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# Plio-Pleistocene magnetostratigraphy of northern Bohai Bay and its implications for tectonic events since ca. 2.0 Ma

Qinmian Xu[a,*], Guibang Yuan[a], Jilong Yang[a], Houtian Xin[a], Liang Yi[b], Chenglong Deng[b,c,**]

[a] Tianjin Center, China Geological Survey, Tianjin 300170, China
[b] State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 10029, China
[c] University of Chinese Academy of Sciences, Beijing 100049, China

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ABSTRACT

The sediments of Bohai Bay Basin in North China have recorded the processes of basin filling and structural evolution, which may have resulted from the destruction of the North China Craton during the late Mesozoic and early Cenozoic. However, the absence of a reliable chronostratigraphic framework for the sedimentary sequences in the basin has prevented a comprehensive understanding of these processes. In this study, we combine paleomagnetic and sedimentary analyses of the sediments from two new boreholes (NY05 and TZ02) from northern Bohai Bay to provide new insights into the sedimentary history and regional tectonic processes since the Pliocene. The main findings are as follows: (1) Magnetite and hematite are the main carriers of the characteristic remanent magnetization. (2) The boreholes record the Brunhes and Gauss normal chrons, and the Matuyama reversed chron. (3) Subsidence-related differences in the depths of the Matuyama/Brunhes (M/B) and Gauss/Matuyama (G/M) boundaries, sediment accumulation rates, and the sedimentary environments of the different tectonic units, enable us to identify that tectonic movements started in the Olduvai normal subchron and the development of the WNW-orientated tectonic features were intensified. (4) In the Huanghua depression, comparative analysis of subsidence-related differences between western and northern Bohai Bay indicates that the subsidence of the northern Bohai Bay may have been superimposed on the WNW-orientated tectonic activity and faulting associated with the collision between the Indian and the Eurasian Plates, in the context of localized subsidence.

## 1. Introduction

The Bohai Bay Basin in eastern China contains abundant information about the regional structural framework, processes of sedimentary basin infilling, and petroleum reservoirs (Allen et al., 1997; Ren et al., 2002; Qi and Yang, 2010; Yin, 2010; Li et al., 2012; Guo et al., 2015). The basin has also recorded information about structural processes possibly resulting from lithospheric thinning beneath the North China Craton during the late Mesozoic and the early Cenozoic (Li et al., 2012; Zhu et al., 2012). However, the absence of a reliable chronostratigraphic framework for the sedimentary sequences has precluded a comprehensive understanding of the processes of basin infilling, structural evolution and their relationships with regional tectonics, especially during the late Cenozoic.

During the last two decades, numerous boreholes of Pliocene-Quaternary age have been obtained from the Bohai Bay Basin and they offer an excellent opportunity to establish a regional chronostratigraphic framework by integrating magnetostratigraphic dating with other chronostratigraphic data (Yao et al., 2010; Yi et al., 2016). In this study, we combine new high-resolution magnetostratigraphic results from two borehole cores (NY05 and TZ02) with the previously-published magnetostratigraphy of other borehole cores from northern Bohai Bay, including BG10 (Yuan et al., 2014) and MT04 (Xu et al., 2014). Our aim is to explore the regional structural characteristics during the interval from the Pliocene to the Quaternary.

## 2. Geological setting and sampling

### 2.1. Geological setting

The Bohai Bay Basin, located at the centre of the eastern block of the North China Craton (Li et al., 2012), is flanked by the Yanshan fold belt to the north, the Taihang fold belt to the west and the Tancheng-Lujiang Fault to the east (Fig. 1a). The basin consists of a series of depressions

* Corresponding author.
** Corresponding author at: State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 10029, China
*E-mail addresses:* xuqinmian@163.com (Q. Xu), cldeng@mail.iggcas.ac.cn (C. Deng).

