



Early Miocene vegetation and climate in Weichang District, North China

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ABSTRACT

The Early Miocene palynological assemblage of Guangfayong (GFY) in the Weichang District, Hebei Province, China has been studied. It consists of 48 palynomorphs belonging to 39 families, with pollen and spores belonging to angiosperms (28.9%), gymnosperms (59.9%), ferns (10.8%) and other elements (0.5%). Based on the palynological assemblages of GFY and Wuluogong (WLG), another locality in the Weichang District, the Early Miocene vegetation of the Weichang District, was characterized by a mixed temperate forest of conifers (e.g. *Pinus*, *Picea*, *Tsuga*) and broad-leaved trees (e.g. *Betula*, *Alnus*), with some subtropical plants (e.g. *Carya*). The palaeoclimatic parameters of Guangfayong were obtained by applying the Coexistence Approach: the mean annual temperature from 7.8 to 14.9 °C, the difference of temperature between the coldest and warmest months from 14.2 to 23 °C, the mean temperature of the coldest month from –3 to 5.9 °C, the mean temperature of the warmest month from 23.5 to 25.4 °C, the mean annual precipitation from 658.7 to 1389.4 mm, the minimum monthly precipitation from 7.6 to 16.4 mm, and the maximum monthly precipitation from 161.4 to 205.9 mm. It suggests a warm temperate to subtropical climate in Weichang District, similar to that of present-day Zhaojue City, Sichuan Province in the Yangtze River Valley. When the palaeoclimatic parameters were compared with those of Middle Miocene Shanwang Basin, it would seem that the temperature and precipitation were a little higher in the Middle Miocene of eastern China. However, if the latitudinal temperature gradient at that time is considered, the median temperature values of GFY of Early Miocene and Shanwang of Mid-Miocene were similar.

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1. Introduction

A critical assessment of the possible impacts of Global Change must not only be concerned with the reliability of model predictions for the future, but also include information about past climate and environmental changes (Uhl et al., 2006). Plant evolution and vegetation succession during the Cenozoic in China yield important information on the climate changes in this part of the world.

In the present work, the pollen grains and spores were obtained from sediments of Guangfayong section (Early Miocene), Hebei Province, North China. By combining the palynological data from the contemporaneous Wuluogong Section in the same district, the vegetation and the climate in the Early Miocene were reconstructed quantitatively. In addition, in order to investigate the general climatic

trend in eastern China, these results were compared with those of the Middle Miocene of the Shanwang Basin in Shandong Province.

2. Locality, material and methods

2.1. Study site

The Jibei Plateau in the northern part of Hebei Province, North China, was formed during the Neogene and uplifted strongly during the Yanshan Movement (Liu et al., 2005). As a result widespread volcanism took place. The basalts have been referred to the Hannuoba Formation and dated as Miocene based on the geological research of HBGMR (1989), Wang et al. (2006) and Yan, (1998) and plant fossils of Andersson (1923) respectively. The K–Ar dating (22.1 Ma) of the basalts confirms this conclusion (Li and Xiao, 1980). These basalts are covered by Quaternary sediments (HVEC, 1996).

The study site (42°07'34" N, 117°50'27" E; Fig. 1), part of Guangfayong (GFY) geological section, is in a small valley close to Guangfayong town in Weichang County, Hebei Province, China. It represents an interbasaltic horizon within the Hannuoba Formation.

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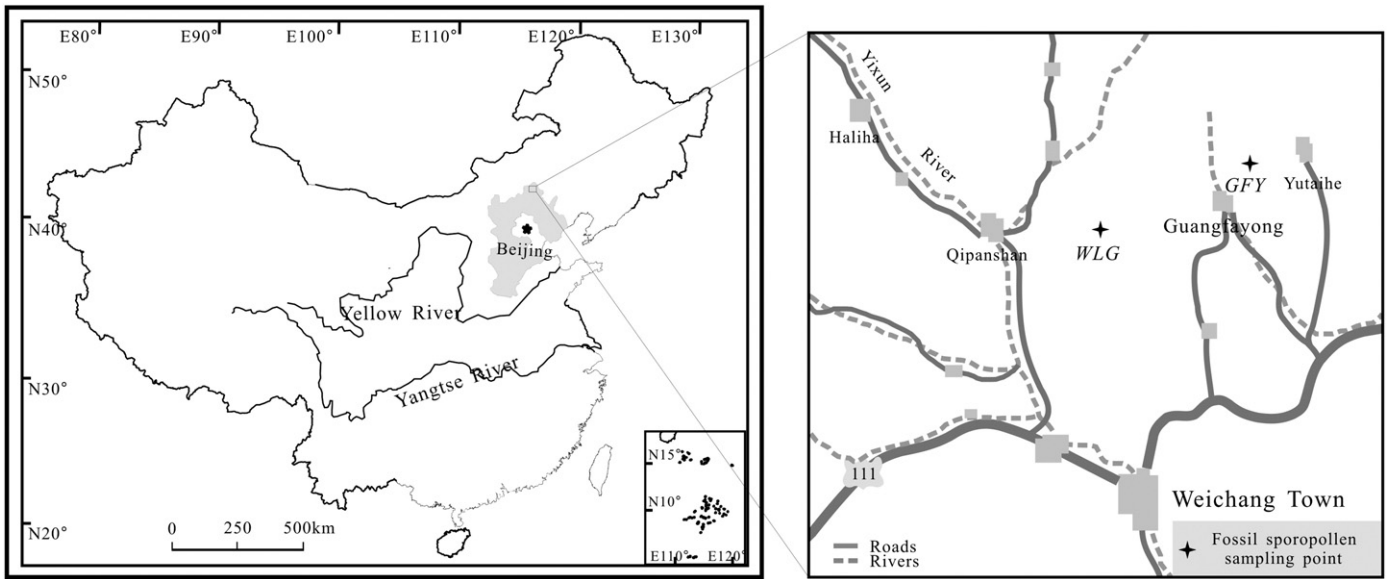


