American Mineralogist, Volume 97, pages 1533–1543, 2012

MSA Roebling medal lecture

Mineralogy, petrology, U-Pb geochronology, and geologic evolution of the Dabie-Sulu classic ultrahigh-pressure metamorphic terrane, East-Central China†

Juhn G. Liou,[1,*] Ruyuan Zhang,[1] Fulai Liu,[2] Zeming Zhang,[2] and W. Gary Ernst[1]

[1]Department of Geological and Environmental Sciences, Stanford University, Stanford, California 94306, U.S.A
[2]Institute of Geology, Chinese Academy of Geological Sciences, 26, Baiwanzhuang Road, Beijing 100037, China

Abstract

The Dabie-Sulu Triassic collisional orogen in eastern Asia was created by northward subduction of the Yangtze continental-crust capped plate beneath the Sino-Korean craton. Eclogites, garnet peridotites, and surrounding country rock gneisses and marbles were all subjected to in situ UHP metamorphism, as indicated by the presence of rare but widespread coesite inclusions in eclogitic minerals and in zircon crystals in the country rocks, as well as by virtually identical metamorphic ages of various UHP rock types. Metamorphic *P-T* estimates, combined with investigations of mineral exsolution textures and high-*P* polymorphs, indicate that recovered depths of continental subduction may have exceeded 200 km. Parageneses of mineral inclusions in zoned zircon domains combined with U-Pb ages delineate a well-constrained *P-T*-time path, suggesting exhumation rates of 5–10 km/Myr. A similar *P-T*-time trajectory has been established for the microdiamond-bearing Kokchetav Massif. Thus far, however, diamond inclusions have not been confirmed from coesite-bearing zircon domains of Dabie-Sulu UHP rocks despite numerous detailed studies. Oxygen isotopes of minerals from many outcrop samples and the Chinese Continental Scientific Drilling (CCSD) project main hole cores indicate that $\delta^{18}O$ depletion took place in a volume of Proterozoic protoliths exceeding 100 000 km^3 along the northern edge of the Yangtze craton. Evidently, passive-margin sediments and bimodal igneous rocks that had formed during rifting and breakup of the supercontinent Rodinia were subjected to extensive meteoric water-rock interactions attending terminal Neoproterozoic Snowball Earth conditions. Such hydrothermal alteration volatilized and depleted C from the relatively oxidized protoliths, accounting for the rare occurrences of graphite and apparent lack of microdiamond in Dabie-Sulu UHP rocks.

Keywords: UHP metamorpism, Dabie-Sulu, coesite, zircon, *P-T*-time path, fluid-rock interactions