Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02343, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02343
EGU General Assembly 2008

A geometric model to simulate the evolution of an oyster reef on the southern Jiangsu coast, China

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Abstract Oyster reefs are coastal habitats with important ecological benefits and contain sedimentary records of abundant information on environmental changes. An oyster reef evolution model is proposed based on the principle of the carbonate sequence stratigraphy. It consists of four modules, for sea level curve, top layer elevations for clastic sediments, reef vertical growth rates and the elevation of the reef top, respectively. A carbonate production rate function is modified to calculate the oyster reef growth rate under specific conditions, and the input parameters are derived by means of sedimentary environment analyses and geomorphological comparisons. As an example of the application of the model, the colonization, development and burial of the Xiaomiaohong oyster reef on the Jiangsu coast have been investigated. The model output shows that the water depth above the reef and the estuarine environmental parameters control the evolution of the oyster reef, with a maximum vertical growth rate of around 13.5 mm/a. At an initial stage, the reef growth is dominated by up-building; after the reef began to emerge above the mean low tide on springs at around 910 years before present, its growth is characterised by lateral building. The area of the reef above the mean low tide on springs reaches a maximum at 330 years before present. At the present time, the reef growth becomes extremely slow, and in 250 years its growth will be terminated due to the accumulation of clastic sediment, when the reef will have a maximum thickness of 12.54m. The model also shows that the evolution of the oyster reef is influenced by complex processes, which are affected by a number of factors such as sea level fluctuations, ground subsidence, deposition of clastic materials, salinity and suspended sediment concentration. In a sedimentary record, the top

layer of oyster reefs should be considered as an indicator of being below the ancient sea level, rather than the exact position of the sea level.

Keywords oyster reef evolution, growth rate function, sedimentary sequence, geometric model, Jiangsu coast