Tectonic evolution of Paleo-Tethys in NE Iran

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The timings of the onset of oceanic spreading, subduction and collision are crucial in plate tectonic reconstructions, but not always straightforward to resolve. The evolution of the Paleo-Tethys Ocean dominated the Paleozoic-Early Mesozoic tectonics of West Asia, but the timeline of events is still poorly-constrained. In this study we present detrital zircon ages from NE Iran, in order to determine the timing of tectonic events in the region, and the wider implications for regional tectonics, paleogeography and climate change. Paleozoic clastic rocks record two major age peaks at \(\sim 800\) Ma and \(\sim 600\) Ma. The consistency in age patterns shows a dominant provenance from the Neoproterozoic basement of northern Gondwana. We interpret deposition on a long-lasting passive continental margin after the initial spreading of the Paleo-Tethys Ocean. Initial collision between the South Turan (Eurasia) and Central Iran (Gondwana) blocks caused coarse clastic deposition, the protolith of the Mashhad Phyllite, in a peripheral foreland basin on the Paleozoic passive margin. The Mashhad Phyllite yields major zircon age clusters at 450-250 Ma and 1900-1800 Ma, with a clear provenance from the active, Eurasian, margin. The Paleozoic ages reveal a long-lived subduction zone under the South Turan Block began in the latest Ordovician. Analysis of the age spectra allows us to constrain the timing of initial collision as no later than 228 Ma, which is also a constraint on the maximum depositional age of the Mashhad Phyllite. Based on our new results and previous data, we discuss the interaction between the Rheic and Paleo-Tethys oceans, and explain how a new subduction zone may have initiated after continental collision. The timing of collision is similar to the Carnian Pluvial Event (CPE). Paleo-Tethys collision has previously been suggested as the trigger for this climatic change, and our study provides timing evidence that reinforces Paleo-Tethys closure as a causal mechanism for the CPE.