda Shelf margin and the margins of an adjacent carbonate platform. Although extensive high-resolution seismic, side-scan sonar, and sediment data were collected on the Sunda Shelf margins, no *Halimeda* bioherms were identified. However, when similar data sets were collected on the carbonate platform, remarkable biohermal buildups of *Halimeda* were immediately recognized. These *Halimeda*-rich deposits are accumulating primarily along the western and southern margins of Kalukalukuang Bank (K-Bank), which is located 60 to 70 km east of the shallow Sunda Shelf edge (Fig. 2). Until the Indonesian features were determined to be bioherms built mostly from the accumulation of aragonitic *Halimeda* plates (Roberts et al. 1987a, b), the only other modern bioherms attributed to *Halimeda* growth and accumulation were described from reef-protected areas of the northern Great Barrier Reef (Orme et al. 1985). Now, Hine et al. (1988) have reported similar bioherms from the western Caribbean. The term “bioherm” is used to describe these features because they do not have a rigid internal framework like a reef, but they still have relief above the surrounding sea floor and are in situ accumulations formed generally under conditions of low marine energy input. Both piston cores and vibracores taken on the tops and flanks of the Indonesian bioherms confirm that the single most important constituent is *Halimeda* in the form of disarticulated plates and plate fragments.

Previous reports on the Indonesian bioherms (Roberts et al. 1987a, b; Phipps and Roberts 1988) indicate that *Halimeda*-rich sediment from which these features are composed has a distinctive seismic signature. As compared to reefs, hardgrounds, and other typical carbonate types of seafloor relief forms, the *Halimeda* bioherms are relatively transparent acoustically, but contain