## 5.2.P05

# Timing and pyroclastic activity at the onset of flood volcanism in central east Greenland

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Paleocene-age flood basalts along the east Greenland margin associated with the break-up of Pangaea are thought to have been emplaced in two distinct phases that are separated by a hiatus in volcanism. Evidence for this hiatus is a sediment horizon of variable thickness between the rift to drift successions in southeast Greenland (SEG), central east Greenland (CEG), and the Faeroe Islands. Argon geochronology data from lavas from ocean drilling cores in SEG have constrained the majority of the volcanic activity throughout the rifted margin to ~60-61 Ma and 57-54 Ma with a volcanic hiatus between ~60 and 57 Ma [1,2]. To determine the age of the onset of flood volcanism in CEG, we utilized argon geochronology to date plagioclase from lavas from the Milne Land Formation (MLF), the first lava formation associated with flood volcanism. Our results indicate that MLF lavas from inland nunataks are ~57-59 Ma. These new ages span the time frame for the proposed volcanic hiatus in SEG suggesting that, if there was a hiatus in CEG, it was < 1 Ma. In connection with this work, we examined the petrography and geochemistry of deposits associated with this hiatus in CEG. At Nansen Fjord, this critical interval contains a 5-7 m thick volcaniclastic deposit. Features including scoriaceous, fluidal, and blocky palagonitized and chloritized glass shards and euhedral to subhedral augite indicate that this is a juvenile pyroclastic deposit. This deposit is underlain by evolved tholeiites of the Nansen Fjord Formation (NFF) and is overlain by lavas of the MLF. Unaltered clinopyroxene from the pyroclastic deposit indicate that it has no geochemical affinity to the NFF but is similar to the overlying MLF. Based on this work, it appears that flood volcanism was preceded by pyroclastic activity and is compositionally related to the earliest plateau lavas, which may have been volatile rich. This difference in both timing and volcanic processes from more distal localities may be due to the close proximity of CEG to the inferred plume track.

**References**

[1] Sinton, C.W. and Duncan, R.A. (1998) *Proc. of ODP, Scientific Results* **152,** 387-402.
[2] Tegner, C. and Duncan, R.A. (1999) *Proc. of ODP Scientific Results* **163,** 53-62.

## 5.2.P06

# Petrology and geochemistry of the Milne Land Formation, central east Greenland flood basalt province

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Paleocene tholeiitic lavas of the Milne Land Formation (MLF) in central east Greenland (CEG) mark the onset of rifting and flood basalt volcanism associated with continental break-up and formation of the North Atlantic ocean basin. The MLF is the lowermost formation of the plateau lavas and links the commonly crustally contaminated, primitive lavas of the lower volcanics to the largely uncontaminated evolved FeTi basalts of the overlying Geikie Plateau Formation. MLF lavas are compositionally diverse yet show systematic variations in Mg number, $TiO_2$, and rare earth elements (REE) abundances, but near constant $\Delta$Nb (–0.1 ± 0.1 1SD) with stratigraphic height. REE modeling shows a progressive decline in the mean extent (F) and mean pressure (P) of partial melting during emplacement of the MLF in the Sortebræ region of the CEG [1]. Lavas of the Nansen Fjord region best represent the MLF stratigraphy (ca. 1500 m) in CEG because the base of the formation is exposed, unlike in Sortebræ region, allowing for an extension of the trace element stratigraphy presented by [1]. Several distinct MLF lava types (picrites, orthopyroxene (opx) ankaramites, and low-$TiO_2$ basalts) are associated with the dominant FeTi basalts of this region. Picrites that occur at the base of the formation have lower $La/Sm_n$ and higher $Dy/Yb_n$ than other MLF lavas, suggesting that the initial phase of flood basalt volcanism was associated with higher F and P than previously estimated. The eruption of primitive melts early in the emplacement of the MLF suggests more direct sampling of asthenospheric melts during continental break-up and plate separation. Opx ankaramites occur ca. 400 m above the base of the MLF and are intercalated with high $SiO_2$ (> 52 wt.%) and high Ba (> 200 ppm) lavas. The high-$SiO_2$ and high-Ba lavas represent a period of crustal contamination of fractionated magmas, while the opx ankaramites reflect contamination of more primitive melts at lower crustal conditions. Low-$TiO_2$ basalts first appear near the top of the MLF and have distinctly lower REE ratios than all other plateau lavas, suggesting these lavas were not derived from a similar source as implied by $\Delta$Nb, but rather were generated from melting of a heterogeneous mantle.

**References**

[1] Tegner C., Lesher C.E., Larsen L.M. and Watt W.S. (1998) *Nature* **395,** 591-594.