Life cycle of an Archean subduction zone from initiation to arc–polarity reversal: Insights from the Zunhua ophiolitic mélange, North China Craton

Wenbin Ning, Timothy Kusky*, Junpeng Wang, Lu Wang, Hao Deng, Ali Polat, Bo Huang, Hongtao Peng, Peng Feng

Introduction

Documentation of a Neoarchean Zunhua ophiolitic mélange (ZOM) in the Eastern Hebei Complex, a tectonic mélange in the Jianping, Zanhuang and Dengfeng Complex of the North China Craton (NCC) defines an Archean suture zone (ca. 1600 km), which delineated the boundary between the Eastern Block and the Central Orogenic Belt of the NCC. However, the subduction initiation process, age, and longevity are poorly understood.

Conclusions and implications

A life cycle of an Archean subduction zone, including birth (subduction initiation), maturity (arc magmatism), death (arc-continent collision) and re-birth (arc–polarity reversal), is recorded in the Zunhua ophiolitic mélange, and the geodynamics of plate tectonics at the Neoarchean was similar to that of today.

Metamorphosed intermediate–mafic volcanic blocks exhibit systematic successive geochemical variations, from MORB-like to volcanic arc-like, and the N-MORB-like meta-basalts show remarkable similarity with the subduction initiation-related Izu–Bonin–Mariana (IBM) fore-arc basalts.

Typical “block-in-matrix” fabric in the ZOM

Fore-arc basalt blocks within the ZOM

Chromites in dunite blocks of the ZOM produced by rock-melts reaction between harzburgite and boninitic melts, which considered to occurred during subduction initiation.

Tectonic map of the NCC and the Eastern Hebei Complex