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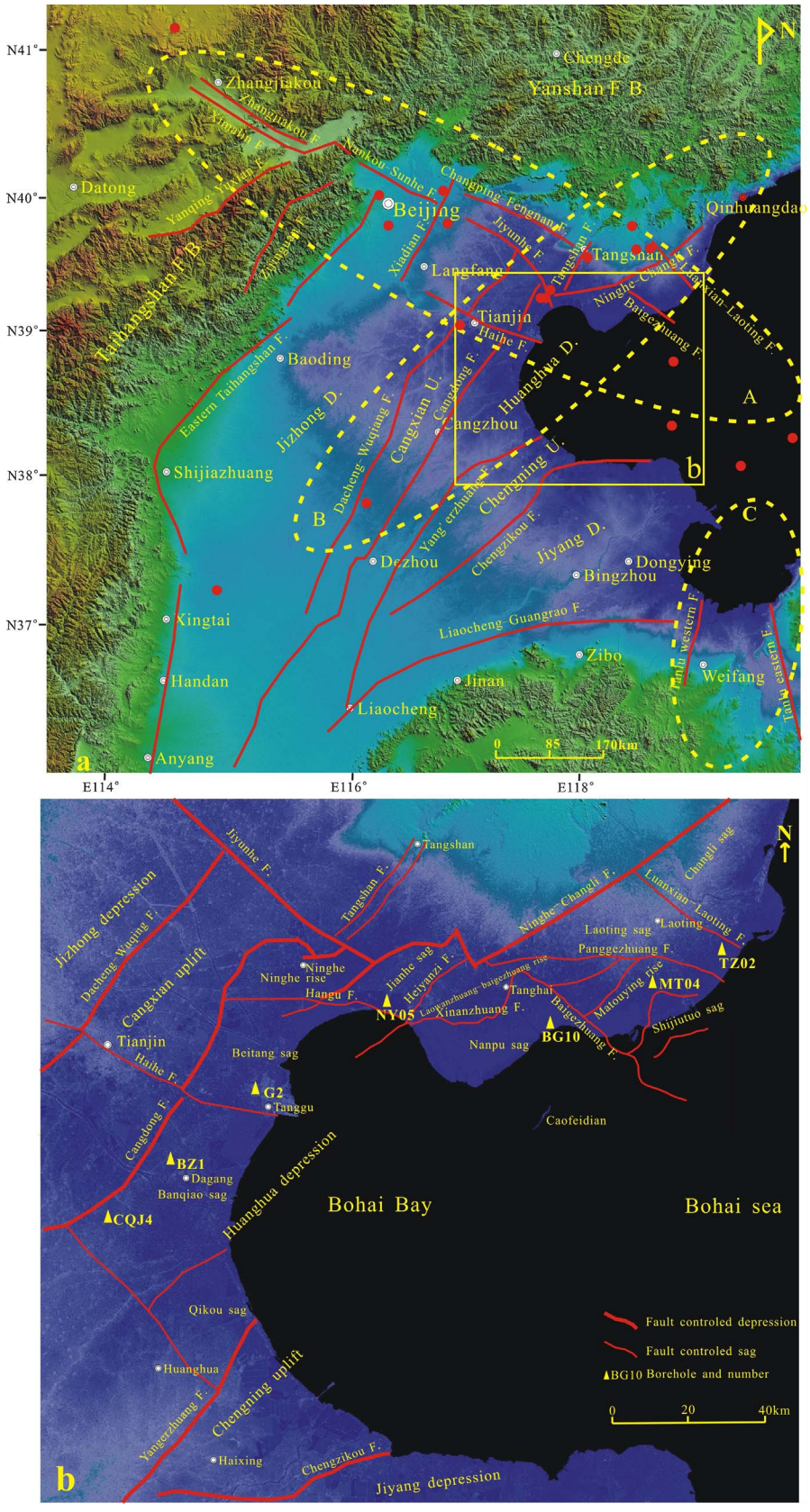


**Fig. 1.** Tectonic map of the North China Plain (a). Tectonic map of the coastal area of Bohai Bay and locations of boreholes (b). A: NW-trending structure, the Zhangjiakou-Penglai Fault zone; B: NE-trending structure; C: NE-trending structure, the Tancheng-Lujiang Fault zone. Red square: $Ms >= 6.0$. The base map data are from NASA. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

and uplifts separated by regional-scale faults (Qi and Yang, 2010) (Fig. 1a). Northern Bohai Bay is located within the northeastern Huanghua depression. The NEE-trending Ninghe-Changli Fault separates the Yanshan fold belt in the north from the Huanghua depression in the south. The area consists of a series of secondary sags and rises, including Jianhe sag, Laowangzhuang rise and Nanpu sag in the western part, and Matouying rise and Laoting sag in the eastern part. The formation and evolution of these sags and rises during the late Cenozoic