American Mineralogist, Volume 90, pages 814–820, 2005

Sodic amphibole exsolutions in garnet from garnet-peridotite, North Qaidam UHPM belt, NW China: Implications for ultradeep-origin and hydroxyl defects in mantle garnets

SHUGUANG SONG,[1] LIFEI ZHANG,[1] JING CHEN,[2] JUHN G. LIOU,[3] AND YAOLING NIU[4]

[1]Key Laboratory of Orogenic Belts and Crustal Evolution, MOE, School of Earth and Space Science, Peking University, Beijing 100871, China
[2]Electron Microscopy Laboratory, School of Physics, Peking University, Beijing 100871, China
[3]Department of Geological and Environmental Sciences, Stanford University, Stanford, California 94305, U.S.A.
[4]Department of Earth Sciences, University of Durham, Durham DH1 3LE, U.K.

ABSTRACT

Two types of amphibole exsolution lamellae were discovered in garnet from a few garnet peridotites from the North Qaidam ultrahigh-pressure metamorphic belt, northern Tibet, NW China. The amphibole lamellae are strictly oriented in four directions corresponding to the isometric form {111} (i.e., octahedron planes) of garnet. Observations by transmission electron microscopy (TEM) show that amphibole lamellae are topotaxtially concordant with the host garnet and possess 9.8 to 10 Å lattice "c"-spacing. Electron-microprobe analysis reveals that these exsolved amphibole lamellae are high in Na and Ti. The TEM observations and recalculated compositions indicate that the oriented amphibole lamellae exsolved from original supersilicic majorites with high concentrations of Na_2O (0.3 wt%) and hydroxyl (up to 1000 ppm by weight). These results imply that the host garnet peridotites were formed at depths greater than 200 km and that garnet can be an important reservoir of water at such depths in the mantle.