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Latest Permian Deep-water Fauna from South China and Its Implications for the Mass Extinction and Palaeogeography

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The Paleozoic-Mesozoic mass extinction is the largest event among the ‘‘Big Five’’ during the Phanerozoic in terms of the severity of taxonomic diversity losses (Sepkoski, 1981; Erwin, 1994). This event killed about 90% of marine species. The Late Permian and Permian-Triassic marine invertebrate faunas of South China have been abundantly documented, as evident from several detailed taxonomic monographs (Chao, 1927, 1928; Huang, 1932, 1933; Zhao et al., 1978, 1981; Jin et al., 1974; Yang et al., 1987; Li et al., 1989; Shen and Shi, 2007, etc.). Most fossils in these monographs were mainly collected from shallow-water carbonate facies. Since the late 1970s, some articles about Late Permian deep-water invertebrates, especially brachiopods and radiolarians, have been published (Liao, 1979, 1984; He et al., 2005, 2012; Chen et al., 2006, 2009; Feng et al., 2007). However, detailed knowledge about the taxonomic composition, morphogical features and palaeogeographical distribution of latest Permian marine deep-water invertebrates is still very limited.

Here we summarized the features of the latest Permian marine deep-water invertebrates: (1) The benthic fauna is characterized by a low genus-level or even species-level diversity, with small, thin-shelled brachiopods, bivalves and a few foraminifers; by contrast, the planktons (radiolarians) and nektons (cephalopods) are diversification in the fauna. (2) Radiolarians are very abundant, with numerous shallow-water Entactinaria and Spumullaria forms and a few (or abundant) deep-water Albaillellaria or (/and) Latentifistularia forms. (3) Brachiopods mainly include Chonetid-Productida forms (accounting for 50% in the brachiopod species diversity), followed by Spiriferida (14%), Non-chonetid Productida (10%), Athyridida (10%)，Orthida (8%), Orthotetida (4%), Rhynchonellida (2%) and Lingulida (2%), based on the research of brachiopods from over ten sections from South China. The Chonetid-Productida brachiopods are characterized by a small body size (averagely smaller than 10 mm), thin-shelled, a row of hingespines and abundantly pseudopunctae in the internal surface of shell. The features of brachiopods suggest that the latest Permian deep-water brachiopod fauna of South China shares some common features with the PTB mixed brachiopod fauna, especially in terms of taxonomic composition and certain apparent morphological adaptations (He et al., 2012). This commonality is interpreted to indicate a time and a broad marine environment of widespread low oxygen supply and/or reduced trophic resources during the end-Permian life crisis in South China (He et al., 2012). Additionally, the miniaturization of invertebrates (e.g., brachiopods, sponges, conodonts and foraminifers) across the Permian-Triassic transition (Luo et al., 2008; He et al., 2007, 2010) also indicates a setting of anoxic or reduced trophic resources.

Palaeogeographically, the data, including the ratio of deep-water radiolarian forms to shallow-water radiolarian forms, lithology and biotic associations, suggest that the bathymetry deepened from south to north across the northern part of the Yangtze Basin and also deepened from north to south across the southern part of the “Yangtze” Basin, reaching in excess of 200 m. It further indicates that the northern and southern margins of the “Yangtze” Basin were open to the Palaeotethys Ocean during the latest Permian.

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