

The mantle mega-wedge beneath East Asia formed ~145 million years ago

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In the eastern Asian continent, the Pacific slab is stagnant in the MTZ (between 410 and 660 km) and the overlying upper-mantle region forms a “mantle mega-wedge” (MMW) that extends >1800 km inland from the trench. Due to continuous material transfer from this stagnant slab, the overlying MMW hosts unusually high amounts of recycled water and carbon, significantly affecting the melting behavior of the mantle and evolution of the lithosphere. The timing of the initiation of such a MMW structure is thus critical to understanding Asian geodynamics but remains poorly assessed. Here, we address this issue by examining the spatiotemporal variations of magmatism and deformation in the northern Sino-Korean craton. A compilation of age data for Mesozoic igneous rocks from this area reveals over 1000 km of inland-ward migration of a magmatic belt during 185~145 Ma and then back again after ~145 Ma, coinciding with the transition from contractional to extensional deformation regime in the very early Cretaceous. This dichotomy of magmatism and deformation is best interpreted as the consequence of a change from forward-subduction to rollback of the Paleo-Pacific slab. Because trench retreat and slab-roll back are demonstrated as the pre-request of slab stagnation in the mantle transition zone, we suggest that the MMW structure beneath East Asia probably has developed since ~145 Ma.