

Full length article

Upper Triassic reef coral fauna in the Renacuo area, northern Tibet, and its implications for palaeobiogeography

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ARTICLE INFO

Keywords:

Upper Triassic
Scleractinian coral fauna
Renacuo area
Northern Tibet
Palaeobiogeography

ABSTRACT

Upper Triassic reef corals from the Riganpeicuo Formation in northern Tibet represent important scleractinian coral fauna that help explain the palaeobiogeography of the eastern Tethys region during the Late Triassic period. The corals were discovered in bedded limestone in patch reefs or biostromes of the Renacuo area. In this paper, 15 genera and 25 species are identified and categorized, the systematic composition of these corals and their relationships with other Triassic coral faunas are also discussed. The results show that these corals are composed of the typical elements of the western Tethys, with the following genera and species that are endemic to China: *Radiophyllia* cf. *astylatus*, *Margarosmia* *zogangensis* and *Conophyllopsis* *qamdoensis*, and the genera *Retiophyllia*, *Margarosmia*, *Hydrasmilia*, *Procycolites*, *Pamiroseris*, *Araiophyllum*, *Stylophyllopsis*, *Stylophyllum* and *Guembelastraea* provide important links to the Tethys province. The coral fauna also highlights the connection between the Qiangtang terrane and the Songpan-Ganzi fold belt, but shows that the areas are distinct from the Himalayan terrane. It has been interpreted that the Qiangtang terrane and the Songpan-Ganzi fold belt were in the vicinity of the gradually-closed Paleo-Tethys Ocean, which resulted in the free transmigration of the benthonic organisms of these areas. On the other hand, the Himalayan terrane was separated from the Qiangtang terrane by a wide ocean-meso Tethys during the Late Triassic period, which made it impossible for the benthonic organisms on both flanks to freely migrate toward the opposite continental margins.

1. Introduction

The period of recovery and proliferation of reef ecosystems that occurred during the Middle and Late Triassic was characterized by the rise of reefs dominated by scleractinian corals and coralline sponges (Flügel, 2002; Lehrmann et al., 2006; Yin and Song, 2013; Peybernes et al., 2015). Late Triassic scleractinian corals are well known in the reef and reef-related settings of the Tethys, especially in the Alpine regions of central Europe (Turnšek and Ramovš, 1987; Roniewicz and Stanley, 2013; Tosti et al., 2014), and the research on Triassic scleractinian corals in these areas has been carried out for over 160 years (e.g. Reuss, 1854; Frech, 1890; Volz, 1896; Melnikova, 1975, 1996; Roniewicz, 1989, 2011; Roniewicz et al., 2007). However, the study of Late Triassic reef corals in China only began in the past century and has received considerably less attention. The Late Triassic scleractinian corals of China have been collected mainly in Tibet, and in the adjacent areas of Sichuan, Yunnan, Qinghai, and Xinjiang; they are mostly distributed on both sides of the Bangong Lake – Nujiang – Changning – Menglian collision zone (Bo et al., 2017).

Tibet is an ideal region for research on Late Triassic reef corals, due to the wide distribution of the Triassic marine strata and the abundant scleractinian fossils that are well preserved in the Upper Triassic strata (Liao and Xia, 1994); it is the key area connecting the Tethyan realm (Wang et al., 2009; Fan et al., 2017). Some research was performed on the biostratigraphy and general paleontological taxonomy of Triassic scleractinian corals in Tibet, and a number of Triassic scleractinian coral reefs were found in eastern Tibet (such as those discovered in Dênqên, Riwoqê, Chamdo, Jomda, Chagyab, Konjo, Zogang, and Markam), southern Tibet (Nyalam and Tingri), and the central region (Lhünzhub, Coqên, and Nagqu). The corals bear a taxonomic relationship to faunas from the western Tethys, as well as from the Pamirs and Timor. Past investigations of these Late Triassic corals emphasized the coral fauna composition, diversity and their strong Tethyan character (Yoh, 1965, 1982; Wu, 1975; Liao and Li, 1979; Liao, 1982; Deng and Zhang, 1984a, 1984b; Xia and Liao, 1986; Yoh and Liao, 1986; Deng, 1990; Liao and Xia, 1994; Ji et al., 2010a; Liao and Deng, 2013; Huang et al., 2014). Nevertheless, there is no comprehensive study on Upper Triassic reef corals from northern Tibet, although some researchers

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<http://dx.doi.org/10.1016/j.jseaes.2017.05.006>

Received 24 February 2017; Received in revised form 27 April 2017; Accepted 6 May 2017

Available online 10 May 2017

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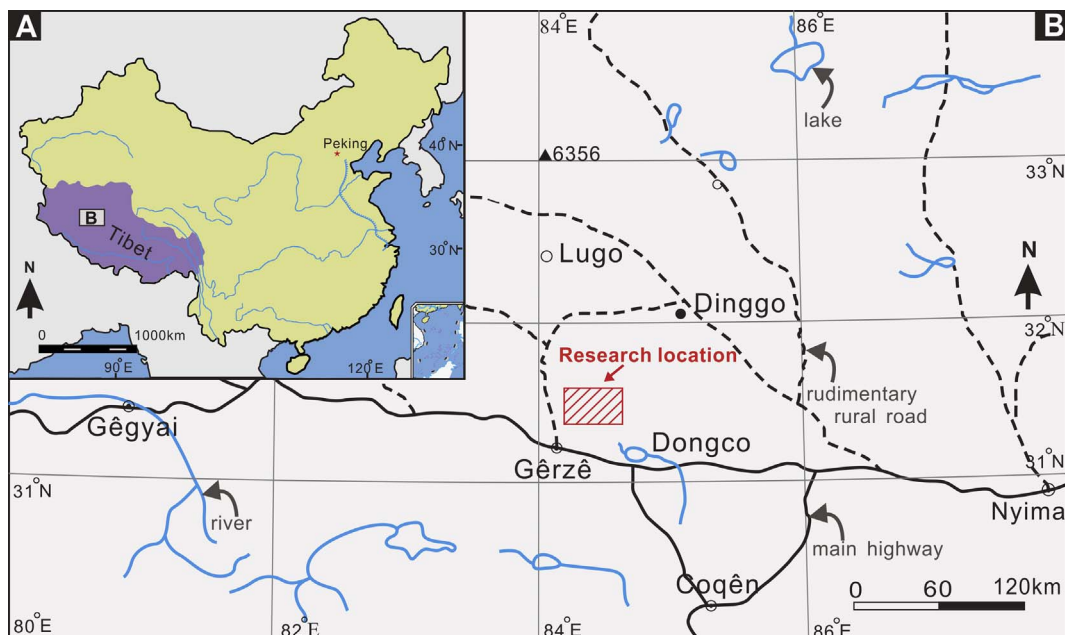


