# Granulite xenolith constraints on the modification of the lower crust beneath the northern margin of the North China craton

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It has been well accepted that the lithosphere of the North China craton was severely destroyed in Mesozoic, in that the cratonic thick lithosphic mantle was replaced by manlte with oceanic affinity. A large amount of studies on the peridotite xenoliths entrapped by basalts of varied ages have invariably confirmed such catastrophic transformation. Howerver, it is still unclear whether the crust, espceically the lower crust also experiences significant modification or just keep stable and intact since its formation in Archean. A suite of granulite xenoliths captured in Cretaceous alkline basalts in the northern margin of the North China provide valuable constraints on the evolution of the lower crust. These xenoliths are mainly two-pyroxene granulites. We performed in situ U-Pb dating and Hf isotopic analyses on zircons separated from these xenoliths. CL images revealed that the majority of zircons are of igneous origin, though some zircon rims are metamorphically recrystallized. Zircons from one sample are discordant and show an upper intercept age of 2.5 Ga, representing the crystallization age of the protolith, which is consistent with the granulite terrain-based conclusion that the lower crust was mainly formed in 2.5 Ga ago. Apart from the Archean xenoliths, there are samples in which zircons are concordant with ages ranging from 200 to 300 Ma and peaking at 250-280 Ma, their Hf isotopic compostions, with εHf(t) values trending towards positive suggest that mantle materials contributed to the formation of their protoliths. Their relative younger model ages also ruled out their origin of mere remelting of preexisted lower crust, and underplating of mantle-derived magmas plays a considerable role in modifying the lower crust. Furthermore, the timing of magmatic underplating is colsely correlated with the closing and subsequent evolution of the Paleo-Asian ocean. We conclude that the modification of the lower crust beneath the northern margin of the North China craton was mainly, if not totally attributed to the southward subduction of Paleo-Asian oceanic slab and subsequent magmatisms.

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# The comparison experiments of acid leaching and bioleaching of sand-type uranium ore

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A series of comparison experiments of acid leaching and bioleaching of sand-type uranium ore were conducted in laboratory. The average grade of ore is 0.416‰, and the main size of the ore particles was 0.3-0.6mm. Acidibacillus ferrooxidans and Acidibacillus thiooxidans, by which $Fe^{2+}$ was oxidized to $Fe^{3+}$ to produce ferric acid leaching solution, were employed in the bacterial leaching processes.

For experiments under different conditions, 2.4kg uranium ore were divided into 12 uniform parts and each was put into a 500ml conical flask. Then these 12 flasks were ranged equally into three groups. Sulphuric acid solution was used for ore acidification; concentration of 2.0g/L was for group 1, 3.5g/L for group 2, and 5.0g/L for group 3. When the pH value of leaching system went down below 2.0, bacterial ferric acid solution with different concentration of $Fe^{3+}$ and $H_2SO_4$ were added into different flask for bioleaching; a uniform acidity was also applied for all individuals in a same group, 2.0g/L was for group 1, 3.5g/L for group 2, and 5.0g/L for group 3; the ferric concentrations of 0g/L, 2.0g/L, 3.5g/L and 5.0g/L were applied respectively for those four flasks of every group.

Results showed that the uranium yield had been influenced by the solution acidity both in acid leaching and bioleaching processes; the yield could be increased by 2~3 percents as the solution acidity rose by 1.5g/L. The yield also determined by leaching technique. Comparing to acid leaching, bioleaching using bacteria solution of 2-5g/L $Fe^{3+}$ could raise the yield by 6-11 percents. However, the leaching efficiency of 5g/L $Fe^{3+}$ did not gain advantage over that of 2g/L; it indicated that concentration of 2g/L of $Fe^{3+}$ in the bacterial leaching process was effective and economical.

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