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Late Cretaceous palynofloras from the southern Laurasian margin in the Xigaze region, Xizang (Tibet)

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Abstract

Palaeontology plays an indispensable role in interpreting the sedimentary and tectonic history of the convergence of India and Laurasia and its consequences. Hitherto, spores and pollen grains have not been used very much in this connection. In this paper, we consider the palynology of two sedimentary successions in Xizang (Tibet) that reflect the early stages of this convergence. One of these is near the town of Xigaze, in Xigaze County (the eastern site), and the other is in Zhongba County (the western site). The palynomorph assemblages from these sites are broadly comparable in being dominated by gymnosperm pollen taxa, especially *Classopollis* and *Exesipollenites*. Angiosperm pollen grains are more common at the eastern site, especially representatives of the genus *Proteacidites*. The assemblages are considered to be late Late Cretaceous (Santonian–Maastrichtian) in age and, in common with the lithologies from which they were recovered, reflect a hot, arid or semi-arid climate comparable to that prevailing in South China during this period.

Keywords: Cretaceous; Yarlung Zangbo Suture; Xizang (Tibet); Spores; Pollen grains

1. Introduction

Cretaceous rocks occur widely on the northern side of the Yarlung Zangbo Suture in Xizang (Tibet), China (Fig. 1), but fossils are generally rare in the successions that have been examined, and they have not been reported previously at all from the Ngamring, Sangzugang and Padana formations. The possibility that they might yield palynomorphs has, however, been almost completely ignored hitherto. Although deposited in a marine environment, even small quantities of spores and pollen grains preserved in the sediments will reflect, to some extent, the composition of the vegetation on adjacent land masses and changes to the terrestrial environment related to the tectonism associated with the collision of India with Laurasia.

The two sections on which this paper is based are located in the Xigaze area of Xizang (Fig. 1). The eastern site, Qiabulin (or Donggar Coal Mine) is about 40 km west of the town of Xigaze (c. 45 km by road). The section concerned, in the Qiabulin Formation (Fig. 2A), has been studied by geologists for many years but, as for the other formations mentioned above, no fossils have been found in it previously. This formation, as originally defined, encompassed all of the red and varicoloured deposits between overlying limestones of the Sangzugang Formation and the coal-bearing Qiuwu Formation, i.e., units 2–6 in Fig. 2A, and was regarded as Cretaceous in age (Wen, 1974; Wu et al., 1977). Later Yin et al. (1983, 1988) suggested that all the varicoloured beds above the Qiuwu Formation were Eocene–Oligocene in age. These authors stated that the Qiabulin Formation is faulted against the Sangzugang Formation (F_1 in Fig. 2A). An attractive alternative interpretation was proposed by Qian (1985) who stated that there was a major (regional) fault within the red beds with Late Cretaceous deposits on one side and a Cenozoic (Paleogene) succession on the other.

The western site, Cuojiangding, is situated about 350 km west-north-west of Qiabulin (Fig. 2B). The succession exposed was first described by Qian et al. (1982), who considered it to comprise late Cretaceous and early Tertiary (Cenozoic)

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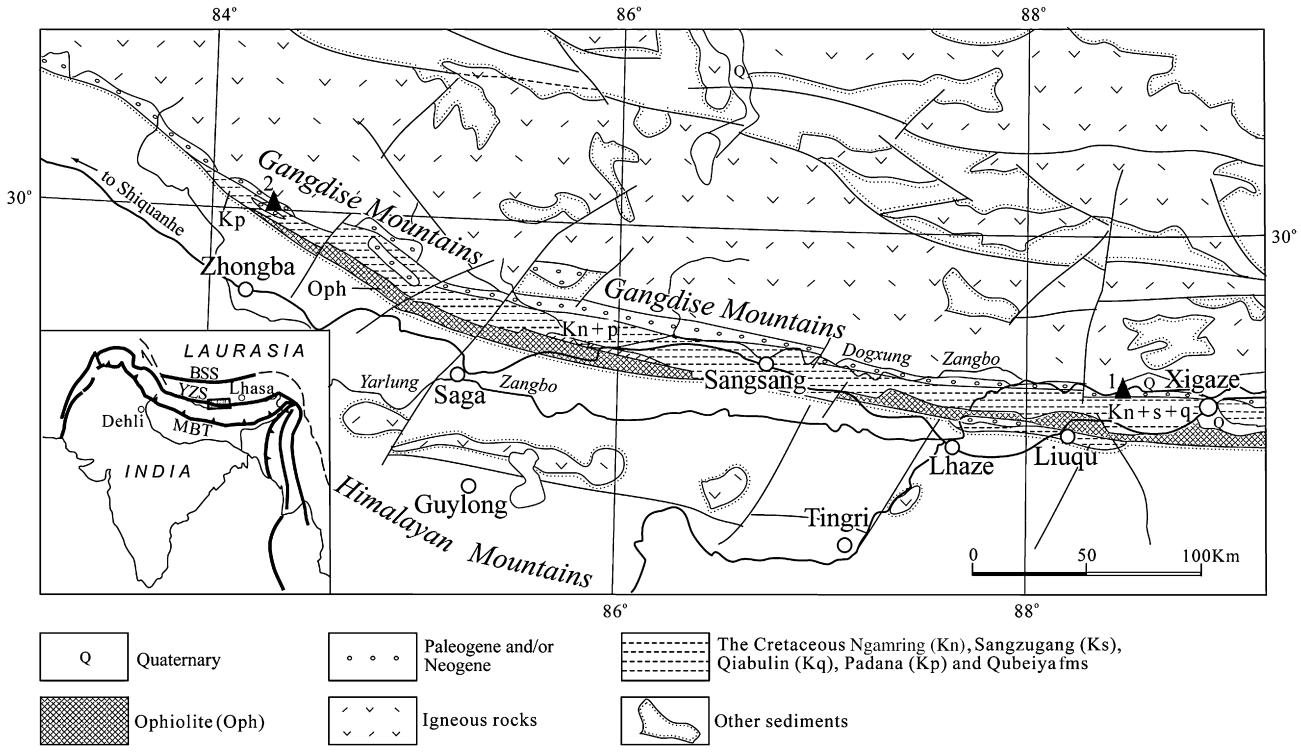

