5.3.58

U-Pb age constraints on the subduction–extension interval in the Averoya–Nordoyane area, Western Gneiss Region, Norway

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The interval between subduction and syn-uplift ductile extension has been determined using eclogite facies transformation zircons and those formed in amphibolite-facies extentional boudin-neck pegmatites. Eclogite zircons are typically small, rounded, low U with concordant U-Pb systems whereas those from infill pegmatites are commonly near concordant with abundant cores, hence multiple single tips are analyzed. Samples from 3 sites on or near Averoya and 9 sites in the Nordoyane area 70 km to the south-west were analyzed.

Zircons from the Averoya eclogite display 2 stages of metamorphic zircon growth. Three fractions of small rounded typical eclogite grains have identical concordant 206/238 ages of 415+/-1 Ma whereas 2 tips from large euhedral grains have concordant ages of 411+/-1.5 and 410+/-1.5 Ma (all errors 2σ). The latter grain type probably formed during decompression that produced local cm-scale melt pods. Zircons from a post-uplift pegmatite that cuts the eclogite are sharp faceted, low U without visible cores but our initial results showed a ca. 1500 Ma inheritance. Grains selected after removal of tiny cores, revealed by HF-etching, gave 5 concordant analyses with a mean 206/238 age of 395.3+/-1 Ma. A second boudin-neck pegmatite 26 km to the east yielded 5 near concordant data with a mean 207/206 age of 395.5+/-2 Ma for the final stage of ductile flow in the region.

Eclogite from the margin of the 1255+/-2 Ma Flem Gabbro gave 2 concordant 206/238 zircon ages of 408+/-1 Ma and 410+/-1 Ma whereas those from nearby Lepsoya gave 2 concordant fractions both with 206/238 ages of 411.5+/-1.2 Ma. Boudin-neck pegmatite from between 2 house-size eclogite rafts beside the Flem Gabbro gave a mean 207/206 age of 397+/-3 Ma for the late stage of ductile flow. In this case the 2 most concordant fractions have ages of 394 and 395 Ma. A second boudin-neck pegmatite adjacent to the UHP eclogite on Fjortoft gave an age of 394.5+/-2 Ma.

Subduction-extension intervals of 20 m.y. (415 - 395 Ma) and 14 m.y. (410 - 396 Ma) are defined for the Averoya and Nordoyane regions with a remarkably uniform age for the cessation of ductile flow. Baddeleyite in the Flem and Haram Gabbros (1466+/-2 Ma) did not react with $Si0_2$ to make zircon until this 395 Ma event and rutile records ca. 400ºC cooling ages of 376+/-2 Ma. Region-wide unroofing at 395 Ma could explain coeval ductile flow and rapid cooling.

5.3.61

Hf-Nd-Sr-Pb isotope evidence for relict Indian mantle beneath Pacific crust at the Solomon island arc

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At the Solomon island arc, the Australian Plate is presently subducted beneath the Pacific Plate. The collision of the Ontong Java Plateau with the old northeastern island arc caused a reversal in subduction polarity (ca. 12 Ma ago [1]) leading to the present day setting. A particular feature of the Solomon arc is the subduction of a spreading center (Woodlark Rise). Picritic rocks from the New Georgia group, Solomon Islands, occur only above the subducting Woodlark Rise and contain up to 29.7 wt.% MgO, whereas the most primitive basalts contain around 12 wt.% MgO. Linear trends defined by trace elements vs. MgO indicate that the picritic suite resulted from a mixing between a basaltic-picritic melt and a Mg- and Cr-rich source, probably mantle peridotites.

LILE abundances in the New Georgia group magmas indicate a strong source enrichment by subduction components. $^{87}Sr/^{86}Sr$ and εNd values range from 0.7033 to 0.7043 and +6.3 to +8.0, respectively. These values partially overlap with compositions of the Indian MORB field and lie between those of the neighbouring New Britain and Vanuatu arcs. εHf values ranging from +12.2 to +14.6 can show in combination with the εNd values that the examined magmas were most likely generated within the Indian mantle domain. The presence of relict Indian material in the mantle wedge that originates from N-S directed subduction prior to the subduction polarity reversal is confirmed also by ΔεNd vs. ΔNd systematics [2]. Pb isotope data ($^{206}Pb/^{204}Pb$ ca. 18.45 to 18.62, $^{207}Pb/^{204}Pb$ ca. 15.51 to 15.56 and $^{208}Pb/^{204}Pb$ ca. 38.3 to 38.4) indicate a bimodal distribution of Pb isotope compositions. They can identify the enrichment of the mantle wedge by two types of subduction fluids that originate (1) from the old subduction components from the Pacific plate (> 12 Ma old) and (2) from more recent subduction components derived from the Australian plate.

References

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