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Climate and tectonic changes during the Indo-Asia collision

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The interplay between the Indo-Asia collision, uplift of the Tibetan Plateau and climate belongs to the most significant and fascinating issues of tectonics and paleoclimate. According to prevailing hypotheses supported by various tectonic and climate models the impact of the continental collision on climate is twofold: (1) Globally, the orogenesis increases rock weathering and organic carbon burial which enhances consumption of atmospheric CO2 leading to Cenozoic global cooling. This mechanism, rather than the opening of a sea passage around Antarctica, is now believed to have pre-conditioned the Eocene-Oligocene transition, an abrupt cooling event associated with the onset of Antarctic ice-sheet formation 34.0 million years ago. (2) Regionally, uplift of the Tibetan Plateau and the retreat of an epicontinental sea formerly extending over Eurasia in the Paleogene triggers dramatic aridification and cooling of continental Asia and the onset of the Asian monsoons. To test these hypotheses, we have started building the critical paleoenvironmental information that is essentially lacking in the Paleogene period when these events are taking place. We provide evidence based on pollen analysis of significant Tibetan uplift prior to ca. 36 Ma (Hoorn et al., this session). However, we also show that regional aridification on the Tibetan Plateau is precisely dated at the 34 Ma Eocene-Oligocene transition (Abels et al., this session). This remarkable correlation demonstrates that global climate, and not only Tibetan uplift must be recognized as a major contributor to Asian paleoenvironments. Building on these results, we have tackled two essential questions: 1. What are the cause, age and consequences of the epicontinental sea retreat? Bio- and magneto-stratigraphic dating results indicate that a significant marine retreat from the Tarim basin most likely relates to sea level lowering at the Eocene-Oligocene transition (Bosboom et al., this session). 2. What is the precise timing of the Indo-Asia collision and how much continental shortening must be accommodated by continental deformation? End-members have been proposed placing the collision at either 55 Ma or 35 Ma. Our new paleomagnetic results (Dupont-Nivet et al., this meeting) constrain the paleolatitude of the southern margin of Asia at 19.5 +/- 5.0°N. This implies onset of collision ca. 48 Ma with 3300 +/- 600 km subsequent latitudinal convergence between India and Asia divided into 1500 +/- 600 km within Asia and 1800 +/-700 km within India.