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Emplacement Ages of the Molybdenum–bearing Granites in the Jinduicheng Area of East Qinling, China: Constraints from Zircon U–Pb Ages and Hf Isotopes

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1 Regional Geological Setting

The Jinduicheng area is located in the east of Shaanxi Province along the southern fringe of the North China Plate. In terms of geotectonics, it is situated at the west end of the East Qinling Molybdenum Belt, along the southern margin of the North China Craton (Fig. 1). Supracrustal units in the mine area include Middle Proterozoic andesitic volcanic rocks of the Xiong'er Group and Neoproterozoic quartz arenites and minor slate, and these rocks overlie gneisses and migmatites of the Archaean basement. The principal units that crop out in the mine area are andesites, dacites, rhyolites, and minor basalts of the Middle Proterozoic Xiong'er and Proterozoic Luanchuan groups. To the south of the deposit, quartz arenites, shales, and slates of the Paleoproterozoic Gaoshanhe Formation of the Guandaokou Group unconformably overlie the Xiong'er Group. The NNE–striking Jinduicheng anticline within the Xiong'er Group, which is the dominant fold in the area, and two sets of faults (trending between NE and ENE, and between NW and WNW). The intrusion of the porphyry and the subsequent hydrothermal alteration were both controlled by the NW–trending faults. The Yanmen'ao Fault marks the northernmost extent of Mo mineralization, and movement along the Ludougou Thrust resulted in the emplacement of quartz sandstones (Gaoshanhe Formation) over the Mo deposit.

Magmatic rocks are broadly spread in the Jinduicheng area, with Proterozoic granitoids and granite pegmatite exposed at the northeastern end of the mining area. The diabase and syenite porphyry of the Indochinese epoch occur mainly in the Dongping–Huanglongpu–Taiziping area. The Yanshanian granites present two different morphologies: granite batholiths, including the

Laoniushan granite pluton, and minor intrusions, associated with the Mo mineralization, such as the Jinduicheng and Balipo porphyries and the Shijiawan granite.

2 Discussion

The Mesozoic porphyry assemblage in the Jinduicheng area is a special molybdenum area in China, the Mo deposits, including the Jinduicheng, Balipo, Shijiawan, Huanglongpu, are distributed. The emplacement age and geochemical features of the granites in the Jinduicheng area can provide essential information for the exploration and development of the porphyry molybdenum deposit. The zircon U–Pb ages of the Jinduicheng granite porphyry (143 ± 1 Ma) and the Balipo granite (154 ± 1 Ma), agree well with the Re–Os ages of molybdenite in the Jinduicheng molybdenum polymetallic deposit (139 ± 3 Ma) and the Balipo molybdenum polymetallic deposit (156 ± 2 Ma), indicating that the emplacement of granite porphyries occurred between Late Jurassic and Early Cretaceous. Zircons from the Jinduicheng area give the $\varepsilon_{\text{Hf}}(t)$ values mainly ranging from -10 to -16 , and -20 to -24 , respectively, corresponding to two-stage model ages ($t_{\text{DM}2}$: mainly focused on 1.86 – 2.0 Ga, and 2.2 – 2.6 Ga, respectively) of zircons of the granite from the Jinduicheng values. The ore-forming materials are mainly derived from crust, with minor mantle substances. Zircons of the granite from the Balipo area give $\varepsilon_{\text{Hf}}(t)$ values ranging from -18 to -20 , -28 to -38 , and -42 to -44 , respectively, corresponding to two-stage model ages ($t_{\text{DM}2}$: mainly focused on 1.88 – 3.0 Ga, and 3.2 – 3.90 Ga, respectively) of zircon of the granite from the Jinduicheng. The $\varepsilon_{\text{Hf}}(t)$ values of the Jinduicheng porphyry more than that of the Balipo porphyry, and two-stage model ages ($t_{\text{DM}2}$) less than that of the Balipo porphyry, shows that the source of the porphyries originated from

