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Biostratigraphic and paleogeographic significance of a palynological assemblage from the Middle Devonian Ulusubasite Formation, eastern Junggar Basin, Xinjiang, China

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ABSTRACT

Abundant palynomorphs are here reported for the first time from tuffaceous siltstones of the Middle Devonian Ulusubasite Formation at the Zhifang Section, eastern Junggar Basin, Xinjiang, Northwest China. Thirty-four miospore species assigned to 23 genera (four established species, two cf., 19 sp., and nine spp.), 19 acritarch species assigned to 19 genera (10 established species, three cf., five sp., and one spp.), and scolecodonts are identified. The biostratigraphic ranges of the acritarchs and miospores indicate a Mid Devonian age, corroborating the age assignment previously based on associated corals, brachiopods, and plant fossils. Paleogeographic reconstruction for the Middle Devonian indicates that the eastern Junggar Basin was part of the Kazakhstan Plate and situated in the low-mid latitudes of the Northern hemisphere between the Euramerican landmass to the west, and the North and South China, and Gondwana landmasses to the east and south. Although there is some miospore compositional similarity between the eastern Junggar Basin and the landmasses of Euramerica, South and North China, and Gondwana, it is not particularly high, and is mainly at the generic level. The acritarch assemblage, however, consists mostly of cosmopolitan species and provides new evidence for extending the marine linkage between North America, Baltica, the Junggar Basin of Kazakhstan, and Gondwana. Paleontologic and lithologic evidence indicates that the Ulusubasite Formation was deposited in a near-shore marine environment.

1. Introduction

Middle Devonian palynofloras from China have been mainly reported from Yunnan Province, South China where terrestrial facies are well-developed and exposed in the eastern part of that province (Lu, 1980, 1988; Gao, 1981; Zhu and Lu, 2002). Because of an unconformity between the Late Ordovician and Early Carboniferous in the North China Block, Devonian palynological data have been reported only from scattered localities on the southern margin of the block (e.g., Gao and Liu, 1988).

Xinjiang is thought to be tectonically separate from South and North China during the Devonian and because of extensive oil and gas exploration since the 1980s, its geology is now becoming better known. Whereas there are several Upper Devonian palynological reports in the literature (Lu and Wicander, 1988; Zhu, 1999, 2000), there have been no reported Middle Devonian palynologic studies from this region. This study is thus the first report of any Middle Devonian palynomorphs from the eastern Junggar Basin of China.

Thirty samples were collected from the Zhifang Section of the eastern region of the Junggar Basin, North Xinjiang by the first author (H. Zhu) for palynological analysis. Eight of those samples yielded abundant palynomorphs including miospores, acritarchs, and scolecodonts. Although palynomorph preservation is less than ideal, this is the first reported Middle Devonian palynologic occurrence from this area of China. Thus, it provides information on both the terrestrial miospores and marine acritarchs for a region that is palynologically depauperate compared to the rest of the world for this time period. Furthermore, despite the generally poor preservation of the miospores, the total recovered palynomorph assemblage provides some useful biostratigraphical and paleogeographical insights during this time interval.

2. Geological setting

Xinjiang is the largest provincial region in China and lies in the northwest part of the country. It is geomorphologically subdivided

