

Paper Number: 1328

The multi-stage tectonic evolution of the Xitieshan terrane, North Qaidam orogen, western China: from Grenville-age orogeny to early-Paleozoic ultrahigh-pressure metamorphism



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The geodynamic evolution of the early Paleozoic ultrahigh-pressure metamorphic belt in North Qaidam, western China, is controversial due to ambiguous interpretations concerning the nature and ages of the eclogitic protoliths. Within this framework, we present new LA-ICP-MS U-Pb zircon ages from eclogites and their country rock gneisses from the Xitieshan terrane, located in the central part of the North Qaidam UHP metamorphic belt. Xitieshan terrane contains clearly different protolith characteristics of eclogites and as such provides a natural laboratory to investigate the geodynamic evolution of the North Qaidam UHP metamorphic terrane.

LA-ICP-MS U-Pb zircon dating of three phengite-bearing eclogites and two country rock gneiss samples from the Xitieshan terrane yielded 424 – 427 Ma and 917 – 920 Ma ages, respectively. The age of 424 – 427 Ma from eclogite probably reflects continental lithosphere subduction post-dating oceanic lithosphere subduction at ~ 440 – 460 Ma. The 0.91 – 0.92 Ga metamorphic ages from gneiss and associated metamorphic mineral assemblages are interpreted as evidence for the occurrence of a Grenville-age orogeny in the North Qaidam UHPM belt. Using internal microstructure, geochemistry and U-Pb ages of zircon in this study, combined with the petrological and geochemical investigations on the eclogites of previous literature's data, three types of eclogitic protoliths are identified in the Xitieshan terrane i.e. 1) Subducted early Paleozoic oceanic crust (440 - 460 Ma), 2) Neoproterozoic oceanic crust material emplaced onto micro-continental fragments ahead of the main, early Paleozoic, collision event (440 - 420 Ma) and 3) Neoproterozoic mafic dikes or mantle plume intruded in continental fragments (rifted away from the former supercontinent Rodinia).

The results presented here demonstrate that the basement rocks of the North Qaidam terrane formed part of the former supercontinent Rodinia, attached to the Yangtze Craton and/or the Qinling microcontinent, and recorded a complex tectono-metamorphic evolution that involved Neoproterozoic Grenville- and Early Paleozoic Caledonian orogenies (Fig. 1).

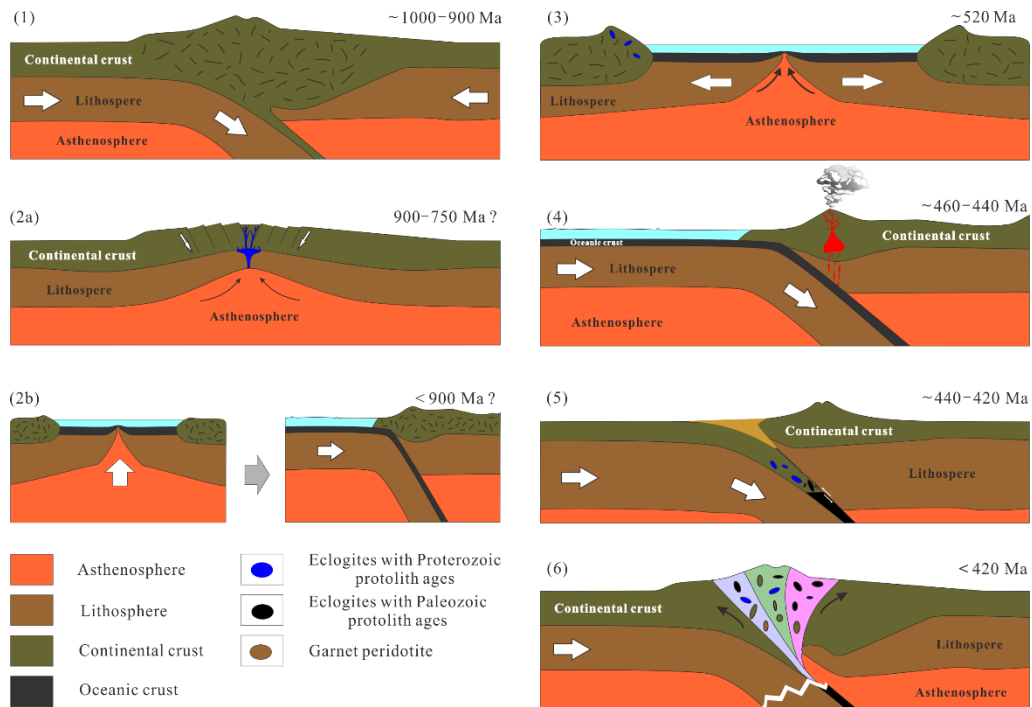


Figure 1: Model illustrating the proposed tectonic evolution of the North Qaidam orogenic belt from the Neoproterozoic to the early Paleozoic. See text for further details.