Fig. 1. Geology of part of Xizang (Tibet) showing the distribution of Cretaceous rocks in the research area, delineated by the small hatched rectangle in the inset map, the latter showing the general structure of the region. MBT, Main Boundary Thrust; YZS, Yarlung Zangbo Suture; BSS, Bangong Co-Siling Co Suture. The two fossil sites are indicated by solid triangles: 1, Qiabulin; 2, Cuojiangding. Revised from Wu et al. (1977), Qian et al. (1982), Liu et al. (1988) and Yin et al. (1988).

deposits. Liu et al. (1988) examined this section again and subdivided it on lithological grounds. These studies and others (e.g., by Xu et al., 1989) included reports of occurrences of foraminifers, bivalves, ammonites, gastropods, and echinoids, but no macro- or microfossil plant remains were noted.

2. Material and methods

The two sections were re-measured by one of us in 1999 (LJ; see Fig. 2, which mainly shows the Cretaceous parts). Samples collected from them were fairly evenly spaced, with seven taken from units 2 and 3 of the Qiabulin Formation at Qiabulin and 39 from the Padana, Qubeiya and Quxia formations (units 2–15) at Cuojiangding. All were subjected to hydrochloric and hydrofluoric acid digestion in the laboratory. Palynomorph identification and counting was carried out using a Nikon microscope. A relative abundance scale (<1%, trace/T; >1–3%, present/P; >3–10%, common/C; >10–30%, frequent/F; >30%, abundant/A) was used to describe the composition of the palynological assemblages. Only samples that provided counts of at least 100 spores and pollen grains were documented in this way, although more impoverished assemblages have been taken into account in our analysis.

3. The palynomorph assemblages

Several of the palynological preparations proved to be moderately rich in palynomorphs. As a result, a late Cretaceous palynoflora is documented here from the Yarlong Zangbo Suture area of Xizang for the first time. This was encountered in one sample from Qiabulin (prefixed DG) and in seven from Cuojiangding (prefixed C), as follows: DG03-3, C05-2, C05-4, C06-2, C06-3, C07-1, C07-3 and C08-3. The numbers after DG and C refer to the unit and the sample within that unit, respectively. Three less productive samples were also counted: C07-2, C07-4 and C08-1. Most of the fossils are poorly preserved and dark brown to black in colour, reflecting a high level of thermal alteration. As a result they are commonly difficult to identify with confidence.

The palynomorph assemblage from the Qiabulin section (Fig. 3) is mainly composed of gymnosperm and angiosperm pollen in approximately equal proportions. The former consist of *Classopollis annulatus* (F), *C.* spp. (C), *Cycadopites* spp. (C), *Ephedripites* (*Distachyapites*) sp. (C), *E.* (*Ephedripites*) sp. (C), *Exesipollenites tumulus* (C) and *Pinuspollenites* sp. (P).

Angiosperm pollen grains include *Fraxinoipollenites* sp. (T), *Lingbaopollis* sp. (T), *Momipites* sp. (T), *Nanlingpollis* sp. (P), *Pilosipollis elegans* (T), *Proteacidites* sp. cf. *P. thalmannii* (C), *P.* sp. nov. A (C), *P.* sp. (P), *Quercoidites microhenrici* (C), *Q. minutus* (P), *Rhoipites dolium* (C), *Rutaceoipollenites archiacus* (P), *Talisiipites megorites* (P), *Tricolpopollenites* spp. (C), *Tricolporopollenites* sp. (C); *Trilobapollis ellipticus* (P) and *Ulmipollenites* sp. (T).

Pteridophyte spores are scarce. Those recorded were *Cyathidites australis* (P), *C. minor* (P), *Deltoidospora* spp. (P), *Lygodiumsporites pseudomaximus* (C), *Polypodiaceaesporites haardti* (C) and indeterminate remains (C).