

TECTONIC EVOLUTION OF THE NORTH QAIDAM UHP TERRANE

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The North Qaidam ultra-high pressure (UHP) metamorphic belt is a recently discovered UHP terrane (YANG et al., 2001), located within the Early Paleozoic Qilian orogenic belt on the northern margin of the Tibetan Plateau, Western China. The orogen preserves a Precambrian to Mesozoic history of continental rifting, ophiolite emplacement, arc convergence and continental collision. Three fundamentally different models have been proposed: (1) an early Paleozoic mega-accretionary complex, where the site of arc magmatism migrated progressively southward (SENGOR & NATAL'IN, 1996), (2) north-dipping subduction by a series of micro-plates (e.g. LI et al., 1978), and (3) a shallowing south-dipping subduction zone (e.g. GEHRELS et al., 2003). Each model makes predictions about timing of subduction, number and polarity of subduction zones, which can be tested in the context of the formation and exhumation of the UHP rocks. Pre-Mesozoic rocks can be divided into two units: (1) epidote-amphibolite grade late Proterozoic rocks (Dakendaben gneiss) which include the UHP eclogite-bearing gneiss, and (2) a suite of early Cambrian (545.5 ± 6.0 Ma) epidote-amphibolite facies ophiolitic rocks. The contact between the ophiolite and UHP gneiss is sharp but irregular; marked by discrete shear zones with top-N and top-NE sense shear indicators which become subhorizontal when the effects of Cenozoic thrusting are removed. This detachment is also isoclinally folded at a wave-length of 15 - 20 km, exposing UHP eclogite-bearing gneiss in the cores of antiforms. Middle Paleozoic granites (510 - 400 Ma, GEHRELS et al., 2003) intrude the belt placing a lower bound on the cessation of the ductile phase of deformation. Regional muscovite cooling ages of 460 - 365 Ma indicate that the metamorphic complex reached the middle crust in the Ordovician and a Devonian unconformity indicates that it was at the surface by ~365 Ma. Early Cenozoic imbricate thrust faults placed UHP rocks over unlithified Tertiary sediments of the Qaidam Basin and generated broad regional folding and repetition of UHP units. Results indicate generation of UHP rocks by the closure of a small back arc ocean behind a more established arc, favoring a hybrid model consistent with south-dipping subduction (SOBEL & ARNAUD, 1999) and the existence of multiple sutures within the Qilian orogen (LI et al., 1978). Furthermore, preliminary petrologic and geochronologic results indicate that exhumation to the surface occupied two distinct stages: (1) rapid exhumation of the UHP rocks to the lower/middle crust, (2) slow exhumation from the middle crust to the surface.

References

- GEHRELS, G.E., YIN, A., FENG, W.X. (2003): GSA Bulletin, 115, 881-996.
LI, C.Y., LIU, Y., ZHU, B., FENG, Y.M. & WU, H.C. (1978): -In: Scientific Papers on Geology and International Exchange, Geologic Publishing House, Beijing, 147-197.
SENGOR, A.M.C. & NATAL'IN, B.A. (1996): - In: YIN, A. & HARRISON, T.M. (ed.): The Tectonics of Asia, Cambridge University Press, New York, pp. 486-640.
SOBEL, E.R. & ARNAUD, N. (1999): Tectonics, 18, 64-74.
YANG, J.S., XU, Z.Q., ZHANG, J.X., CHU, C.Y., ZHANG, R.Y. & LIOU, J.G. (2001): GSA Memoir, 194, 151-170.