CONTROL ID: 1807868

TITLE: Improvements in the chronology, geochemistry and correlation techniques of tephra in Antarctic ice

AUTHORS (FIRST NAME, LAST NAME): Nels Anton Iverson[1], Nelia W Dunbar[2], William C. McIntosh[1, 2], Nicholas J Pearce[3], Philip R Kyle[1]

INSTITUTIONS (ALL): 1. Earth and Environmental Sciences, New Mexico Tech, Socorro, NM, United States.
2. New Mexico Bureau of Geology and Mineral Resources, New Mexico Tech, Socorro, NM, United States.
3. Institute of Geography and Earth Science, Aberystwyth University, Aberystwyth, Wales, United Kingdom.

ABSTRACT BODY: Visible and crypto tephra layers found in West Antarctic ice provide an excellent record of Antarctic volcanism over the past 100ka. Tephra layers are deposited almost instantaneously across wide areas creating horizons that, if found in several locations, provide “pinning points” to adjust ice time scales that may otherwise be lacking detailed chronology. Individual tephra layers can have distinct chemical fingerprints allowing them to correlate over great distances. Advances in sample preparation, geochemical analyses (major and trace elements) of fine grained tephra and higher precision 40Ar/39Ar dating of young (<100ka) proximal volcanic deposits are improving an already established tephra record in West Antarctica.
Forty three of the potential hundreds of silicate layers found in a recently drilled deep West Antarctic Ice Sheet Divide core (WDC06A) have been analyzed for major elements and a subset for trace elements. Of these layers, at least 16 are homogenous tephra that could be correlated to other ice cores (e.g. Siple Dome, SDMA) and/or to source volcanoes found throughout Antarctica and even extra-continental eruptions (e.g. Sub-Antarctic islands and South America). Combining ice core tephra with those exposed in blue ice areas provide more locations to correlate widespread eruptions. For example, a period of heightened eruptive activity at Mt. Berlin, West Antarctica between 24 and 28ka produced a set of tephra layers that are found in WDC06A and SDMA ice cores, as well as at a nearby blue ice area at Mt. Moulton (BIT-151 and BIT-152). Possible correlative tephra layers are found at ice ages of 26.4, 26.9 and 28.8ka in WDC06A and 26.5, 27.0, and 28.7ka in SDMA cores. The geochemical similarities of major elements in these layers mean that ongoing trace element analyses will be vital to decipher the sequence of events during this phase of activity at Mt. Berlin. Sample WDC06A-2767.117 (ice age of 28.6±1.0ka) appears to correlate to blue ice tephra BIT-152 and to tephra layer SDMA-5683 (ice age of 28.5ka). This tephra layer also appears to be present in blue ice at Mt. Terra Nova on Ross Island, 1400km away, suggesting that it may be a possible to link ice cores in East Antarctica (e.g. Talos Dome and Law Dome).
The amount of feldspar in ice core tephra is typically too small to be directly dated by

40Ar/39Ar method, making it very important to geochemically correlate these layers to proximal deposits where more and larger feldspar can be sampled. The correlation of WDC06A-2767.117 to the coarse, proximal BIT-152 provides one such link. The New Mexico Geochronology Research Lab (NMGRL) has two new multi-collector ARGUS VI mass spectrometers that can provide single crystal laser fusion ages that are approximately an order of magnitude more precise than the previous determinations. With these advancements in analytical technology, we hope to improve precision on “pinning points” in the deep ice cores where annual layer counting becomes less precise.

KEYWORDS: 8455 VOLCANOLOGY Tephrochronology, 1145 GEOCHRONOLOGY Tephrochronology.

(No Image Selected)

(No Table Selected)

Additional Details

Previously Presented Material: 30%- GSA Bulletin (Dunbar et al. 2008) and Quaternary Science Reviews (Dunbar et al. 2011)

Contact Details

CONTACT (NAME ONLY): Nels Iverson

CONTACT (E-MAIL ONLY): niverson@nmt.edu

TITLE OF TEAM: