

Khondalites in the North China Craton: Palaeoproterozoic or Archaean?

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The basement architecture of the North China Craton has not been well constrained until recently, with the recognition of the Trans-North China Orogen, which separates the craton into two blocks, namely the Eastern and Western Blocks (Fig. 1; Zhao et al. 2001). A recent model for the evolution of the craton suggests that the Eastern and Western Blocks developed independently during the late Archaean and early Palaeoproterozoic and collided along the Trans-North China Orogen at ~1.85 Ga (Zhao et al., 2001; Wilde et al., 2002; Guan et al., 2002). Although there is much increased knowledge concerning the pre-collision history of the Eastern Block and the Trans-North China Orogen (Zhao et al., 1998, 2000; Wu and Zhong, 1998; Wu et al., 2000; Guo et al., 2002), the history of the Western Block is still poorly constrained.

The basement rocks in the Western Block are mainly exposed in the northern part of the block (Fig. 1), whereas the southern part of the block is covered with the Ordos basin. The exposed basement can be further divided into two distinct lithotectonic units. These are (i) the late Archaean TTG gneisses + mafic granulites/greenschists and (ii) the Khondalite Series (age not previously known), defined as a suite of granulite-facies supracrustal rocks including chiefly graphite-bearing sillimanite-garnet gneisses and associated garnet-bearing felsic paragneisses (leptynites), quartzites, calc-silicate rocks and marbles (e.g. Walker, 1902). The TTG gneisses + mafic granulites/greenschists crop out as high-grade gneisses or granite-greenstone terrains in the northern part of the block, whereas the Khondalite Series is exposed as a typical linear structural belt along the Jining-Daqingshan-Ulashan-Qianlishan-Helanshan zone, separating the northern late Archaean basement from the Ordos basin.

Because of the lack of reliable geochronological constraints, controversy has surrounded the ages of the Khondalite Series and its relationships with the late Archaean mafic granulites and TTG gneisses for a long time. Qian et al. (1985) proposed that the khondalite series in the Western Block were end-Archaean in age and were deposited unconformably on the late Archaean mafic granulite and TTG gneiss basement. However, Lu et al (1996) argued that no

unconformity existed between the Khondalite Series and the mafic granulites + TTG gneisses, and the khondalites and mafic granulites belonged to the same late-Archaean sedimentary-volcanic assemblage. On the other hand, Jin (2002) obtained and collected sparse Palaeoproterozoic U-Pb ages for the Khondalite Series and thus suggested that they were deposited in the Palaeoproterozoic, not in the Archaean.

To clarify these controversies, we have recently applied the Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry (LA-ICP-MS) technique to the in-situ analysis of $^{207}\text{Pb}/^{206}\text{Pb}$ isotopic ratios on zircons to determine the protolith ages of the Khondalite Series in the Western Block. Cathodoluminescence (CL) images show that most zircons from the khondalites are rounded detrital zircons of igneous origin, indicated by oscillatory zoning.

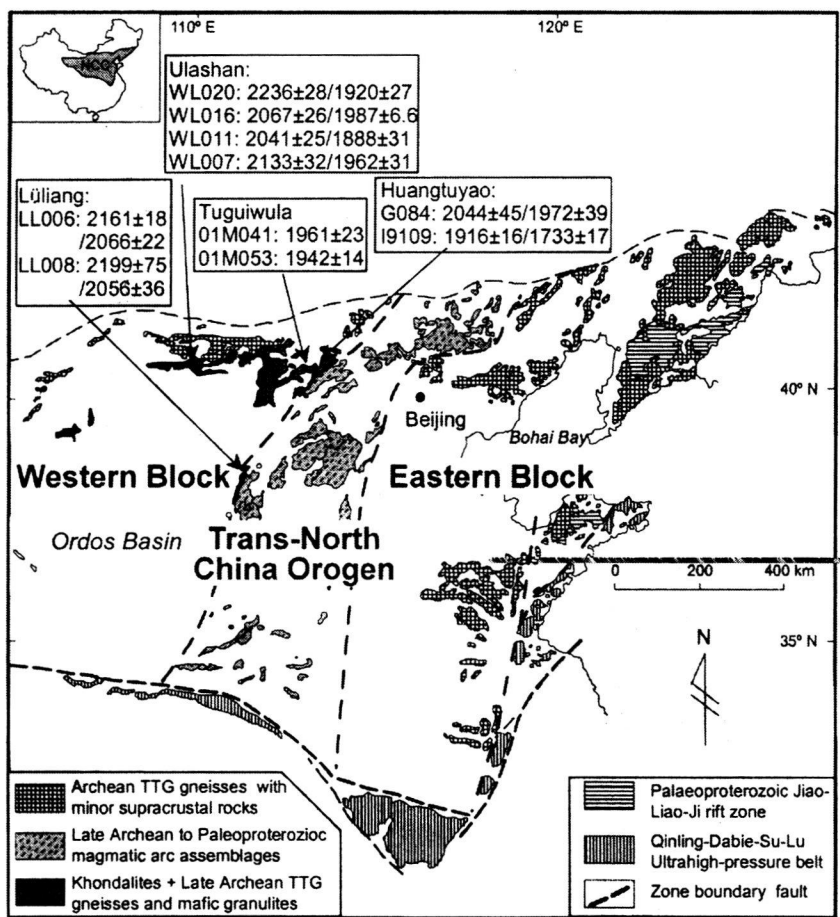


Figure 1. Tectonic subdivision of the North China Craton (Zhao et al., 2001) and the distribution of the Khondalite Series in the Western Block. Also shown are the zircon U-Pb ages obtained for the khondalites using the LA-ICP-MS technique. Inset shows location of the North China Craton (NCC) within China.

Some zircons have a metamorphic rim that is too narrow to be analysed. We have dated four samples from the Ulashan area, two samples from the Tuguiwula area and two samples from the Huangtuyao area. We have also dated two samples from the pelitic schists in the Lüliang area, which certain Chinese geologists have previously equated with the Khondalite Series (Wan et al., 2000). The results of the age determination of all these samples are shown in Figure 1. Based on these zircon ages, we conclude that: (1) all the khondalites in the Western Block of the North China Craton are Palaeoproterozoic in age, not Archaean as previously considered; and (2) no unconformity existed between the khondalites and the late Archaean mafic granulites + TTG gneisses because the former do not contain any late Archaean zircons derived from the latter, and thus, the Khondalite Series must be tectonically allochthonous to the late Archaean mafic granulites + TTG gneisses.

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