DATING OF UHP METAMORPHISM, NE GREENLAND CALEDONIDES

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Obtaining reliable estimates for the timing of eclogite facies metamorphism is critical to establishing models for the formation and exhumation of high pressure and ultra-high pressure (UHP) metamorphic terranes in collisional orogens. The presence of pressure dependant phases such as coesite in metamorphic zircon is generally regarded as evidence that the zircon growth occurred at UHP conditions and, if dated, should provide the necessary timing information. We report U-Pb SHRIMP ages and REE SHRIMP data from coesite-bearing zircon suites from two samples in the North East Greenland Caledonides. The samples were collected from kyanite eclogites and quartzofeldspathic gneisses that enclose them exposed on an island in Jokelbugt (78° 00' N, 18° 04' W), NE Greenland. Kyanite-eclogite yielded round zircons with well defined growth domains observed in cathode-luminesence (CL) images. Low U cores (U = 1 - 85 ppm; Th/U = 0.004 - 0.055) contain an inclusion suite of kyanite-clinopyroxene-garnet-rutile. $^{206}Pb/^{238}U$ ages corrected for common Pb by the ^{207}Pb method yield a weighted mean age of 359 ± 8 Ma (MSWD = 2). REE patterns from cores are uniform and display negative Eu and positive Ce anomalies. A second core domain has an inclusion suite of coesite-kyanite-clinopyroxene-garnet-rutile and U=10 - 243 ppm, Th/U = 0.003 - 0.013. This domain yields a $^{206}Pb/^{238}U$ weighted mean age of 347 ± 4 Ma (MSWD = 3). REE patterns are more variable in this domain. The positive Ce anomaly persists but the Eu anomaly does not. Zircon rims with U = 39 - 333 ppm and Th/U = 0.006 - 0.095 yield a $^{206}Pb/^{238}U$ weighted mean age of 342 ± 3 Ma (MSWD = 2). The rim REE patterns are more uniform with no Eu anomaly. A sample of quartzofeldspathic gneiss yielded a population of round zircons that exhibit multiple CL domains as well. Zircon cores with U = 159 - 324 ppm and Th/U = 0.14 - 0.33 give $^{206}Pb/^{238}U$ ages ranging from 360 to 1414 Ma. Regression of the ^{204}Pb-corrected data yields an upper intercept age of 1973 ± 35 Ma (MSWD = 1), the inferred protolith age. REE patterns with positive Ce and negative Eu anomalies are consistent with an igneous origin. There is clear evidence in CL images for recrystallization of the core regions as well as growth of distinct rims. In addition, some low U zircon grains may be entirely metamorphic in origin. Lower U core and rim domains with U = 2 - 73 ppm, Th/U = 0.004 - 0.047, and a coesite-clinopyroxene-garnet inclusion suite give a $^{206}Pb/^{238}U$ weighted mean age of 357 ± 5 Ma (MSWD = 2). REE patterns are variable in the low U core regions but uniform in the rims; Ce and Eu anomalies are present in all REE analyses. Results from the suite of samples analysed demonstrate that variation in U/Pb age and REE patterns match the variation in domains defined by CL image analysis. Both zircon recrystallization and new zircon growth occurred during UHP metamorphism. The variation in U-Pb ages from coesite-bearing zircon in the 3 samples examined indicates that UHP metamorphism had occurred by 360 and persisted at least through 350 Ma.