Intra-oceanic arc accretion along Northeast Asia during Early Cretaceous provides a plate tectonic context for North China craton destruction

*Tsung-Jui Wu[1], Jonny Wu[1], Kazuaki Okamoto[3,2]

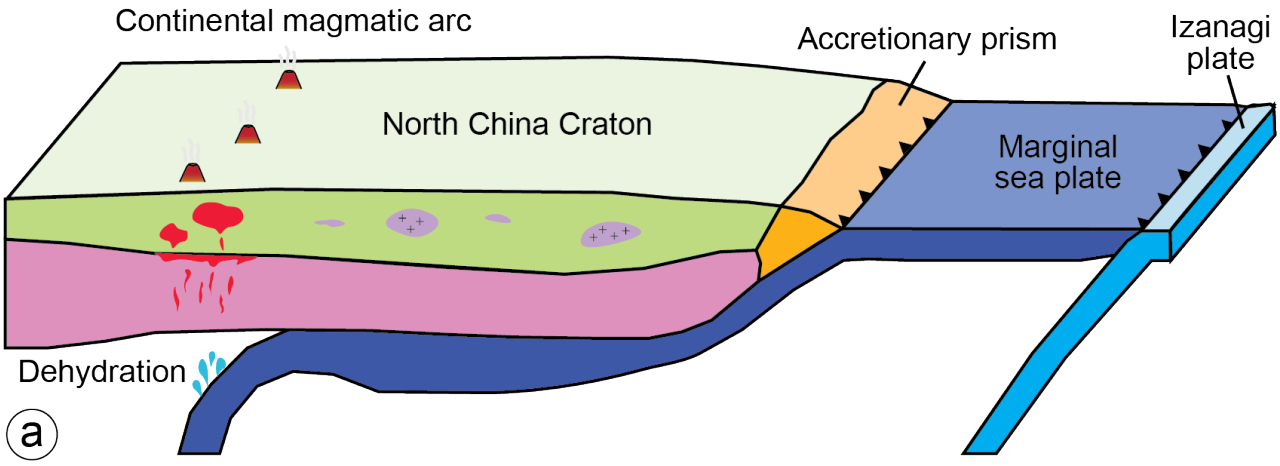
1. Department of Earth and Atmospheric Sciences, University of Houston, 2. Faculty of Education, Saitama University, Saitama, Japan, 3. The United Graduate School of Education, Tokyo Gakugei University, Koganei, Japan

The eastern Eurasian continental margin along northeast Asia shows abundant evidence for subduction-related igneous activity during Cretaceous times. Consequently, studies of the eastern Eurasian margin typically reconstruct long-lived plate convergence that involves the subduction of the modern and Paleo-Pacific plates through time. However, many first-order details of NW Paleo-Pacific (Panthalassa) plate tectonic reconstructions remain controversial. Some models consider that during the Early Cretaceous times, an oceanic plate continuously subducted under the Eurasian continental margin to form an ‘Andean-type’ margin, and a continental arc-trench system was developed. In contrast, others suggest that intra-oceanic arcs formed outboard of the continental margin due to intra-oceanic subduction, and these arcs accreted along the East Asian margin; we call these ‘intra-oceanic arc’ models. In addition, the NW Panthalassa plate tectonic context Early Cretaceous times has important implications for the simultaneous North China craton destruction (i.e., NCC destruction). The NCC destruction is typically considered within the context Andean-style subduction, while the intra-oceanic arc models were less considered. Here we review oceanic terrane accretions along NE Asia during Cretaceous times from published magmatism, stratigraphy, and paleomagnetism. We synthesize an alternative ‘intra-oceanic subduction’ -style NE Asian plate tectonic model between ~15-40° N latitudes during the Early Cretaceous (130-100 Ma) and discuss implications for NCC destruction.

