

Using the volcano-magmatic record to constrain geodynamic evolution during the closure of the Mongol-Okhotsk Ocean in NE Mongolia

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Abstract

The Mongol-Okhotsk belt extends for more than 3000 km, from Mongolia to the Sea of Okhotsk in the northwest Pacific Ocean. It is the relict of the Mongol-Okhotsk ocean, a cryptic basin for which the timing, location and modes of opening and closure are still debated. One of the key components associated with the progressive closure and final collision and suturing of this ocean is the vast magmatic and volcanic record north and south of the presumed suture. Permian to Triassic magmatic and volcanic rocks are particularly abundant in the belt. They are characterized by bimodal volcanism, abundant calc-alkaline activity, secondary alkaline activity, and geochemical signatures that point to both volcanic-arc and within-plate origin as well as crustal and mantle sources. This has led to two main tectono-magmatic interpretations: (1) an Andean-style active margin modified by a mantle plume and/or affected by lithospheric delamination that evolved to a syn- and post-collisional setting, and (2) a mantle plume that recycled geochemical signatures from a long-lived active margin after the ocean was closed either by anatexis or by melting a remnant slab. These two models have first-order implications for the tectonic setting as well as for the location of the proposed mantle plume through time. We reconstruct the distribution of magmatic and volcanic provinces surrounding the Mongol-Okhotsk Suture Zone using G-Plates and the most recent paleomagnetic and mantle tomographic reconstructions to restore the position of the proposed mantle plume and the location of the slab between the Late Permian and Early Jurassic. Our reconstructions enable us to test the kinematic restoration and the viability of both the active subduction and the mantle plume models during the closure of the Mongol-Okhotsk Ocean.

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