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# Kinematic reconstruction of the Tibetan-Himalayan orogen since the Cretaceous

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Knowledge of the kinematic evolution of the Tibetan-Himalayan orogenic system is paramount to understand the geodynamics, development of topography and climate changes in a region that contains some of the world's most important biodiversity hotspots. The tectonic framework however has been controversial with multiple models proposed. The Late Cretaceous to Palaeogene anomalously high velocity of the Indian plate has been hypothesised to be caused by two north-dipping subduction zones, and the arrival of the continental margin of the Indian plate is considered to have triggered both the slowdown of the Indian plate as well as a phase of overriding plate deformation. Here, we present a quantitative reconstruction of the tectonic evolution of this orogen with particular focus on deformation of the upper plate, which is responsible for the topographic evolution. We build our reconstruction in GPlates using a systematic reconstruction protocol. To this end, we review the geology and orogenic architecture of the Tibetan-Himalayan orogen. We present a single reconstruction for the evolution of the overriding Eurasian plate. We show that this reconstruction is consistent with palaeomagnetic and seismic tomographic data. We then reconstruct three alternative tectonic and palaeogeographic scenarios for the lower plate based on data from the Himalaya, Burma and Kohistan, whose sparsity permits multiple interpretations. Whereas one of our scenarios is consistent with the hypothesis that Late Cretaceous acceleration of the Indian plate was driven by two subduction zones, we demonstrate that it does not explain early Eocene acceleration. Moreover, the notion that the arrival of the Indian continental margin triggers a phase of overriding plate deformation is supported by only by one of our scenarios, in which this occurs at 25 Ma. None of our scenarios however support the hypothesis that the arrival of the Indian continental margin corresponds to the middle Eocene slowdown of the Indian plate. Finally, our reconstructions provide the platform for future work to include reconstructions of palaeotopography and palaeoclimate to identify the environmental changes that may have driven the development of regional biodiversity hotspots.