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Aalenian to Lower Bajocian ammonites from the Qiangtang block (North Tibet)

Jiarun Yin [a], Robert B. Chandler [b,*]

[a] China University of Geosciences, 29 Xueyuan Lu, Beijing 100083, China
[b] Department of Earth Sciences Natural History Museum, Cromwell Road, London SW7 5BD, UK

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ABSTRACT

Aalenian and Bajocian ammonites from the Qiangtang block (North Tibet) are described. Comparisons with successions of similar age in Europe allow the establishment of a correlation at zonal level. The relationship between early stephanoceratids and the otoitid *Emileites* is discussed. *Emileites callomoni* sp. nov. is erected. *Haplopleuroceras*, *Fontannesia*, *Witchellia* and *Sonninia* also occur and their significance highlighted. A lectotype for *Haplopleuroceras mundum* Buckman is designated.

1. Introduction

Middle Jurassic Aalenian to Early Bajocian rocks contain ammonite evidence that provides information vital for establishing migratory and evolutionally pathways useful in establishing biostratigraphical correlation between widely separated regions of the world. Recent research (e.g. Sadki and Mouterde, 1994; Sandoval et al., 2012; Fernández-López and Pavia, 2015; Sandoval and Chandler, 2015) has highlighted the probable ammonite migration routes and existence of an active Aalenian–Bajocian seaway, the so-called Hispanic Corridor providing a route for ammonite migration from the Eastern Pacific to Western Tethys and visa-versa. Fernández-López and Pavia (2015) state this to be "a bidirectional, biodispersal route driven by changes of relative sea-level". The record of ammonite migrations into Western Tethys is preserved in strata, often as cryptogenic appearances of taxa that may be short-lived or persistent, in some cases being the root of lineages that have a long geological history in an area. Due to the paucity of ammonite specimens in collections from the Qiangtang block, North Tibet (Fig. 1), our knowledge of the region, was until now, poorly documented regarding the distribution and range through time of Aalenian to Early Bajocian ammonite taxa into Eastern Tethys (Kamalarjun and Sato, 1964). Here we present information on ammonites found within the Qiangtang block (Westermann and Wang, 1988; Yin et al., 2006; Yin, 2010a,b).

In 2005 J.H. Callomon examined images of Tibetan ammonites collected from the Paducuo section in the care of one of us (JY). Callomon and Chandler (unpublished) observed the presence in these collections of species that occur in the UK but to date had not been reported from Eastern Tethys. A book by Yin (2010a,b) depicting these specimens was then published.

We describe and compare some ammonite assemblages from the Qiangtang block with those established for some classic areas of Europe and beyond. The comparisons made here are between that of Dorset and Somerset UK (e.g. Buckman, 1887–1907, 1893; Parsons, 1974, 1980; Callomon and Chandler, 1990), continental Europe (e.g. Spain (Linares and Sandoval, 1996), Portugal (Henriques, 1992; Henriques et al., 1994), Sicily (Renz, 1925), France (Dubar et al., 1971; Mouterde et al., 1972; Pavia, 1983; Germany (Ohmert, 1988); Hungary (Cresta and Galácz, 1990), North Africa (Morocco, Sadki, 1990; Benshili, 1989, 1990), Iran (Seyed-Emami, 1967) and the Qiangtang block.

The Qiangtang block was subjected to continental collision with the southern edge of the Eurasian continent by the late Triassic and was separated from the Lhasa block by the Banggonghu–Nujiang Ocean during the Jurassic. Marine Jurassic strata are widely distributed in the Qiangtang region with approximately 650 km of rocks, discontinuously cropping out from east to west and 300 km from north to south (Yi et al., 2003). The Qiangtang block preserves strata deposited in the northern part of the eastern Tethys Ocean,

* Corresponding author.
E-mail addresses: yjr@cugb.edu.cn (J. Yin), aalenian@blueyonder.co.uk (R.B. Chandler).

