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Tectonic transition from compression to extension in eastern North China: Evidence from Jurassic–Cretaceous dyke swarms

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Tectonic transitions from compression to extension at an active continental margin provide clues for a better understanding of the geodynamics of plate subduction. Here, we present detailed investigations of Jurassic to Cretaceous dyke swarms in the east margin of the North China Craton (NCC). It is demonstrated that the Jurassic dykes are distinctly different from the Cretaceous dykes, in terms of both occurrence and geochemistry. The Jurassic dyke swarms, which include both mafic and felsic types, all strike NW-dominated directions. Most Jurassic felsic dyke swarms display adakitic geochemical characteristics, interpreted to be formed by melting of the ancient lower crust of the NCC. Jurassic mafic dyke swarms originated from the metasomatic enriched lithospheric mantle. Thus, the Jurassic dyke swarms are indicative of a compressional environment. However, the Cretaceous dyke swarms strike in NE-dominated directions. The Cretaceous felsic dyke swarms are characterized by geochemical features of A-type granites. The Cretaceous mafic dyke swarms have originated from the asthenospheric mantle during back-arc extension. We propose that the Jurassic crustal thickening, lower crustal reworking and the melting of ancient lithospheric mantle are the result of the Paleo-Pacific subduction and related compression. In contrast, crustal thinning indicated by the orientation of Cretaceous dyke swarms and their high-temperature features, as well as the reworking of the upper and middle crust and the appearance of depleted mantle, are the result of extension caused by the rollback of the Paleo-Pacific Plate. Variations of composition and orientation of dyke swarms effectively reflect the tectonic transition from compression in the Jurassic to extension in the Cretaceous along the east margin of the NCC.