



Chansitheca wudaensis (Gleicheniaceae, fern) from the early Permian Wuda Tuff Flora, Inner Mongolia

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Abstract

A large number of specimens of *Chansitheca wudaensis* Deng, Sun et Li from the early Permian Wuda Tuff Flora allow an emendation of this species. Characters of the sporangial structure and *in situ* spores are examined for the first time. Sori are arranged on lateral veins of pinnule lobes, and are 0.61–0.69 mm long and 0.35–0.41 mm wide. Sporangia are sessile and surrounded by an annulus, which is composed of two rows of oblong thick-walled cells. Trilete, smooth *in situ* spores have diameters of 21.05–26.31 μm. Features of the reproductive organ indicate that this species is similar to *Szea* Yao et Taylor and some species of *Oligocarpia* Goepfert and belongs to the Gleicheniaceae. Based on a taphonomical analysis, *C. wudaensis* was an herbaceous element of the groundcover in the peat-forming coal swamp.

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1. Introduction

Chansitheca Regè is an ancient leptosporangiate fern genus that is known from late Palaeozoic to early Mesozoic. Since it was erected based on *Chansitheca (Sphenopteris) palaeosilvana* Regè (1920) from the early Permian Lower Shihhotse Formation in Shanxi, four other species have been assigned to this genus. Of the five described species, four are from China, including *Chansitheca palaeosilvana*, *Chansitheca kidstonii* Halle, 1927, *Chansitheca wudaensis* Deng, Sun et Li, 2000, and *Chansitheca anxiensis* Li (Huang et al., 1989) and of Cisuralian age. The other species is known from the Late Triassic of Argentina, namely *Chansitheca argentina* Herbst (Herbst, 1963). Among these species, *Chansitheca anxiensis* was subsequently considered as a junior synonym of *Szea sinensis* Yao (Yao et al., 1993). In *Chansitheca wudaensis* from the Shanxi Formation of Wuda, Inner Mongolian, the annulus surrounds the entire sporangium with the exception of the stomium, so that *Chan-*

sitheca can be placed in Gleicheniaceae (Deng et al., 2000). Up to date, the fertile structure of *Chansitheca* such as the morphology and the structure of the sorus, sporangium, annulus, and spore were insufficiently known. As a result, it was hardly possible to distinguish this genus from *Oligocarpia* Goepfert, *Szea* Yao et Taylor, or *Henanotheca* Yang that all belong to the Gleicheniaceae (Abbott, 1954; Yao and Taylor, 1988; Yang et al., 2006).

Recently, a number of very well preserved specimens of *Chansitheca wudaensis* were collected from the early Permian Wuda Tuff Flora in Inner Mongolia (Wang et al., 2012, 2013). They are preserved as compression/impressions, including both sterile and fertile leaves on which the sporangial structure and spores *in situ* are observable including detail that could be studied by light and electron microscopy.

2. Geological setting, material, and method

The locality is situated in the Wuda Coal District near the city of Wuda in the Inner Mongolia Autonomous Region of North China (Fig. 1A). The coal district is part of the northwestern