Fig. 1. Maps showing the sporopollen sampling point.

Samples of the mudstone and lignite were collected for palynological analysis (Fig. 2). The shale near the top of the sequence was not sampled, as it was too weathered to supply trustworthy data. The Wuluogong (WLG) section (42°06' N, 117°45' E; Fig. 1), is located in the southwestern part of Guangfayong town. According to the study of Li and Xiao (1980), the WLG section is of the same age as the GFY

section. The palynological assemblage from WLG was analyzed by Gan and introduced in the Selected Works of the First Chinese Sporopollen Academic Meeting (Gan, 1982). Unfortunately, there were no plates of pollen and spores in the paper of Gan. However, we checked his original manuscript, with ten unpublished plates. The key findings of Gan's work are mainly summarized in the discussion.

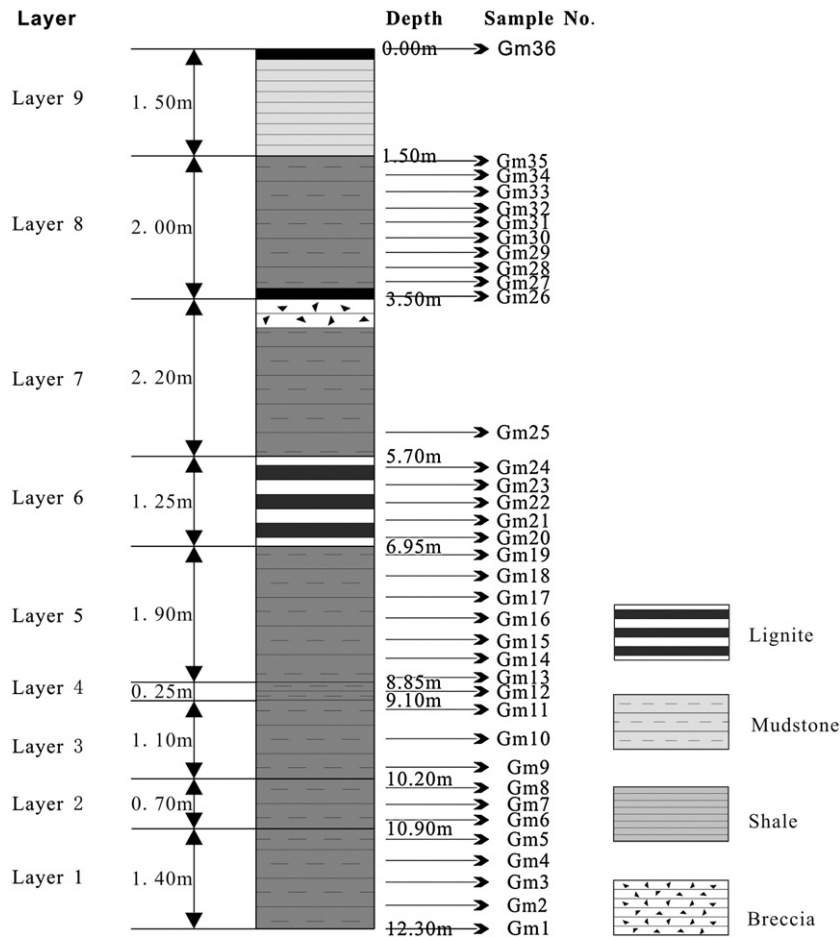


Fig. 2. Sedimentary succession through the Guangfayong section.

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