Eocene Planktonic Foraminifera and the Age of the Youngest Marine Sediments in Tüna, Yadong, Southern Tibet

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1 Introduction

The collision evolution between the Indian plate and the Eurasian plate is one of the significant geological events since the Mesozoic. It has profoundly influenced the global tectonic framework and led to the formation of the Qinghai-Tibet Plateau, which has attracted extensive attention of global geologists and become a research hotspot (Butler, 1995; Li and Wan, 2003a and b; Wang et al., 2003; Aitchison et al., 2007). However, there is still no consensus on the starting time of collision. The main reason for this is that scientists have different understandings of the initial time of collision and the methods used to determine the initial time are also different (Li and Wan, 2003a; Wang et al., 2003; Aitchison et al., 2007). A Cretaceous-Paleogene marine stratigraphic sequence in southern Tibet, which contains abundant microfossils (Wan, 1990; Willems and Zhang, 1993; Ding, 2003; Li and Wan, 2003a and b; Li et al., 2003, 2005a and b, 2007, 2009, 2011a and b; Niu et al., 2016; Wang et al., 2017; Zhang and Li, 2017) can provide a direct constraint on the age of the Neo-Tethyan Ocean (Ding, 2003; Li and Wan, 2003a and b; Li et al., 2003, 2005a and b; Jiang et al., 2015).

2 Materials and methods

The Gulupu section is located ~2km west of the town of Tüna, southern Tibet, which was interpreted as being deposited on the Greater Indian passive continental margin. The Zhepure Formation of this section is mainly composed of micofossil-bearing shale and limestone (Niu et al., 2016; Zhang and Li, 2017), which represented the southern Tethyan passive margin succession. Building the chronology required to calculate the rates of changes is a challenge in studying the evolution of the organisms in any given period of geological history. 154 samples were taken for study on the planktonic foraminiferal biostratigraphy of the Sandy-shale Member of the Zhepure Formation in the Gulupu section. The extraction and identification of the planktonic foraminiferas were carried out in the Micropalaeontology Laboratory of the China University of Geosciences (Beijing). To free the radiolarians from the rocks (mainly shale), the following procedures were followed. Samples were broken into the pieces with the particle size of 0.6-1 cm and placed in beakers. A diluted (10–15%) anhydrous sodium sulfate solution was added to cover the rocks for about two weeks. The samples were wet sieved using 20 and 250 mesh sieves and the residual samples were dried and examined. Representatives of each species were measured, gold-coated and imaged using a Scanning Electron Microscope (SEM).

3 Planktic foraminiferal biostratigraphy

Detailed study has been carried out on the planktonic foraminiferal biostratigraphy of the Sandy-shale Member of the Zhepure Formation in the Gulupu section and 119 species of 24 foraminiferal genera were identified, the important elements (Fig.1) of which include Acarinina bullbrooki, A. breedermanni, A. pentamerata, A. punctocarinata, A. soldadoensis, A. spinuloinflata, A. strabocella, A. wilcoxensis, Chiloguembelina cubensis, C. parallela, Cribrorhantkenina inflata, Dentoglobigerina galavis, Globigerina daubjergensis, G. eocaena, G. fringe, G. hagni, G. lozanoi, G. soldadoensis, G. triloculinoides, Globigerinatheka semiinvoluta, G. sub congolobata subconglobata, Gumbelina midwayensis, Hankenia mutallii, Hastigerina bolivariana, Morozovella acuta, M. aequa, M. angulata, M. aragonensis, M. caucans, M. formosa formosa, M. gracilis, M. lehneri, M. lensformis, M. marginodentata, M. spinulosa, M. subbotinae, M. uncinita, M. velascoensis, M. trinidadensis, Planoglobanoinala pseudogalianeriana, Paragloborotalia griffinoides, Pseudoglobigerinella bolivariana, P. micra, P. naguewicianensis, P. pseudoscitula, Subbotina eocaena, S. patagonica, S. semni, S. triangularis, S. triloculinoides, Truncorotaloides rohri and T. boweri.

Based on the analysis and summary of the planktic foraminifera, this paper preliminarily establishes a high-precision planktic foraminifera biostratigraphy of the Eocene in Gulupu, Yadong, southern Tibet. The Paleogene planktic foraminiferal biostratigraphy mainly established by Bolli et al. (1985) was used as a comparison. Seven planktonic foraminiferal biozones were recognized as follows (in ascending order):
3.1 Morozovella formosa formosa Zone

The important elements of this zone are Acarinina pentacamerata, A. primitiva, A. soldadoensis soldadoensis, Morozovella aragonensis, M. lensiformis, M. formosa formosa, M. marginodentata and Pseudoastigerina micra etc. The age of this zone is middle Ypresian.

3.2 Morozovella aragonensis Zone

The representative elements of this zone are Acarinina pentacamerata, Morozovella aragonensis, M. formosa formosa, M. subbotinae and T. cerroazulensis frontosa etc. The age of this zone is late Ypresian.

3.3 Acarinina pentacamerata Zone

The important elements of this zone are Acarinina pentacamerata, Morozovella aragonensis, M. quatra, Pseudoastigerina wilcoxensis, Turborotalia bowieri, T. cerroazulensis frontosa, T. praecentrales and T. libyensis etc. The age of this zone is latest Ypresian.

3.4 Hartkenia nutalli Zone

The important elements of this zone are Acarinina bullbrooki, A. spinulosiflata, M. aragonensis, M. lehneri, M. spinulosa, Globigerina eocaena and G. semni etc. The age of this zone is Lutetian - early Bartonian.

3.5 Globigerinatheca subconglobata subconglobata Zone

The important elements of this zone are Acarinina bullbrooki, A. crassata, A. primitiva, A. pseudotopilensis, A. strabocella, Chilougenina ootara, C. trinitatensis, Globigerina eocaena, Globigerina officinalis, Globigerinatheka semni, M. spinulosa, Planorotalites pseudoscutula, T. boweri and T. cerroazulensis cerroazulensis etc. The age of this zone is likely early Bartonian.

3.6 Morozovella spinulosa—Acarinina bullbrooki Zone

The important elements of this zone are Morozovella lehneri, M. spinulosa, Pseudoastigerina micra, T. boweri, T. cerroazulensis cerroazulensis and T. cerroazulensis cocoaeensis etc. The age of this zone is middle Bartonian.

3.7 Globigerinatheka seminovolata Zone

The important elements of this zone are Chilougenina
wilcoxensis, Dentoglobigerina galavisii, Pseudohastigerina mira, P. nagewicziensis, Turboerella boweri, T. ceratozoina ceratozoina and T. ceratozoina cocoeoensis etc. The age of this zone is roughly early-middle Priabonian.

4 Conclusions

The Zhepure Formation records a diverse, abundant, well-preserved planktic foraminiferal fauna that can be assigned to seven Eocene planktic foraminiferal zones, including M. formosa formosa, M. aragonensis, A. pentacamerata, H. mutalli, G. subconglobata subconglobata, M. spinulosa-A. bulbrooki and G. seminulata zones.

The planktonic foraminiferal assemblage from the Sandy-shale Member of the Zhepure Formation gives it an early to late Eocene age, which indicates the final closure of the Tethys seaway should occur in the late Eocene or later in Tüna area.

Key words: Eocene, Yadong, Zhepure Formation, Tethyan Ocean, planktonic foraminifera

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References


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