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Archean to Paleoproterozoic Evolution of the North China Craton: Preface

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ABSTRACT

As one of representative cratons in China, the North China Craton records a long-term and complicated tectonic history, including the formation of Eoarchean continental nucleus, Neoarchean continental crustal growth and reworking, Paleoproterozoic amalgamation of micro-blocks and formation of orogenic belts related to the Columbia supercontinent, and formation of late Paleoproterozoic to early Neoproterozoic rifts. In recent years, extensive geochemical, geochronological, magmatic and metamorphic, structural, and geophysical investigations have been carried out on the North China Craton, which have resulted in a series of new achievements and some percussive interpretations of the Precambrian continental crustal formation and evolution. These new data and results allow us to make a correct judgment for organizing this special issue in which representative and creative experts currently working in the craton exhibit outcomes of their research on the craton. Thirty-nine contributions have been collected in this special issue, which provide insightful understanding of the components, magmatism and metamorphism, metallogeny, and tectonic evolution of the North China Craton, and give an insight into discussion about some key issues on the basis of new data and interpretation. Such a special issue will not only make a timely addition to the literatures on the Precambrian research field, but will also open a new window through which the international geological community will adequately understand what major advancements have been obtained in the Precambrian geology of the North China Craton and what issues are still unresolved and controversial at present.

1. Introduction

Although the North China Craton (NCC) is one of the oldest cratonic blocks, containing rocks as old as 3.85 Ga, it was still amongst the most poorly understood cratons in the world until the beginning of this century. Since 2000, researchers in China and their international collaborators have carried out extensive field-based petrological, structural, metamorphic, geochemical, geochronological and geophysical investigations on the NCC, and produced a vast amount of new data and competing interpretations, which have led to major advancements in understanding the accretion and amalgamation of the craton. The most prominent achievement of these investigations is recognition of a number of micro-continental blocks and associated Himalayan-type orogenic belts in this craton. There is now a broad consensus that the NCC was formed mainly through Archean accretion, crustal overgrowth and re-working, and Paleoproterozoic amalgamation of several small blocks along a few Paleoproterozoic continent-continent collisional orogenic belts. These achievements have been reflected in two previous special issues published on Precambrian Research in 2012 and in 2014 (Zhao and Guo, 2012; Zhai et al., 2014). However, there are still many unresolved issues related to the timing and geodynamic processes of major Archean and Paleoproterozoic events that led to the formation and evolution of the NCC. This forms a justification for this special issue entitled “Archean to Paleoproterozoic Evolution of the North China Craton”, in which we have collected thirty-nine papers presented with new data obtained for various tectonic domains in the NCC, and evaluate current models proposed in the last decades. Such a special issue will not only make a timely addition to the literatures on the Precambrian study field, but will also open a new window through which the international geological community will understand what major advancements have been obtained in the Precambrian geology of the NCC.

2. New advances in the basement of the North China Craton

2.1. Eastern Block

2.1.1. The oldest continental nuclei and granite–greenstone belt

Since ~3.8 Ga trondhjemitic gneisses were identified in the Baijiafen area of the Anshan City in the Eastern Block of the NCC

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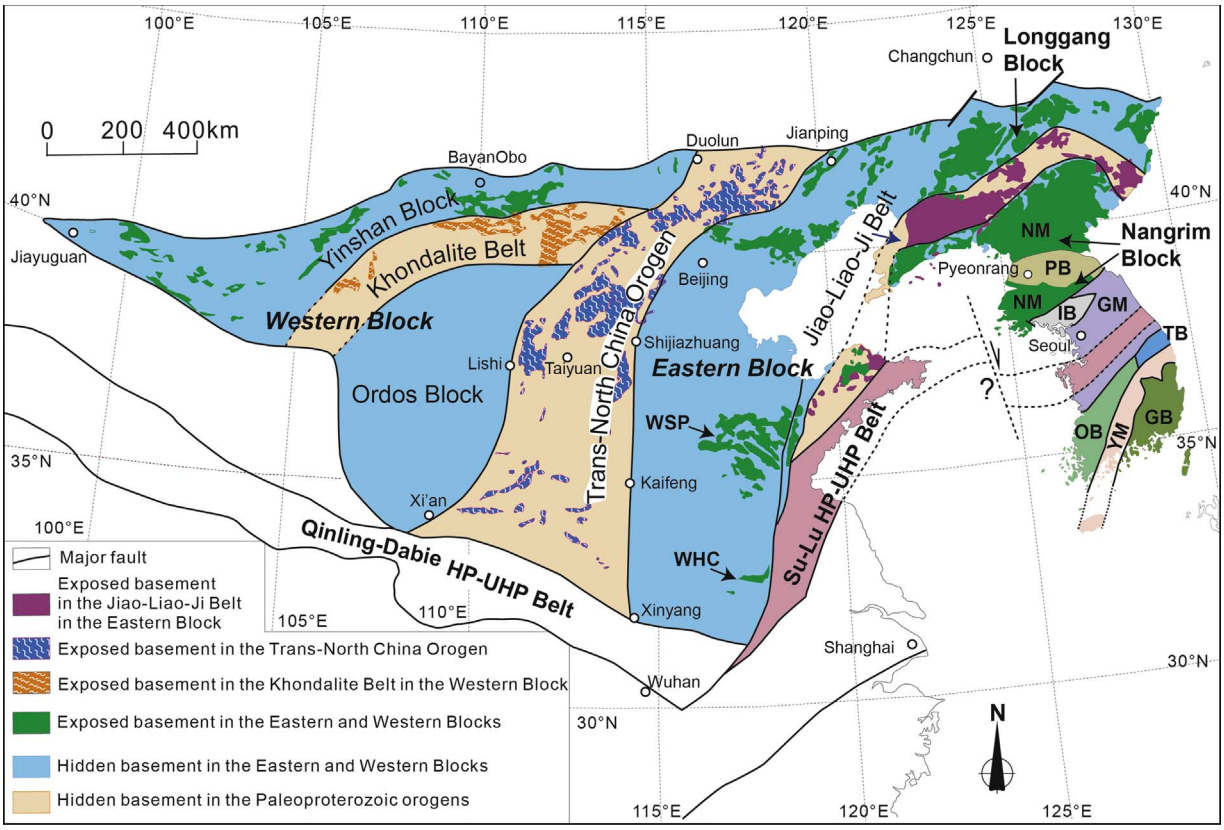