Fig. 1. Map showing the sample locality of the scleractinian corals from the Renacuo area in northern Tibet.

have reported recently on areas such as the Guoganjianian mountain in Gêrzê (Ji et al., 2010b) and the purported Zhanjin Formation in Gêrzê (Bo et al., 2015; Luo et al., 2015).

In order to ascertain the features of the Late Triassic scleractinian coral fauna in northern Tibet, provide the basis for the stratigraphic division and correlation of the Triassic strata, inquire into the plate tectonics and paleobiogeography of the eastern Tethys, and establish the relationship of the Triassic scleractinian corals fauna between the eastern Tethys and the western Tethys, we collected more than 128 specimens of the scleractinian corals from the Renacuo area in the northern Tibet. We describe and illustrate in detail 15 genera and 25 species in accordance with their corallite structure, morphology of the septa, and typology of the growth forms, and compare the coral faunas from the Himalayan terrane, Lhasa terrane, Qiangtang terrane and Songpan-Ganzi fold belt. Moreover, we also discuss the biogeographic characteristics of these regions during the Late Triassic period.

2. Geology and tectonic setting

The scleractinian corals analyzed in the present paper were collected from the Renacuo area in Tibet, China (Fig. 1). The fossils were found in the limestones of the Riganpeicuo Formation of the Donggou section (X: 251167.67, Y: 3626597.93, Z: 4960 m) in Gêrzê county and in the Zishicuo section (X: 324,817, Y: 864,450, Z: 5007 m) in Rongma county.

The Renacuo area, the research location of this study, was located on the southern margin of the southern Qiangtang terrane during the Triassic period. The southern Qiangtang terrane in northern Tibet was located between the Longmu Co-Shuanghu Suture Zone and the Bangong-Nujiang Suture Zone (Yang et al., 2017) (Fig. 2), which became a new part of the Tethys Ocean in the Late Triassic after the closure of the ancient Tethys during the period from the Late Permian to the Triassic. It is a very important tectonic belt that contains the evolutionary information of the Tethys Ocean from multiple periods (Mo and Pan, 2006; Wang et al., 2009; Peng et al., 2014). In the Late Triassic, with the extension of the Qiangtang terrane, the carbonate sediments of the Upper Triassic Riganpeicuo Formation were developed in the southern Qiangtang terrane, which had unconformable contact with the overlying Sewa Formation (lower-middle Jurassic) and unconformity with the underlying Longe Formation (Permian) (Hou et al., 2014).

The Upper Triassic organic reefs are well developed in the Riganpeicuo Formation (Fig. 3). The reef-building organisms consist of scleractinian corals, calcispongiae, calcareous algae, and other reef-inserted organisms such as foraminifera, brachiopods, bivalves, gastropods, echinoderms, and bryozoans (Hou et al., 2014). The carbonate in the Riganpeicuo Formation may be divided into 5 sedimentary facies based on the characteristics of the rocks and combination type, namely, debris littoral facies, restricted platform facies, open platform facies, platform edge shallow facies, and platform edge reef facies. The Z values of the salinity (from 126.32 to 135.37) indicate that the paleoseawater in the Renacuo area of the Gêrzê ranged from normal marine to hypersaline, and the average temperature of the paleoseawater was 22.4 °C according to the analysis of the C and O isotopes (Hou et al., 2013). The sedimentary environment of the Riganpeicuo Formation in the Renacuo area was the epicontinental sea sedimentary environment in a warm and humid climate.

More information on the geological situation and the origin and fauna composition of the Riganpeicuo Formation was documented by Chen (2007), Bo (2014) and Hou (2014). Furthermore, Hou et al. (2013, 2014) and Hou (2014) presented information on the coral-bearing beds of the Riganpeicuo Formation and geological investigations on the Late Triassic reefs of northern Tibet. Flügel (1982, 2002) and Martindale et al. (2015) reported on the general aspects of the formation in the Upper Triassic reef facies in the Tethys realm.

All the specimens and thin sections described and illustrated here are stored in the Teaching and Research Section of the Earth Sciences and Resources School at the China University of Geosciences, Beijing. The fossil specimens were sliced into thin sections and illustrated with the aid of a camera lucida attached to a microscope.

3. Upper Triassic reef corals from the Renacuo area in Tibet

3.1. Occurrence of the corals

Scleractinian corals from the Upper Triassic Riganpeicuo Formation in the Renacuo area were abundant and diverse. Fifteen genera and 25 species are described and illustrated in detail in this paper. In this fauna, Remimaniphylliidae is the dominant family, and the representative genera of Margarophylliidae and Stylophylliidae are present. The species of *Retiophyllia* are the most abundant, accounting for about 30%

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