



Ecological conditions in the deep South China Sea recorded by biogenic sedimentary structures: effects of upwelling, ash fall, and turbidite deposition

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The South China Sea belongs to the marginal seas between Asia and the Pacific. It represents a semi-enclosed basin bordered by the the Asian mainland in the north, the Sunda shelf in the west, the islands of Borneo, Palawan and Luzon to the south and Taiwan to the east. In spite of this situation the South China Sea has fully oxygenated bottom water being exchanged via the Bashi channel with the Pacific. As being close to the mainland of Asia, the South China Sea is affected by monsoonal circulation. The winds induced upwelling two times the year occurring mainly west of about 166° E. Rivers from the Philippines deliver suspension and nutrients fertilizing the sea. At the steep continental margin of the Philippines turbidites originate. Furthermore in 1991 Mount Pinatubo erupted on the Philippines and large amounts of ash were distributed on about 400 000 km² west of the island of Luzon; the ash is 1-100 mm thick.

The 1991-Pinatubo-ash-layer provides an excellent reference horizon to study the effects of sediment supply, regional upwelling, and event sedimentation on bioturbation. The pre-ash biogenic sedimentary structures (ichnofabrics) are preserved as frozen tiers and can be related to the fairly well known environmental conditions. In addition the recolonization of the ash can be monitored based on the cores taken in 1994, 1996, 1998, and 1999. Below the pre-1991-ash a 1-2 cm thick mixed layer occurs. With respect to the ichnofabrics three distinct provinces below the mixed layer can be distinguished:

1. *Nereites* ichnofabrics are formed in brown, oxidized sediments and reach down to the redox boundary, 8-10 cm deep. *Nereites* ichnofabrics occur west of 116° E in water depth >4'000 m; spatially they coincide with the area affected by upwelling and slow

sedimentation. As the *Nereites* traces and other burrows contain 1991-Pinatubo ash, the most endobenthic animals appear to have a dual nutritional strategy: surface feeding during upwelling and sediment feeding during non-upwelling times. Burrow density and their fill point to high population densities.

2. *Scolicia* ichnofabrics produced by burrowing echinoids occur in greenish, oxygen-deficient deposits along the Philippines in water depth from below 500 to about 3'000-3'500 m. This area receives significant input of siliciclastics and organic matter from land. As the 1991-Pinatubo ash is already intensely mixed, the bioturbation rate is really high and hence, the inferred endobenthic population density.

3. *Thalassinoides-Teichichnus* ichnofabrics occur in the area between the *Scolicia* and *Nereites* province. These sediments are characterized by multiple redox horizons; brownish to black deposits stained by Fe- and Mn-oxides, and greyish-green, oxygen-deficient sediments alternate. The sediments are stiff and contain little benthic food. The low amount of vertically displaced 1991-ash points to a low population density.