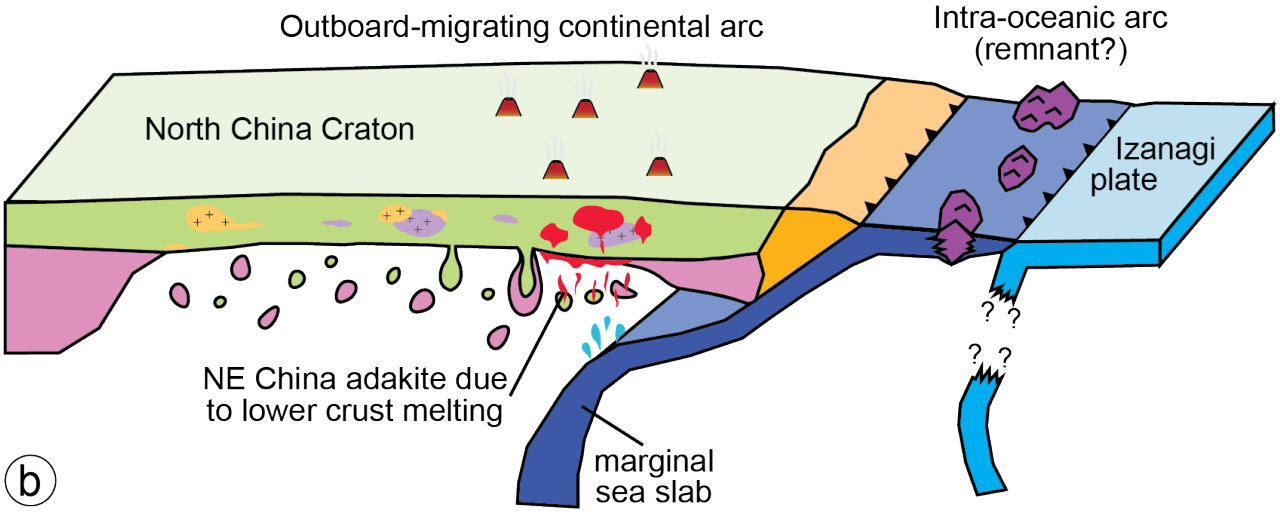
Well-known NE Asian magmatism migrated > 1000 km inboard to NE China during the Jurassic, and then >1000 km outboard during early Cretaceous (140-110 Ma). Early Cretaceous NE Asian igneous rocks include: (1) arc-related igneous rocks, (2) 132-99 Ma adakites in Japan and Sikhote-Alin, and (3) 145-120 Ma K-rich adakites in NE China. Roughly co-eval to these periods (130 to 100 Ma), intra-oceanic arcs accreted diachronously along the Sambagawa belts, SW Japan, Oku-Niikappu belts, NE Japan, and Kema and Kiselevka-Manoma, Russian Far East. Based on the adakite geochemistry and spatiotemporal overlap between the arc accretions and adakites, we link the NE China adakites to lower NCC crustal melting, whereas the Japan-Sikhote Alin adakites originated from oceanic slab melting. We show that eastern Eurasia-NW Panthalassan plate tectonics during the Early Cretaceous was more complex than generally recognized, involving intra-oceanic subduction zones and multiple oceanic plates. The Early Cretaceous-aged NE Asian adakites were generated within elevated mantle geotherms during 140-110 Ma slab rollback and 130-100 Ma intra-oceanic arc accretions. Oceanic mantle emplaced during these events replaced the NCC subcontinental lithospheric mantle with more juvenile mantle during final NCC destruction at 115 Ma. The more complete plate tectonic picture provided here suggests that NCC destruction models that rely on straightforward Andean-style subduction are likely oversimplified. Instead, future NCC destruction studies should include more complex geodynamics with intra-oceanic subduction and additional plates that will alter boundary conditions for geodynamic modeling, petrogenesis, and magmatic mixing models.

Keywords: Early Cretaceous, intra-oceanic arc

150 Ma Inboard continental arc



125 Ma Peak of North China craton lithospheric thinning



100 Ma Final stage of intra-oceanic arc accretion along NE Asia