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Quartz exsolution in clinopyroxene is not proof of ultrahigh pressures: Evidence from eclogites from the Eastern Blue Ridge, Southern Appalachians, U.S.A.

F. ZEB PAGE,* E.J. ESSENE, AND S.B. MUKASA

Department of Geological Sciences, University of Michigan, 2534 C.C. Little Building, Ann Arbor, Michigan 48109-1005, U.S.A.

ABSTRACT

Oriented quartz needles in clinopyroxene have become one of the diagnostic indicators of ultrahigh-pressure (UHP) metamorphism. The presence of apparently exsolved quartz is taken as evidence of decompression of a non-stochiometric Ca–Eskola component ($Ca_{0.5}\square_{0.5}AlSi_2O_6$, CaEs) that is presumed to be stable only at UHP conditions. Eclogite from the Eastern Blue Ridge, North Carolina, contains clinopyroxene ($Jd_{20}CaTs_5Ac_5CaEs_0Di_{65}Hd_5$) with oriented needles of quartz and calcic amphibole that appear to have exsolved together. The quartz + amphibole intergrowths are surrounded by 1–5 μm haloes of neoformed pyroxene ($Jd_{10}CaTs_{10}Ac_5CaEs_0Di_{70}Hd_5$). The modes of quartz, amphibole, and clinopyroxene haloes were determined using BSE images, and reintegrated with the host clinopyroxene. Viewing the quartz and amphibole needles down the **c**-axis of the pyroxene host provides a better estimate of their proportions than in prismatic sections. Reintegrated pyroxene compositions were nearly identical to the analyzed host pyroxene with no CaEs component. Clinopyroxene with CaEs solid solution has been repeatedly synthesized at UHP conditions. However, examination of the phase equilibria usually cited as evidence for CaEs stability at conditions of ≥25 kbar shows that clinopyroxene with 10 mol% CaEs is stable well within the quartz field, and provides a pressure minimum similar to the albite = jadeite + quartz barometer. Exsolution of quartz and associated amphibole is commonplace in clinopyroxene from the Blue Ridge eclogite that lacks coesite or other evidence for UHP metamorphism. The presence of a diluted (5–10%) CaEs component in clinopyroxene does not require UHP conditions.