

Exsolution of thortveitite, yttrialite, and xenotime during low-temperature recrystallization of zircon from New Caledonia, and their significance for trace element incorporation in zircon

CARL SPANDLER,^{1,*} JÖRG HERMANN,² AND DANIELA RUBATTO^{1,2}

¹Department of Earth and Marine Sciences, Australian National University, Canberra, Australia 0200

²Research School of Earth Sciences, Australian National University, Canberra, Australia 0200

ABSTRACT

Recrystallized zircon grains in a phengite-epidote-chlorite schist from north-eastern New Caledonia contain as inclusions a mineral assemblage consisting of celadonite, kaolinite, quartz, Fe-oxy-hydroxide, smectite, chlorite, xenotime-(Y), thortveitite, yttrialite, and allanite-(Ce). This assemblage formed during low-temperature (<100 °C) seafloor alteration of a plagioclase-rich mafic rock and represents the first documented evidence of this alteration event in the high-*P* belt of northeastern New Caledonia. The survival of this low-temperature mineral paragenesis in zircon of a rock that has undergone subsequent eclogite-facies metamorphism testifies to the strength and value of zircon as a container for mineral inclusions. Thortveitite (Sc₂Si₂O₇) and yttrialite (Y₂Si₂O₇) inclusions in the altered zircon cores represent a new occurrence for these minerals and suggest that they may be more common than is currently recognized. The altered zircon cores generally have lower trace-element contents than the pristine igneous zircon cores and we suggest that thortveitite, yttrialite, and xenotime-(Y) formed as a result of trace-element expulsion from zircon during low-temperature recrystallization. Trace-element concentrations in the zircon cores indicate that trivalent cations (REE, Y, Sc) in zircon cannot be charge-balanced by xenotime substitution alone. Pentavalent cation concentrations (Nb, As) are also insufficient for charge balance. The presence of thortveitite (Sc₂Si₂O₇) and yttrialite (Y₂Si₂O₇) suggests that trivalent cations in zircon might be charge-balanced either by monovalent anions substituting for oxygen or by small monovalent cations such as H occurring interstitially in the zircon lattice.