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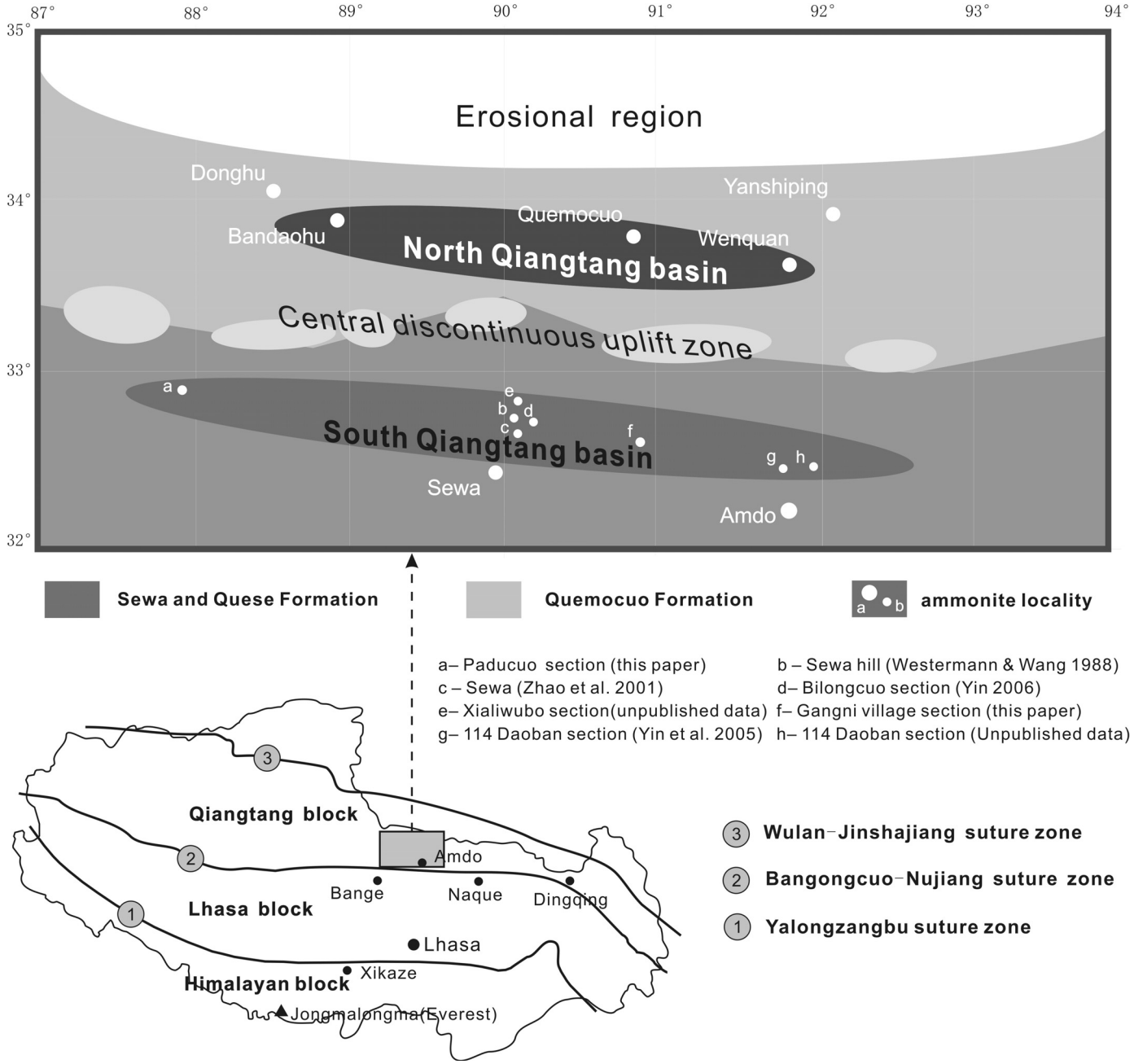

Fig. 1. The Jurassic ammonite localities of north Tibet showing the sedimentary basins and the division of the Qiangtang block with tectonic sutures marked.

previously not reported with relevance to Aalenian–Bajocian ammonite biostratigraphy.

Sedimentological and geophysical studies have shown (Wang et al., 2001, 2008) that a discontinuous uplift zone extends roughly along N32° in the central Qiangtang basin and subdivides the basin into two depressions filled by Jurassic sediments. In the northern depression in the regions of Yanshiping and Quemocuo the Early Jurassic consists of red variegated sandstones, siltstones or mudstones with fresh or brackish water bivalves (Yin, 1991; Yin and Fürsich, 1991), named the Quemocuo Formation. Poorly preserved specimens that may be attributable to *Pleydellia* or possibly early *Leioceras*, field collection number: GBP03 (Fig. 10a1–3) occur in strata at locality 'e', the Xialiwubo section (locality, 32 37 32.97 89 32 43.78) in Fig. 1, indicating a probable Early Aalenian age.

The Middle Jurassic is present as the Buqu Formation (Yin and Fürsich, 1991) and consists mainly of limestones and sandstones with bivalves. Bathonian ammonites also occur in the Buqu Formation from the areas of Quemocuo and Wenquan (Yin, 2005). Recently, Late Bajocian, Late Bathonian and Early Callovian ammonites (*Graciliceras*, *Northocephalites* and *Macrocephalites*) have been found in the Bandaohu area the northern depression of Qiangtang (in progress by JY). The Late Jurassic rocks are mainly red sandstones that lack diagnostic fossils that provide a conclusive age.

The southern depression comprises Early and Middle Jurassic strata called the Quese and Sewa Formations. Oil and gas prospecting and mapping for a 1:250,000 map sheet, organized by the China Geological Survey, has provided a number of Jurassic ammonites over the last decade from eight Bajocian localities recorded to date (Fig. 1).

The name Sewa Formation in the Shuanghua area was proposed by Wen (1979), and was the first stratigraphical unit defined as Bajocian in age in the Qiangtang block (Wang, 1985; Wen, 1984;