Age and duration of eclogite-facies metamorphism, North Qaidam HP/UHP terrane, Western China

C.G. MATTINSON[1], J.L. WOODEN[2], J.G. LIOU[1], D.K. BIRD[1], AND C.L. WU[3]

[1] Dept. Geol. & Env. Sci., Stanford Univ., Stanford, CA 94305-2115, U.S.A.; cgm@pangea.stanford.edu
[2] U.S. Geological Survey, Menlo Park, CA 94025, U.S.A.
[3] Chinese Academy of Geol. Sci., Beijing 100037, China

Amphibolite-facies para- and orthogneisses near Dulan, southeastern North Qaidam terrane, enclose minor eclogite and peridotite which record ultra-high pressure (UHP) metamorphism associated with the continental collision of the Qilian and Qaidam microplates. Field relations and coesite inclusions in zircons from paragneiss suggest that felsic, mafic, and ultramafic rocks all experienced UHP metamorphism and a common amphibolite-facies retrogression. SHRIMP-RG U-Pb and REE analyses of zircons from four eclogites yield weighted mean ages of 449-422 Ma; REE patterns (flat HREE, no Eu anomaly) and inclusions of garnet, omphacite, and rutile indicate these ages record eclogite-facies metamorphism. The coherent field relations, and the similar range of individual ages in each sample suggests that the ~25 m.y. age range reflects the duration of eclogite-facies conditions. Analyses from zircon cores in one sample are as old as 474 Ma; inclusions of Th + REE-rich epidote, and zircon REE patterns are consistent with prograde metamorphic growth.

Ti-in-zircon thermometry [1] suggests cooling from 650-700°C (442-449 Ma) to 600-650°C (433-422 Ma). Zr-in-rutile thermometry yields tightly clustered results of 590°C [1] (or 635°C, [2]) for all four eclogites and one 426 ± 4 Ma paragneiss. The ~25 m.y. duration as well as cooling during eclogite-facies metamorphism suggests the UHP rocks decoupled from the downgoing plate, and were refrigerated by continued subduction.

In the Lüliang Shan (350 km NW) in the North Qaidam terrane, eclogite and garnet peridotite ages of 414-495 Ma suggest that this locality also records a protracted eclogite-facies history. The distance separating these two localities may reflect the length scale of the mechanism responsible for extended high-pressure residence. Evidence of prolonged eclogite-facies metamorphism in other HP/UHP localities (Greenland, Norway, Alps, Dabie-Sulu) suggests that long eclogite-facies residence may be globally significant in continental subduction/collision zones.

References

[1] Watson E., Wark D. and Thomas J. (2006) *CMP* **151,** 413-433. [2] Zack T., Morales R. and Kronz A. (2004) *CMP* **148,** 471-488.