Late Paleozoic to Early Mesozoic magmatism in Linxi area, Inner Mongolia: Implications for the tectonic evolution of the Xing'an–Mongolia Orogenic Belt

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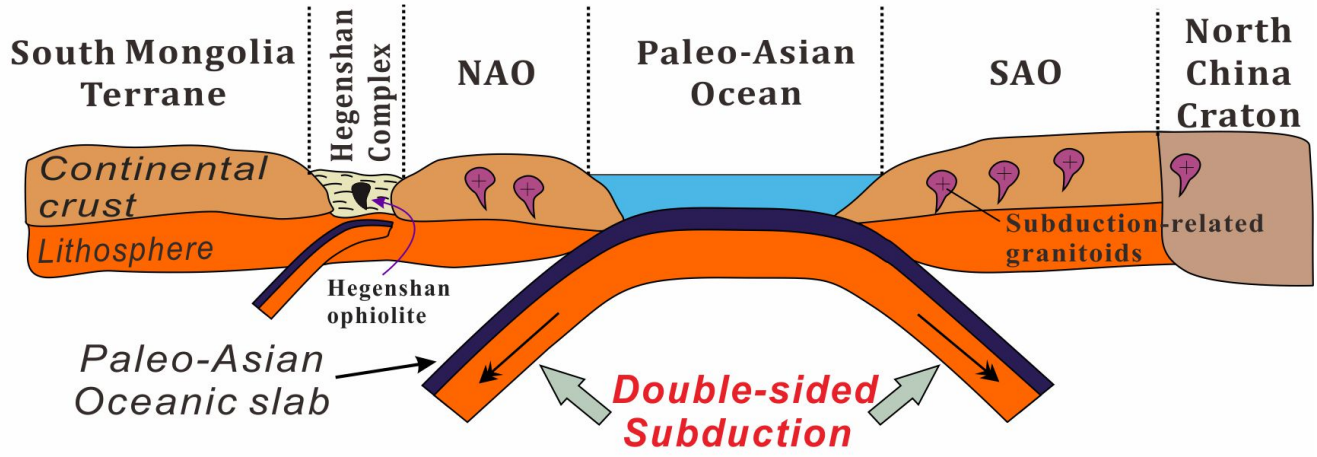
The Central Asian Orogenic Belt (CAOB) is one of the world's largest site of juvenile crustal growth in the Phanerozoic era (Sengor et al., 1993). The southeastern segment of the CAOB is called Xing'an–Mongolia orogenic belt (XMOB, Ren et al., 1980). Numerous fundamental problems are still unsettled, especially when it comes to the tectonic evolution of the XMOB during Late Paleozoic to Early Mesozoic (e.g. Jian et al., 2010; Tong et al., 2015; Xiao et al., 2003; Zhou et al., 2015). The study area (Linxi area, Inner Mongolia), located in the core region of the Solonker–Xra Moron suture (Han et al., 2012; Pei et al., 2017), is undoubtedly the significant region to investigate the tectonic evolution of the XMOB. Here we present new zircon U–Pb ages, whole-rock major and trace element compositions and coupled with Hf isotopes of the representative samples in Linxi area of the XMOB. This work evaluates their petrogenesis and tectonic implications and also provides new constraints on the tectonic evolution of the XMOB.
The representative rock samples analyzed in detail during this study were collected from four plutons in the midwest of the Linxi area, namely the BS, BSFZ, HD and XNG plutons. The BSFZ and XNG plutons consist mainly of granodiorite, granodiorite porphyry and monzogranite, which are belong to I-type granitoids. The BS and HD plutons are mainly composed of granite and monzogranite, which are classified as typical A-type granites. Zircon U–Pb age dating indicates the intrusions were emplaced in two stages: (1) during Late Permian to Early Triassic (the BSFZ and XNG plutons, 252 ±3–246.3 ±3.3 Ma); (2) Late Triassic (the BS and HD plutons, 220.8 ±2.7–211.4 ±2.6 Ma). According to their geochemical characteristics and Hf isotope compositions, as well as Nd isotope published recently in this region, we argue that the investigated granitoids share the similar magma sources which were derived from the partial melting of juvenile lower crust materials. It is notable that the BS and HD A-type granites experienced higher degree of magmatic differentiation compared to the BSFZ and XNG I-type granitoids.
Crustal growth and tectonic evolution of orogenic belts could be deciphered by the accompanied magmatism (Wu et al., 2011). In order to get a more comprehensive understanding of magmatism, here we integrated 95 recently-published single-zircon U–Pb ages of granitoids in adjacent areas. According to these precise geochronological data, four main periods of granitic magmatic activity can be distinguished in this area: Late Carboniferous (330–300 Ma), Early Permian (290–270 Ma), Late Permian–Late Triassic (260–220 Ma) and Late Jurassic-Early Cretaceous (150–110 Ma). The occurrence of the youngest age group is triggered by the Pacific plate subduction (e.g., Ouyang et al., 2013; Wilde, 2015). Other age groups are most likely controlled by the subduction–collision processes driven by the closure of the Paleo-Asian Ocean (e.g., Eizenhöfer et al., 2014; Li et al., 2016). There is a broad consensus that the final closure of the Paleo-Asian Ocean took place along the Solonker–Xra Moron suture zone, which was marked by melanges, blueschists and the Solonker–Sonidyouqi–Kedanshan–Xingshuwa ophiolite belts.
Based on these new data and previous studies, we predict three stages of tectonic evolution during the Late Paleozoic–Early Mesozoic in the XMOB: (1) Late Carboniferous–Early Permian (330–270 Ma): double-sided subduction of the Paleo-Asian Ocean; (2) Middle Permian–Middle Triassic (270–237 Ma): the closure of the Paleo-Asian Ocean and subsequent continent–continent collision between the North China Craton and the South Mongolia Terrane. (3) Late Triassic (237–211 Ma): post-collisional extension.

