



A refined scenario of the India-Eurasia collision derived from the magmatic evolution of NW Himalaya

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The uncertainty in the India-Eurasia collision age strongly affects our ability to understand the geological processes involved in the evolution of this orogen. We have reconstructed the spatial and temporal magmatic evolution of the Kohistan-Ladakh Paleo-Island Arc (KLA, NW Himalaya) through field and multi-isotopic based studies (U-Pb and Hf on zircon; Nd, Sr and Pb on bulk rocks). Our results date the India-Eurasia collision at 40 Ma, and, combined with published observations along the Himalayan Belt and Tibetan Plateau, allow us to propose a refined scenario of the India-Eurasia collision. This model significantly improves our understanding of the dynamics of collision and subsequent phases of deformation involved in the making of the Himalayan orogeny. The KLA was part of an equatorial intra-oceanic island arc chain that was situated >2500 km south of the Eurasian Margin within the Neo-Tethys and show more than 60 Ma of Mesozoic intra-oceanic history. The KLA, wedged between India (Indus Suture) and Eurasia/Karakoram (Shyok Suture) is the most significant preserved portion of this arc chain, whereas only few ophiolitic remnants are present along the Tsangpo Suture. At 50 Ma, the KLA magmatic products record an abrupt shift towards an isotopically evolved composition. This shift temporally corresponds to a sharp drop in convergence rate, the beginning of UHP metamorphism of the Indian margin, the end of marine sedimentation, and the exhumation of the Arc. These changes relate to the India-Arc collision, the beginning of the Indian margin subduction, and the formation of the Indus Suture occurring > 1000 km south of the Eurasian margin that was still showing typical Andean style magmatism. Between 50 and 40 Ma the convergence is driven by the Indian continental subduction as recorded by the UHP metamorphism that reached its peak at 46 Ma. During this period, the Shyok Sea, i.e. the back-arc basin, was still subducting below the Eurasian margin, and mantle derived melts were still being formed in the northern part of the KLA. At 40 Ma, our isotopic and zircon records indicate that the Karakoram margin underthrust below the India/Arc assembly, marking the Shyok Suture formation and the final India-Eurasia collision. This event is recorded all along the belt and corresponds to the shift in magmatism from localized calc-alkaline to widespread alkaline series, and the beginning of rapid exhumation along the southern Eurasian margin that induced a sharp change in the sedimentary output. Our isotopic and inherited zircon records indicate that the oceanic lithosphere may have detached as late as 30 Ma causing India to underthrust the colliding continents, a prelude to the main tectonic and metamorphic activity recorded along the Belt.

Our scenario of a final 40 Ma collision age significantly simplifies the accommodation process of the India-Eurasia collision, by reducing the amount of convergence down to 2000 km.