Timing, Scale and Mechanism of the Destruction of the North China Craton

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Cratons are important geological features on the Earth, and cover ~50% of the continental surface. Cratons were formed mainly during the Precambrian (> 540 Ma), in particular during the Paleoproterozoic (> 1.8 Ga). The typical cratons are characterized by thick lithospheric mantle, cold geotherm, low density and high viscosity, which protect the cratons from destruction by later geological processes. Therefore, cratons are the most stable tectonic unit on the Earth without significant intracrustal ductile deformation, magmatic and seismic activity after their formation and the overlying sedimentary strata are almost horizontally outcropped. The North China Craton (NCC) consists of three major parts: the eastern NCC and the western NCC of Archean age, and the Trans-North China Orogen (the central NCC) which formed during the assembly of the eastern and western NCC ~1.85 Ga ago. While the NCC was tectonically stable as a whole for more than 1 Ga and exhibited features similar to typical cratons ca 450 Ma ago, it experienced widespread thermotectonic reactivation in Phanerozoic time, with the three parts of the NCC evolving differently. Since the initiation of the ”North China Craton Destruction” project by the National Natural Science Foundation of China (NSFC), numerous studies have been conducted on the timing, scale, and mechanism of this destruction through interdisciplinary researches. Available data suggest that the destruction occurred mainly in the eastern NCC, whereas the western NCC was only locally modified. The sedimentation, magmatic activities and structural deformation after cratonization at ~1.8 Ga indicate that the NCC destruction took place in the Mesozoic with a peak age of ca 125 Ma. A global comparison suggests that most cratons on Earth are not destroyed, although they have commonly experienced lithospheric thinning; destruction is likely to occur only when the craton has been disturbed by oceanic subduction. The destruction of the NCC was coincident with globally active plate tectonics and high mantle temperatures during the Cretaceous. The subducted Pacific slab place a premium on mantle convection destabilized beneath the eastern NCC, which result in cratonic destruction in the eastern NCC. Delamination and/or thermal-mechanical-chemical erosion is just a behavior of cratonic destruction.

Knowledge on the destruction or modification of stable cratons is still limited. Exploration of cratonic destruction is the key to continental geology, which helps us to understand the continental formation, evolution and the related effects. Furthermore, this kind of study will provide new breakthroughs that are required to construct a more complete theory on the formation and evolution of the Earth. A state research project, Destruction of the North China Craton (NCC) funded by the NSFC, focuses on the key scientific issues of cratonic destruction. The interdisciplinary approaches adopted in the project go far beyond the limits of traditional scientific methods. Considerable progress has been made on the basic and prospective research fields like continental formation and evolution, which made outstanding contributions to earth sciences in China.