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Pamir tectonic evolution recorded in the western Tarim Basin (China): paleoenvironmental and magnetostratographic analyses of the Aertashi section

Tamsin Blayney (1), Guillaume Dupont-Nivet (2,3,4), Yani Najman (1), Jean-Noel Proust (2), Niels Meijer (3), Pierrick Roperch (2), Edward R. Sobel (3), Ian Millar (5), and Zhaojie Guo (4)

(1) Lancaster Environment Centre, Lancaster University, Bailrigg, Lancaster, LA1 4YQ, U, (2) CNRS OSUR UMR Géosciences, Université de Rennes 1, Rennes 35042, France, (3) Potsdam University, Institute of Earth and Environmental Science, Potsdam - Golm, Germany, (4) Key Laboratory of Orogenic Belts and Crustal Evolution, Ministry of Education, Beijing, China, (5) NERC Isotope Geosciences Laboratory, BGS Keyworth, Nottingham NG12 5GG, UK

In response to the India-Asia continental collision, the northward indentation of the Pamir salient into the Tarim Basin links deep lithospheric processes to surface and atmospheric processes; however, poor temporal constraints for this indentation precludes evaluation of regional geodynamic, geomorphic and climatic models. Here we reconstruct the Pamir tectonic evolution from the most complete sedimentary record from the western Tarim Basin flanking the Pamir (the Aertashi section), based on paleoenvironmental, provenance, and magnetostratigraphic analyses. Increased tectonic subsidence and a shift from marine to continental fluvio-deltaic deposition at 41 Ma indicates when deformation started propagating into Tarim from the distal India-Asia collision. A depositional hiatus from 24.3 to 21.6 Ma followed by the deposition of proximal conglomerates may be related to coeval Indian slab break off and the onset of south dipping continental subduction and roll back of the Eurasian slab. From 21.6 to 15.0 Ma, increasing accumulation of fining upwards clastics is interpreted as the expression of a major dextral transtentional system linking the Kunlun to the Tian Shan and propagating ahead of the northward indentation of the Pamir, which started in southern Tarim at this time. At 15.0 Ma, the appearance of conglomerates with a distinct proximal Pamir source from the west is coeval with the onset of growth strata and clockwise vertical-axis rotation associated with the activation of the local east-vergent Qimugen thrust wedge comprising the Aertashi section. Together this indicates that Pamir indentation and associated deformation reached the study location at this time. This, along with the detrital occurrence of diagnostic 11 Ma volcanics from the central Pamir, provide kinematic constraints on Pamir indentation that are more consistent with proposed tectonic models involving continental subduction rather than delamination. The timing of Pamir indentation, which progressively shielded Tarim from the westerlies, also provides constraints for associated Asian desertification.