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Late Aptian–Albian Yasin-type rudist assemblage in the Himalayas: palaeobiogeographic implications

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ABSTRACT

Shallow water rudist bivalves are a very suitable tool for palaeoenvironmental and palaeobiogeographic reconstructions of the Cretaceous Tethys. For this reason, we have reviewed fossil localities bearing polyconitid rudists of the late Aptian and Albian in the Himalayan area and in other Tethyan sites. The well preserved Rossi Ronchetti rudist collection of Yasin (Kohistan Himalayas) has been reinspected as a reference for the regionally distinctive *Horiopleura haydeni* biofacies. Two morphotypes of the genus related to different sedimentary settings were distinguished on the basis of biometric measurements. Assemblages characterized by benthic organisms of Mesogean affinity dominated by polyconitid and radiolitid rudists, together with nerineid gastropods, corals and orbitolinid forams have a distinct provincial significance. Today, various polyconitid bearing biofacies can be recognized in many sedimentary successions of the Himalayas, westwards to the Iberia region and even eastwards to the Pacific area. Their distribution allows recognition of a palaeobiogeographic pattern influenced by a thermal barrier. It also helps to understand how the accretion of the Lhasa terrane and the Kohistan-Dras intra-oceanic volcanic arc could represent a spreading centre for the "Yasin-type" *Horiopleura haydeni* biofacies (marked by the absence of *Polyconites*) in the South West Asian Province.

1. Introduction

The Alpine–Himalayan chain, extending from Iberia to South West Asia, is a huge complex composed of various continental fragments interspersed with neritic carbonates. These micro continental plates came from the northern and southern margins of the Tethys during the Mesozoic as the proto-Atlantic ocean formed on one side and the Indian tectonic plate moved on the other. They strongly modified the palaeogeography and circulation patterns of the Tethys (Golonka, 2004; Blakey, 2010; Berra and Angiolini, 2014) (Fig. 1 A).

The original concept of an Early Cretaceous Mesogean realm (Douvillé, 1900) marked by the occurrence of molluscs and large foraminifera with a wide longitudinal and narrow latitudinal palaeogeographic extent, has since been widened. This is because the key rudist-orbitolinid assemblages have now been found in many other localities globally and in successions (or "Mésogean extensions") along the Himalayan chain and even further to the east. Gaetani (1997) argued that the collage of terranes, *i.e.*, Mega-Lhasa, was possibly separated by short-lived seas. Jagoutz et al. (2015) and Gibbons et al. (2015) concluded that the intra-oceanic volcanic arcs, such as the Oman-Kohistan-Dras or Kohistan–Ladakh arc, were formed during the northward drift of microplates that departed from the Indian Plate. This raises some questions. What are the defining geographic and biotic features of the Cretaceous Tethys? What are the relations among the microplates in Tethys?

The interposed neritic carbonate rocks of the continental fragments along the Alpine–Himalayan collision belt yield thermophilic sessile mollusc rudist bivalves. They spread along the shallow warm waters of the Cretaceous seas. They were significant organic builders and sediment constituents of neritic carbonates from the Late Jurassic up to the end of the Maastrichtian, when they became extinct. Such bivalves can thus serve as stratigraphic, palaeogeographic and palaeoenvironmental indicators. As an example, the Late Aptian–Albian polyconitid genus *Horiopleura* and its related

