Geodynamic history of subducted slabs along the East Asian margin since the Cretaceous

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The Pacific margin along East Asia has experienced a prolonged history of subduction, punctuated by ridge-trench intersection events, arc accretions and episodic back-arc opening. These events resulted in major changes in the plate boundary configurations and shape and continuity of subducted slabs beneath East Asia. The complete subduction of the Izanagi plate and subsequent margin-wide slab detachment along East Asia has previously been invoked as a trigger for a global change in plate-mantle interactions at 50 Ma. More recently, arc accretion events along the northern East Asian margin have similarly been used to explain the 50 Ma plate reorganization event through changes in Pacific plate motion. We tested two end-member models for the Cretaceous-present history of subduction along the East Asian margin, one that is dominated by a margin-wide ridge-trench intersection and another that additionally includes recently published arc accretion events in the northwest and northern Pacific. We implemented a model of evolving topological plate boundaries using *GPlates* and reconstructed the vanished ocean floor of the northwest proto-Pacific and Pacific oceans. We used the surface plate kinematics and age of the oceanic crust as surface boundary input into numerical mantle flow simulations using *CitcomS*, allowing for the time-dependent tracking of slab material into the mantle. We then compared the present-day predicted mantle temperature structure to seismic tomography images to assess the consistency of the alternative plate tectonic models. Our geodynamic calculations for the Izanagi-Pacific ridge-trench intersection model result in a good first-order match between the present-day temperature predicted by flow models and seismic tomography models along much of the east Asian margin, with two distinct structures corresponding to two major phases of subduction: the subduction of the Izanagi plate before 50 Ma and the more recent subduction of the Pacific plate. The break in the continuity of slab material in the mid-mantle observed in seismic tomography is compatible with the Izanagi slab break-off observed in both the geological record and geodynamic models. Preliminary results from a model that incorporates recently published arc accretion events in the northwest and northern Pacific results in an improved match to seismic tomography along the northern part of the East Asian margin, resulting in a seismic gap further east than previously inferred. We find that considering arc accretion events as well as a ridge-trench intersection event improves the match with present day mantle structure. This approach provides an important tool to better reconcile geological and geophysical constraints on the history of sudduction, in particular in tectonically complex regions.

Keywords: subduction, ridge-trench intersection, slab

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