

# Marine palynomorphs dominated by heterotrophic organism remains in the tropical coastal shallow-water sediment; the case of Selangor coast and the estuary of the Manjung River in Malaysia

KAZUMI MATSUOKA<sup>1</sup>, TATSUYA YURIMOTO<sup>2</sup>, VING CHING CHONG<sup>3</sup> AND ALIAS MAN<sup>4</sup>

<sup>1</sup>Institute for East China Sea Research, Nagasaki University, 1551-7 Taira-machi, Nagasaki 851-2213, Japan  
(e-mail: kazu-mtk@nagasaki-u.ac.jp)

<sup>2</sup>Japan International Research Center for Agricultural Sciences, 1-1 Owashi, Tsukuba, Ibaraki 305-8686, Japan

<sup>3</sup>Institute of Ocean & Earth Sciences, University of Malaya, 50603 Kuala Lumpur, Malaysia

<sup>4</sup>Fisheries Research Institute, FRI Kampung Ache, 32000 Sitawan, Perak, Malaysia

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**Abstract.** We aimed to clarify and quantify the abundance of palynomorphs of tropical coastal marine shallow-water sediments collected from Oman, Malaysia, Okinawa and also the Sanriku region of Japan for making a comparison with temperate areas. Palynomorphs in these samples contained phototrophic and heterotrophic dinoflagellate cysts, acritarchs, resting cells of Prasinophyceae and Chrysophyceae, tintinnomorphs, microforaminiferal linings, testate amoebae and resting eggs and body fragments of copepods. The sediment samples from Malaysia, Oman, and Okinawa were characterized by dominance of heterotrophic marine palynomorphs, in particular microforaminiferal linings and heterotrophic dinoflagellate cysts, while the samples from Sanriku were different and dominated by phototrophic and heterotrophic dinoflagellate cysts. In addition subtropical-tropical assemblages were characterized by low cell/grain concentrations, especially phototrophic dinoflagellate cysts. These characteristics of marine palynomorphs in tropical shallow-water sediments may reflect lower production of phytoplankton in water column as well as high sedimentation rates. Also, high densities of heterotrophic palynomorphs consisting of microforaminiferal linings, tintinnomorphs, crustacean remains and other elements are other characteristics for tropical coastal shallow-water marine sediments. It is difficult to explain the abundant occurrences of heterotrophic dinoflagellate cysts based on the grazing food web against the fact of low phytoplankton production.

**Key words:** dinoflagellate cysts, food web, Malaysia, marine palynomorph, microforaminiferal linings, tintinnomorph

## Introduction

Modern marine sediments preserve various microscopic organic substances called palynodebris and palynomorphs. Although several different definitions of palynodebris have been made by Traverse (1988), palynodebris is best described as irregularly shaped organic materials that consist of wood fragments, plant epidermises, invertebrate cuticles, and other biotic remains (Waveren, 1993). On the other hand, Traverse (1988) defined a palynomorphs as microscopic, resistant-walled organic bodies found in palynologic maceration residues. Palynomorphs consist of terrestrial pollen and spores of

ferns and fungi, dinoflagellate cysts, tintinnomorphs, microforaminiferal linings, copepod eggs and their bodies and appendages, scolecodonts, butterfly scales, and other miscellaneous organic grains. In marine sediments, these palynomorphs, excepting pollen, spores, and dinoflagellate cysts, have been merely documented during pollen, spore and dinoflagellate cyst studies so far. The pollen and spore assemblages are mainly utilized for clarifying paleovegetational and paleoclimatic changes. Dinoflagellate cyst assemblages are also employed for reconstructing oceanographic environmental changes such as SST (e.g. De Vernal *et al.*, 2001), salinity (e.g. Mertens *et al.*, 2008), and nutrient levels (eutrophication; e.g. Throsen