Apatite fission track and (U-Th)/He dating in the world's youngest UHP terrane: The Woodlark rift of southeastern Papuan New Guinea

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Seafloor spreading in the Woodlark Basin of southeastern Papua New Guinea was underway by ~6 Ma and propagated westwards via stepwise spreading nucleation. Just west of the active seafloor spreading tip, extensional gneiss domes form topographic highs of the D'Entrecasteaux Islands (DEI) within the central portion of the Woodlark rift. Since ~8 Ma, HP and UHP rocks were exhumed rapidly from depths of up to ~100 km. Low-temperature thermochronology (apatite fission track (AFT) and apatite (U-Th)/He dating (AHe)) is used to constrain the late-stage exhumation histories in the DEI and conjugate rift margins of the Woodlark Basin. AFT ages generally decrease from ~8 Ma at Misima Island in the east, to between ~1.5 and 0.5 Ma in the DEI. AHe minimun ages similarly decrease to the west, from ~6 Ma at Misima Island to between 2.0 and 0.3 Ma within the DEI with ages youngest on Goodenough Island, the western-most DEI.

Higher temperature thermochronometers and exposure at the Earth's surface provide boundary constraints within which to interpret AFT and AHe results. Detailed age trends are difficult to establish due to the young age and low uranium concentrations resulting in few fission tracks plus small yields of radiogenic ^{4}He. ^{4}He concentrations in these recently and rapidly exhumed samples are often near background levels, and consequently difficult to accurately measure, making some ages unreliable and significantly increasing single grain age variation. We compare AFT ages and AHe ages to higher precision $^{40}Ar/^{39}Ar$ ages (e.g., biotite, K-feldspar) from the same samples in order to judge their reliability and reproducibility. Single grain AHe age variation is large with no apparent variation with respect to [eU], therefore the RDAMM model is not applicable in this case. In the absence of variable [eU] control, minimum single grain AHe ages are reliably closer to the "real" AHe ages, and it is these ages that show the westward younging pattern. Lithology also plays a strong role in the relative signal size; for example, higher [eU] from pegmatitic apatites give reliable ages whereas lower [eU] from a muscovite granite yields unreliable ages.

Dissolved iron partioning between soluble and colloidal fractions in the tropical North Atlantic Ocean

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Dissolved iron distribution and size partitioning were investigated in the tropical North Atlantic Ocean. "Dissolved Fe" (dFe, 0.4μm filtered) was collected along a 27-station transect to 1000m; "soluble Fe" (sFe, 0.02μm filtered) was collected at seven of those stations including one full depth station to 4370m at the transect's deepest point. "Colloidal Fe" (cFe) was defined as the difference between dFe and sFe. In the seven stations where Fe size partitioning was monitored, surface dFe ranged from 0.46 to 1.10nM and was dominated by cFe in all samples but one, averaging 81% (±7) of the surface dFe at these six stations. This reinforces the hypothesis that dust-derived dFe is preferentially distributed into the colloidal size fraction. At the two westernmost sites, a transition towards more subtropical gyre-like characteristics was observed (pycnocline extended to ~400m), and cFe maintained low values throughout the pycnocline (28±9%). sFe, in contrast, was relatively constant with depth directly below the pycnocline, averaging 0.51±0.04nM and 0.37±0.05nM between 500-1000m at the two western stations. From mid-basin to the eastern stations an oxygen minimum zone develops, and across the five stations where Fe size partitioning was monitored oxygen concentrations at 500m decreased from west to east from 105 to 48μmol/kg, increasing to 63μmol/kg at the easternmost station near the African continent. At the same time, there was a shift in the sFe distribution from fairly constant sFe with depth in the west/mid-basin to a strikingly regular peak in sFe at 500m in the OMZ of 0.70±0.01nM in the four eastern stations. In the OMZ, cFe was also high, contributing ~45% of the dFe at 500m. This OMZ peak in sFe was in contrast to the constant sFe profiles observed by Bergquist *et al.* [2] in the same OMZ, although their profile was on the western edge of the OMZ with lowest oxygen concentrations of only 100μmol/kg. Finally, North Atlantic Deep Water was seen in the deep profile from 1500-4370m. Average dFe was 0.79±0.06nM, slightly higher than the deep ocean value further north observed by Wu *et al.* [1] and further west and North by Bergquist *et al.* [2]. sFe was constant at 0.30±0.01nM throughout the NADW, occupying ~38% of the dFe present.

[1] Wu *et al.* (2001) *Science* **293**: 847. [2] Bergquist *et al.* (2007) *GCA* **71**:2960.