Control of pre-existing crustal architecture on Cenozoic formation of the Pamir

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The Cenozoic Pamir comprises the western equivalent of the Tibetan plateau, offset to the north by ca. 300 km. A significant geodynamic question is what controls the lateral extent of the Pamir. Here we suggest that the width of the Pamir is controlled by east-west variations in the rheology of blocks farther to the north. In particular, the rigid, Precambrian-cored Tarim block, directly north of Tibet, apparently does not extend farther west. Indirect evidence for this crustal structure is derived from the late Paleozoic - early Mesozoic evolution of the northern and external Pamir. The northern part of the Western Kunlun comprises Proterozoic Tarim basement; such rocks are unknown on the northern margin of the Pamir. In the late Ordovician or Silurian, the Kudi suture formed, representing the consumption of the Proto-Tethys and the collision of Tarim with the southern part of the Western Kunlun terrain. Although the Western Kunlun has been considered to be the lateral equivalent of the North Pamir, the Kudi suture does not appear to be preserved in the Pamir. In contrast, the North Pamir preserves remnants of a broad Carboniferous ocean which are not recognized in the Western Kunlun. The northern margin of this ocean is unclear; it may have merged with the Turkestan ocean, on the southern margin of the Tian Shan. There are no documented basement units directly north of the Pamir; the basement Garm block lies at the northwest corner of the Pamir and may represent a fragment of Tarim which we suggest must have been rifted away by the Ordovician. The North Pamir Carboniferous deep marine units are unconformably overlain by upper Carboniferous and lower Permian shallow marine units at the eastern and western ends of the North Pamir, suggesting a contractile episode; the contact appears to be conformable in the central part. The lower Permian is overlain by an uppermost Permian - Triassic back-arc basin or rift, which stretches ca. 500 km east-west. There is no evidence that this basin extended into the Western Kunlun. Therefore, the location of the Cenozoic Pamir corresponds to the extent of both Carboniferous oceanic crust and Permo-Triassic extended or oceanic crust. We suggest that the differences between the Western Kunlun Shan and the North Pamir reflect the presence and absence, respectively, of the rigid Tarim block to the north. Although it has been suggested that the geometry of the Pamir reflects the geometry of a promontory at the northwest corner of the Indian indentor; this seems highly improbable given the pre-Cenozoic history. Rather, we suggest that differences in the evolution of the Pamir and
Tibet are first-order consequences of the different rheologies of the northern crustal backstops of these two regions.