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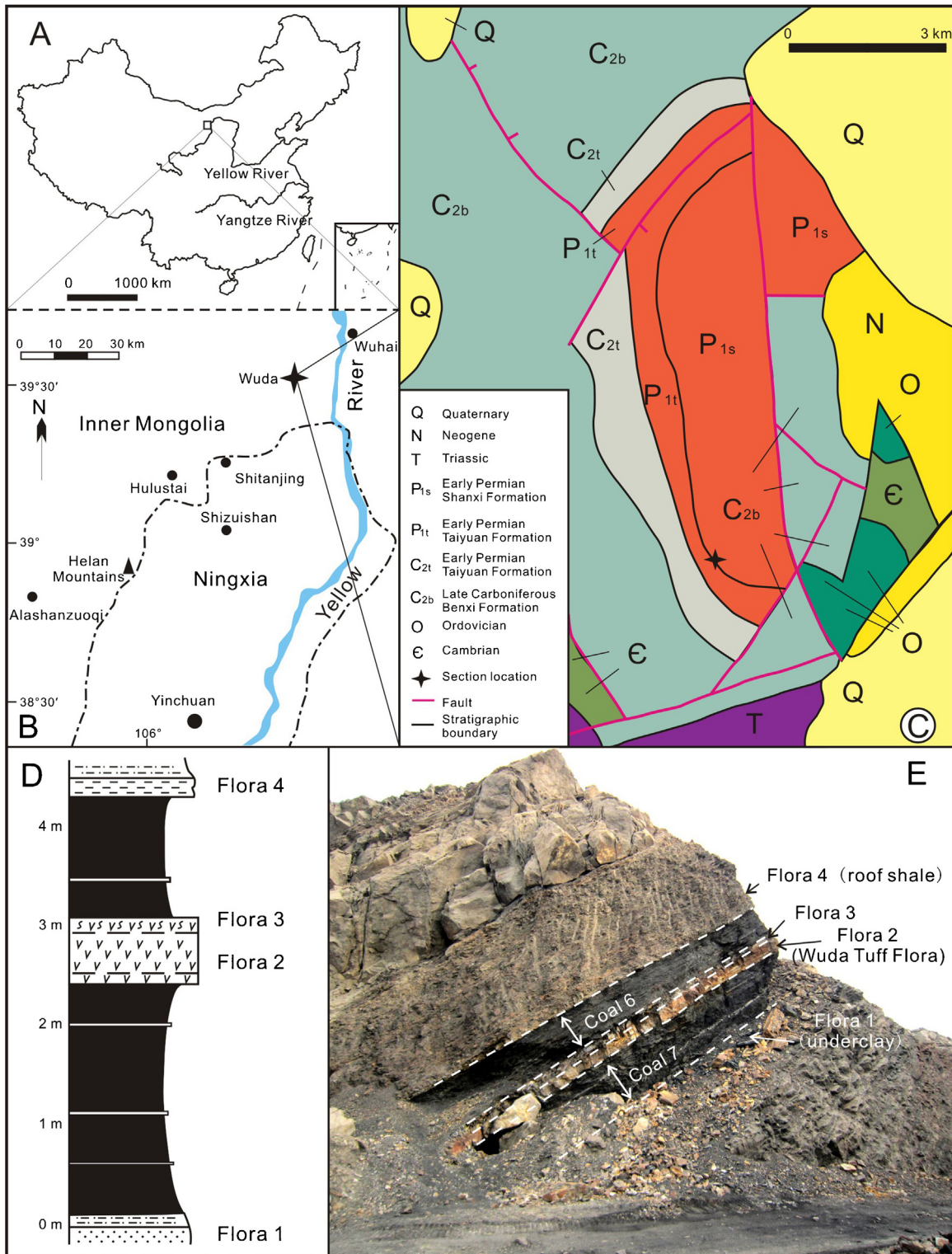


Fig. 1. Locality and outcrops of the tuff bed in the Wuda Coalfield, where *Chansitheca wudaensis* Deng, Sun et Li is found. (A, B) Location of Wuda Coalfield in China (A) and Inner Mongolia (B). (C) Geologic map of Wuda Coalfield. (D, E) Outcrop and lithological column of Coal 6 and Coal 7 with the tuff bed in between. The oldest flora (Flora 1) was rooted in the underclay and initiated peat accumulation that led to the formation of the lower coal (Coal 7), which is overlain by the volcanic tuff. In the middle-lower part of the tuff bed, a second flora (Flora 2, the Wuda Tuff Flora) is preserved, which grew on the peat at the time of the ash-fall. The upper part of the tuff was rooted by a single species of lycosid (Flora 3) again initiating peat accumulation (Coal 6). The roof-shale of Coal 6 yielded the fourth flora, representing the vegetation that lived around a lake that flooded the coal swamp. (See Pfefferkorn and Wang, 2007 for detail description of the four floras.)

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