Fig. 1. Tectonic subdivision of the North China Craton and adjacent regions (modified after Zhao et al., 2012; Oh et al., 2015). Abbreviations: WSP – Archean basement in the western Shandong Province; WHC – Wuhe Complex; IB – Imjinggang Belt; OB – Ogcheon Belt; GM – Gyeonggi Massif; YM – Yeongnam Massif; PB – Pyeongnam Basin; TB – Taebaeksan Basin; GB – Gyeongsang Basin.

(Fig. 1; Liu et al., 1992, 2007), it has attracted many geologists over the world focusing their studies on the petrogenesis, formation ages, compositional features and evolution of these trondhjemitic gneisses. Abundant inherited and detrital zircon ages older than 3.5 Ga have been extensively documented over the past decade in the China Mainland as well. However, the spatial distribution for the ~3.8–3.5 Ga trondhjemitic gneisses in the Eastern Blocks has not been constrained yet. Liu et al. (2017h) identify 3.48–3.45 Ga migmatized tonalitic-trondhjemitic gneisses and 3.41 Ga amphibolite boudin in the Waitoushan-Beitai area of the Eastern Block. In combination with abundant 3.8–3.3 Ga inherited zircons reported by the previous and present studies (Wan et al., 2015), it can be concluded that the Eo- and Paleoarchean rocks are widespread within the Anshan-Benxi-Waitoushan-Beitai area from the Eastern Block, and possibly represent an oldest continental nuclei in the NCC.

The Anshan–Benxi granite-greenstone belt (ABGB) in the Eastern Block consists mainly of supracrustal rocks of amphibole plagioclase gneisses, amphibolites, chlorite schists, biotite schists, quartzites and banded iron formations (BIFs), and intrusive monzogranitic to syenogranitic gneisses. Zircon U–Pb age data reveal that the metavolcanic rocks could be divided into the ~2.53 Ga southern plagioclase gneiss group, ~2.54 Ga southern amphibolite group, ~2.57 to 2.56 Ga northern chlorite schist group, and northern amphibolites group from south to north (Guo et al., 2017b). The four metavolcanic groups showed strong affinities to modern arc magmatisms, indicating the southern Anshan–Benxi greenstone belt likely formed at a convergent plate margin tectonic setting during Late Neoarchean time.

2.1.2. The Neoarchean granitic gneisses and meta-mafic rocks in the Longgang and Nangrim blocks

In order to reveal the Neo-archean tectonic setting and evolutional process of the Eastern Block, present studies have been focused on the genetic mechanism of Neoarchean granitic gneisses and meta-mafic rocks in the Northern Hebei Province (Wang et al., 2017e), eastern Heibei-western Liaoning Province (Fu et al., 2017), Jiapigou–Jingyu area of the Southern Jilin Province (Guo et al., 2017a), Dongjiagou–-Pulandian area of the Southern Liaoning Province (Wang et al., 2017d), and Haiyangsuo area of the Northeastern Sulu UHP Belt (Liu et al., 2017b).

2.53–2.51 Ga monzogranitic–syenogranitic gneisses expose as roughly northeast–southwest-trending and cover ~1500 km^2 in the southern part of the Eastern Hebei–Western Liaoning Province. Considering the geochemical features combined with previous investigations on the late Neoarchean metavolcanic rocks and granitoid orthogneisses, Fu et al. (2017) consider that the magmatic precursors of these granitic gneisses were most likely formed in a back-arc basin along the north margin of the Eastern Block. Similarly, ~2.58–2.52 Ga late tonalitic–trondhjemitic–granodioritic–dioritic (TTGD) gneisses overprinted with 2.51–2.49 Ga amphibolites facies metamorphism are widespread in the Jiapigou–Jingyu area of the Southern Jilin Province of the Longgang Block. Integrated Hf isotopes of TTGD with recent studies on ~2.68–2.65 Ga metavolcanic rocks and voluminous ~2.59–2.54 Ga metavolcanics, Guo et al. (2017a) suggest that the Southern Jilin Province experienced Neoarchean subduction-related evolution history, with an Andean-type active continental margin along the northern margin of the NCC. Additionally, abundant TTGD gneisses are widely distributed in the Dongjiagou–Pulandian area of the southern Liaoning Province as well. Zircon U–Pb dating suggests that the TTGD gneisses experienced two episodic magmatic events at ~2.68–2.63 Ga and ~2.56–2.51 Ga, which were related to two major episodes of crustal growth at ~2.7 Ga and ~2.5 Ga in the Eastern Block. Based on the similar Archean geological events in both the Longgang and Liaonan blocks, Wang et al. (2017d) suggest that a unified late Neoarchean crystalline basement existed in the eastern part of