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Multiple collision events cause episodic extensional exhumation of the Tso Morari core complex in an intra-oceanic setting prior to the India-Asia collision

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Here we consider the tectonic evolution of the Tso Morari schist dome, reporting some new map scale observations concerning the kinematics and sense of shear in the mantling carapace shear zones to this North Himalayan metamorphic core complex. We provide new 40Ar/39Ar geochronological data that date the operation of the major crustal shear zones that were in part responsible for the exhumation of these high-pressure rocks. These results suggest extreme extension at different stages of the exhumation and impact on the interpretation of the large-scale tectonic evolution of this terrane. Bulk rock geochemical analysis of the mafic rocks demonstrate that these were once ocean island basalts, although they are now eclogites that exhibit ultra-high-pressure parageneses. Lithosphere-scale extension on this scenario can be explained if compression during the accretion event led to the formation of back-thrusts that evolved into south-facing subduction zones. Roll back to the north would juxtapose Tso Morari against the Ladakh Batholith, at the same time extending and exhuming these high-pressure rocks. Roll back of a south-facing subduction zones also provides an explanation for the Eocene-Oligocene and Oligo-Miocene thermal pulses and/or extensional episodes experienced by these rocks, and perhaps defines the geodynamic scenario that caused the widespread development of metamorphic core complexes in the north-west Himalaya.