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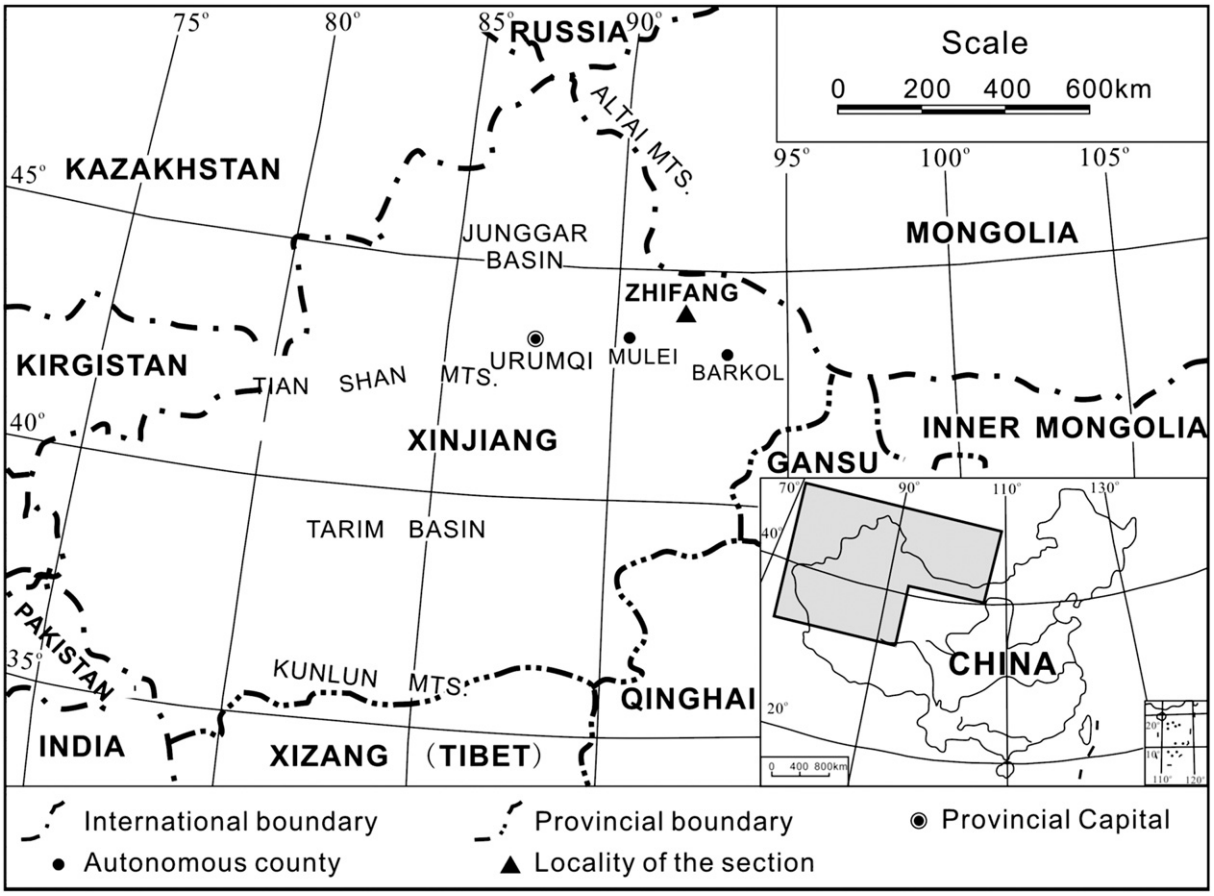

Fig. 1. Location of the Zhifang Section (indicated by a ▲), eastern Junggar Basin, Xinjiang, northwest China. The base map and geographic locations are modified from Li et al. (2006, Fig. 2).

into two parts by the Tianshan Mountains, i.e., South Xinjiang and North Xinjiang (Fig. 1). North Xinjiang is mainly represented by the Junggar Basin, which was part of the Kazakhstan Plate and is presently bounded by the Tianshan Mountains in the south and the Altai Mountains in the north.

The eight productive palynological samples reported here were collected from the upper part of the Ulusubasite Formation of the Zhifang Section (44° 21′ 48″ N, 91° 50′ 24″ E), Barkol County, Xinjiang, Northwest China (Fig. 1). This section, which is one of two key Devonian sections in the Junggar Basin, is located in the eastern part of the basin. The Junggar Basin constitutes the main part of the Junggar–Beishan subregion of the Junggar–Xing'an stratigraphic Region (the area approximately to the north of 42°N, which includes the Junggar Basin, the Beishan Mountains in northern Gansu Province, most of Inner Mongolia, and the northern part of Heilongjiang Northeast China) of China during the Devonian (Hou et al., 2000).

The majority of Devonian rocks in the Junggar area are marine volcanics and massive tuffaceous clastics containing an abundant and diverse marine fauna that includes corals, brachiopods, crinoids, and other marine invertebrates. Occasionally intercalated with these marine beds are fossil plant-bearing rocks.

The Devonian in the eastern Junggar Basin is subdivided into the Lower Devonian Taherbasite and Zuomubasite formations, the Middle Devonian Ulusubasite and Zhifang formations, and the Upper Devonian Keankuduke Formation (Fig. 2). Here, the Ulusubasite Formation conformably overlies the Zuomubasite Formation and is disconformably overlain by the Zhifang Formation.

At the Zhifang Section, the Ulusubasite Formation is about 117 m thick and is mainly composed of tuffs, tuffaceous sandstones, conglomeratic sandstones, marls, bioclastic limestones, and siltstones (Fig. 3). It yields an abundance of fossils, with many megafossil plants, such as *Lepidodendropsis* sp., from the uppermost part of the formation and an abundant and diverse marine fauna from the middle and lower parts, including corals such as *Endophyllum* sp., *Pachyfavosites* sp., *Crassialveolites* sp., and *Tyrganolites*

SYSTEM	SERIES	STAGE	FORMATION
DEVONIAN	UPPER	Famennian	Keankuduke Fm.
		Frasnian	
	MIDDLE	Givetian	Zhifang Fm.
		Eifelian	Ulusubasite Fm.
	LOWER	Emsian	Zuomubasite Fm.
		Pragian	Taherbasite Fm.
		Lochkovian	?

Fig. 2. Devonian stratigraphy in the east Junggar Basin, Xinjiang, China, based on Hou et al. (2000). The contact between the Ulusubasite Formation and the underlying Zuomubasite Formation is conformable, whereas it is disconformable with the overlying Zhifang Formation.