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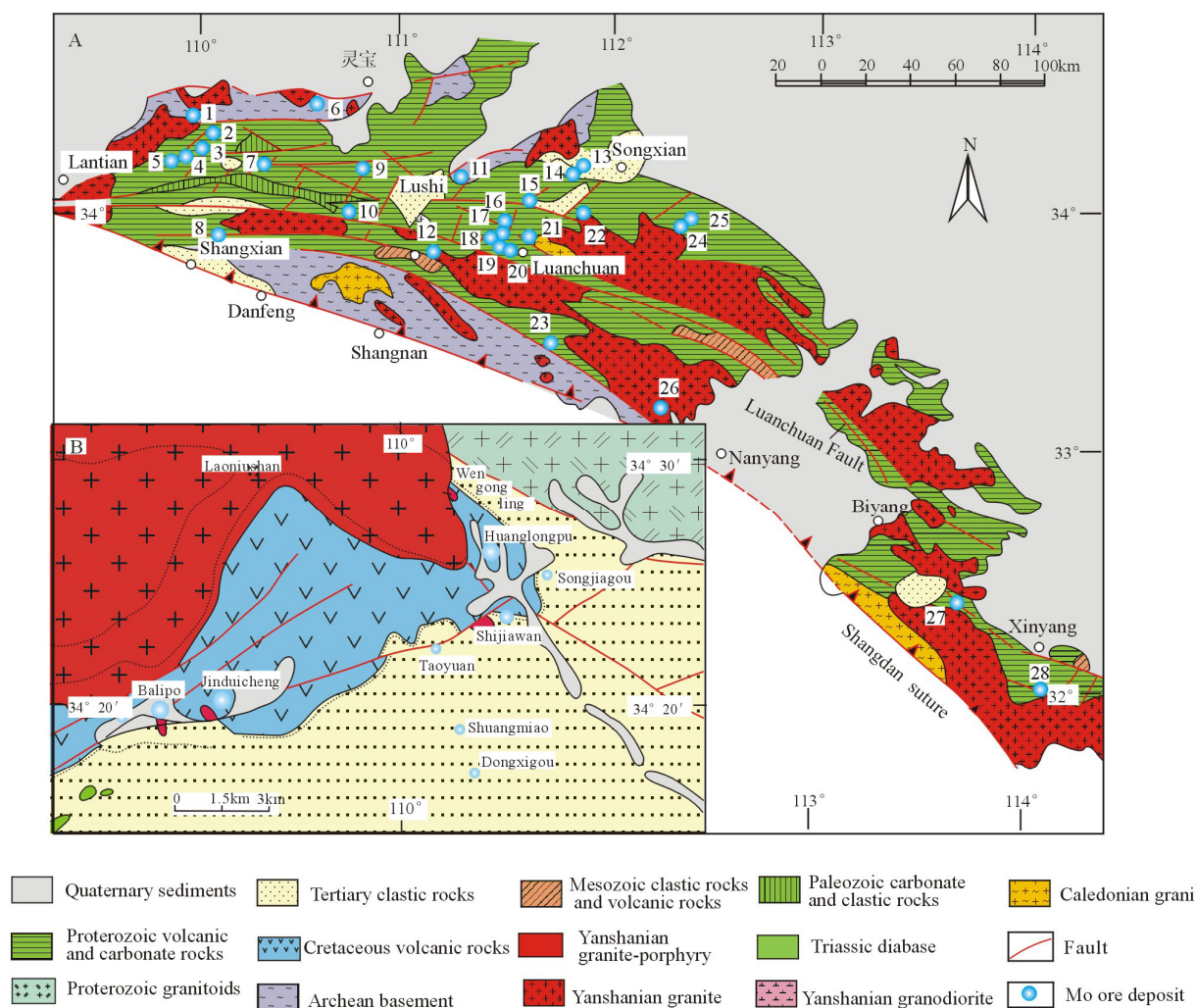


Fig. 1. Regional geological map of Jinduicheng area in East Qinling (after Huang et al., 1987; Mao et al., 2010)

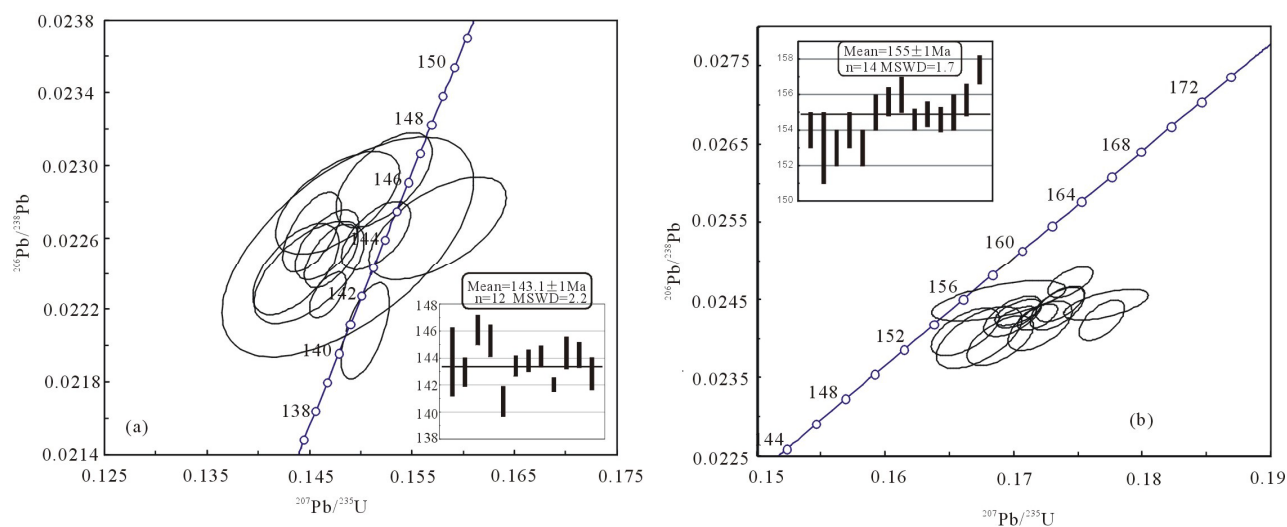


Fig. 2. Concordia plot of U-Pb result for granites porphyry from Jinduicheng area (a), Jinduicheng porphyry; (b), Balipo porphyry

ancient lower crustal materials in the Jinduicheng area, and mixed younger components, more younger components contributed for the source of the Jinduicheng porphyry.

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