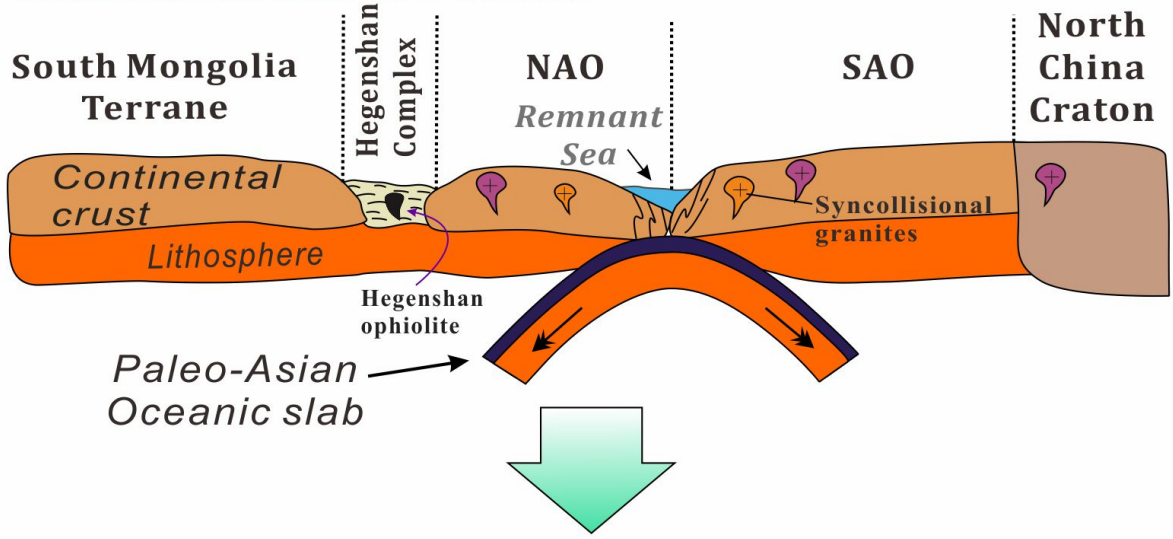
Keywords: tectonic evolution, CAOB, U–Pb–Hf isotopes, magmatism, Linxi

(1) Subduction of the PAO (330–270 Ma)

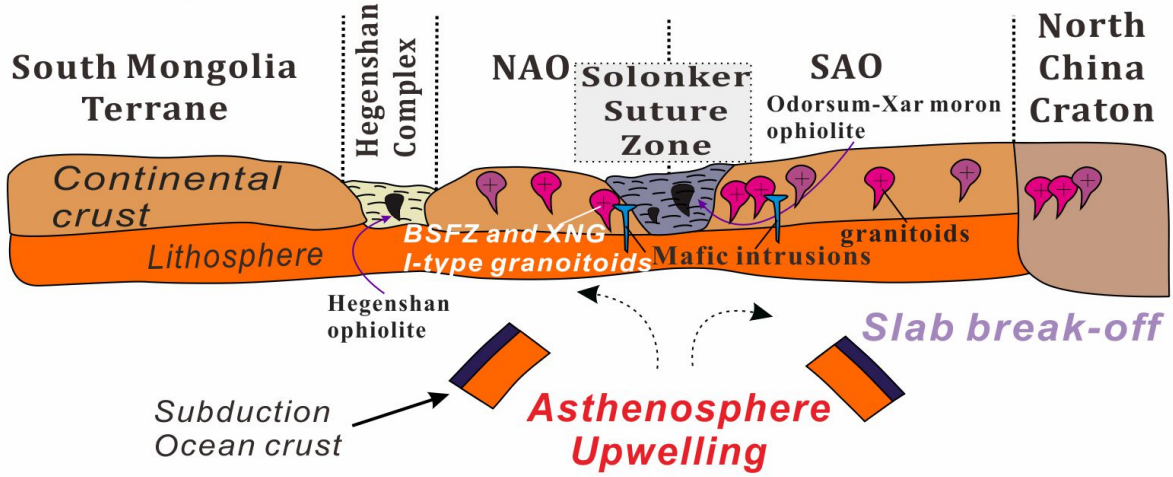


(2) Collisional orogeny (270–237 Ma)

a. Initial collision: 270–260 Ma



b. Subsequent continent–continent collision: 260–237 Ma



(3) Post-collisional extension (237–211 Ma)