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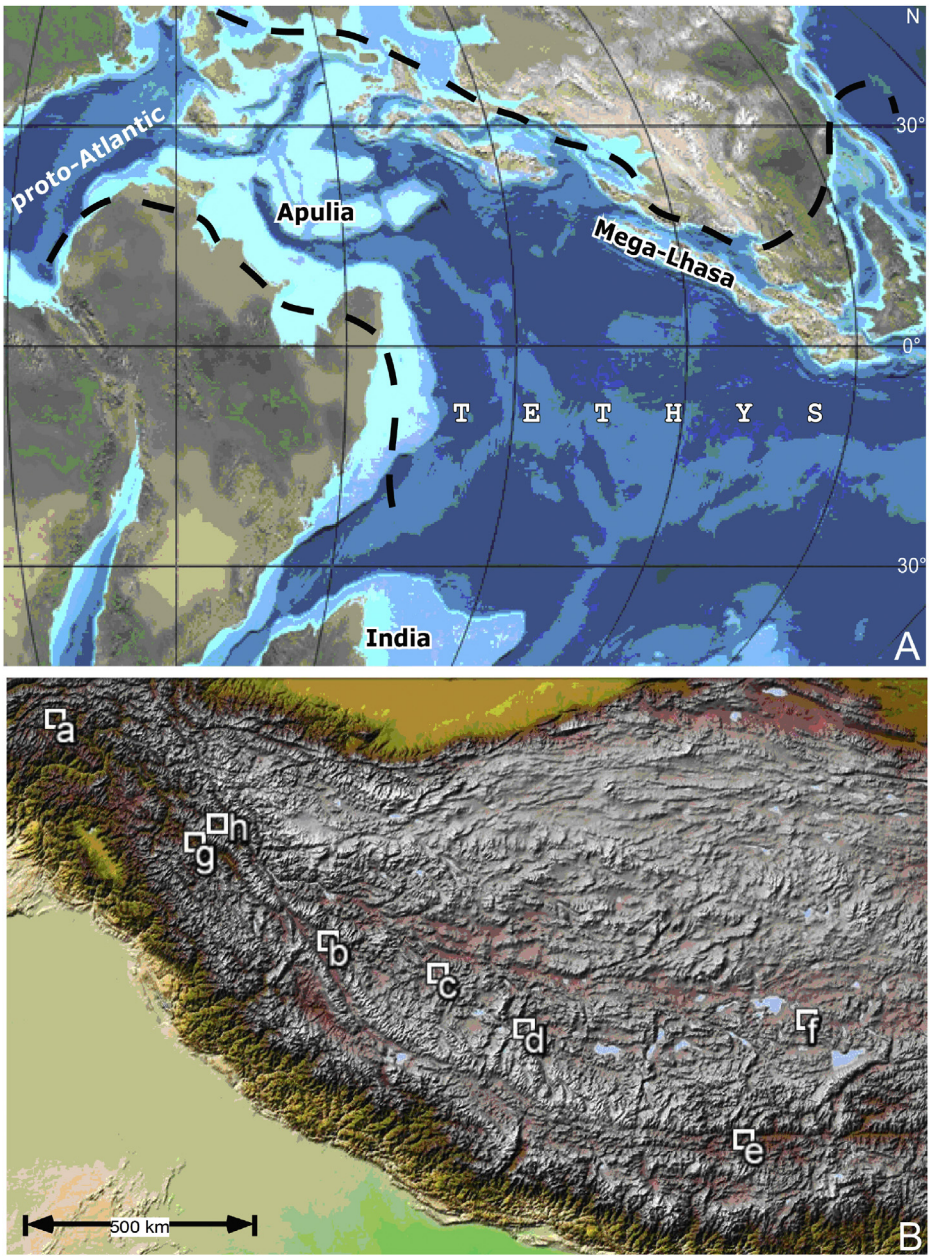

Fig. 1. A: Palaeogeographic map during the Aptian (120 M.Y.) with the Mega-Lhasa terranes and sea-ways. Mesogean fauna is between the dashed line (mod. from Blakey, 2010; © Ron Blakey, Colorado Plateau Geosystems). B: Reviewed fossil localities bearing polyconitid rudist biofacies in the Himalayan area. a) Yasin (northern Pakistan); b) Lameila Mt., Ngari area (Tibet/China); c) Nyer lake (Tibet); d) Zabuye lake (Tibet); e) east of Xigaze (Tibet); f) Duba region (Tibet); g) Shukur (Northern India); h) Khalsi (Northern India) (map modified from Amante and Eakins, 2009).

biofacies have a wide geographic and stratigraphic distribution in the Himalayan region (Fig. 1 B).

The collection of late Early Cretaceous *Horiopleura* fauna from Yasin (northern Pakistan), which was previously studied by Rossi Ronchetti and Farioli Mirelli (1958, 1959) and Rossi Ronchetti (1965), is so well preserved and so significant for taxonomy, stratigraphy and palaeogeography, that it has been widely referred to as the "Yasin-type" fauna in previous Himalayan literature.

The major aims of the present article are to review the "Yasin-type" *Horiopleura* fauna and its correlation in the Himalayan area, to clarify the taxonomy of the genus *Horiopleura* and its biostratigraphic correlation, to reconstruct the palaeobiogeography of the *Horiopleura* fauna, and reveal the relations of the microplates that bear this fauna and its controlling factors, *i.e.*, the palaeogeography of Late Aptian–Albian Tethys.

2. Palaeontological note

In the Himalayas, the rudist assemblage dominated by the polyconitid *Horiopleura haydeni* was first described by Douvillé (1926) from samples collected by Hayden in 1914 from "hippuritic limestone, in the hill immediately behind the rest-house at Yasin, Gilgit Agency" (northern Pakistan, Fig. 1 B) where the rudist beds are sitting on a coral bank with *Rhabdophyllia* and *Isastrea*. He described two new species, *Horiopleura haydeni* and *Praeradiolites gilgitensis* (= *Auroradiolites gilgitensis* in Rao et al., 2015), coming