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40Ar/39Ar thermochronology on North China craton: respond to the lithospheric thinning ?

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It has long been noticed that the North China craton was thinned at some time during Mesozoic time. The lithosphere beneath eastern China is anomalously thin, considering the geologically perceived cratonic nature in the North China. Petrologically, the occurrance of Paleozoic diamondiferous kimberlites in this region indicates that the lithosphere of North China craton must have been ∼200 km thick in Paleozoic times. However, recent studies of mantle xenoliths indicate a much thinner present-day lithosphere, perhaps no more than 80 km thick. This is confirmed both by seismic studies and mantle topography. Hence, the lithosphere beneath North China craton must have lost a portion of ∼120 km in thickness, probably in the Mesozoic. But how and when is still a big dispute among the geologists so far.

Large scale framework of 40Ar/39Ar geochronology and thermochronology is conducted on North China craton in order to constrain the cooling history of the craton as a whole, which may reveal clue for this big event. Samples are modeled by using multiple-domain diffusion theory on K-feldspar and conventional 40Ar/39Ar dating on biotite and hornblende from the abyssal granites around and within North China craton. Almost all the resultant cooling histories show a synchronous fast cooling event during 126-120Ma, suggesting exhuming and unroofing of the North China craton at this time. The 40Ar/39Ar geochronology and thermochronology on metamorphic cores from the craton suggest that the detachment faults saw their summit activities during 126-120Ma either. The cooling histories also show that this unroofing event may go through till 100Ma ago.

This unroofing occurrence must cause geological responds at the same time, as we have already seen phenomena, such as the eruption of the volcanics, emplacement of A-type granites and alkaline rocks, intrusion of dyke swarms, and formation of basins within the craton.

40Ar/39Ar geochronology on volcanics in NE China indicate that the igneous activity had migrated from west to east with peak time during 130-120Ma. Combined with all these evidences, we may have constrained the lithospheric thinning of North China craton: it may start from the west part of the craton at ∼160Ma, and extend eastwards, culminate during 126-120Ma. This process may last until most late Mesozoic time and affect the whole eastern Asia.