Using tephra to correlate paleoclimate records from the mid-west to eastern seaboard of the United States

Britta J.L. Jensen[1,2], Gill Plunkett[1], Robert K. Booth[3]

OBJECTIVES AND METHODS

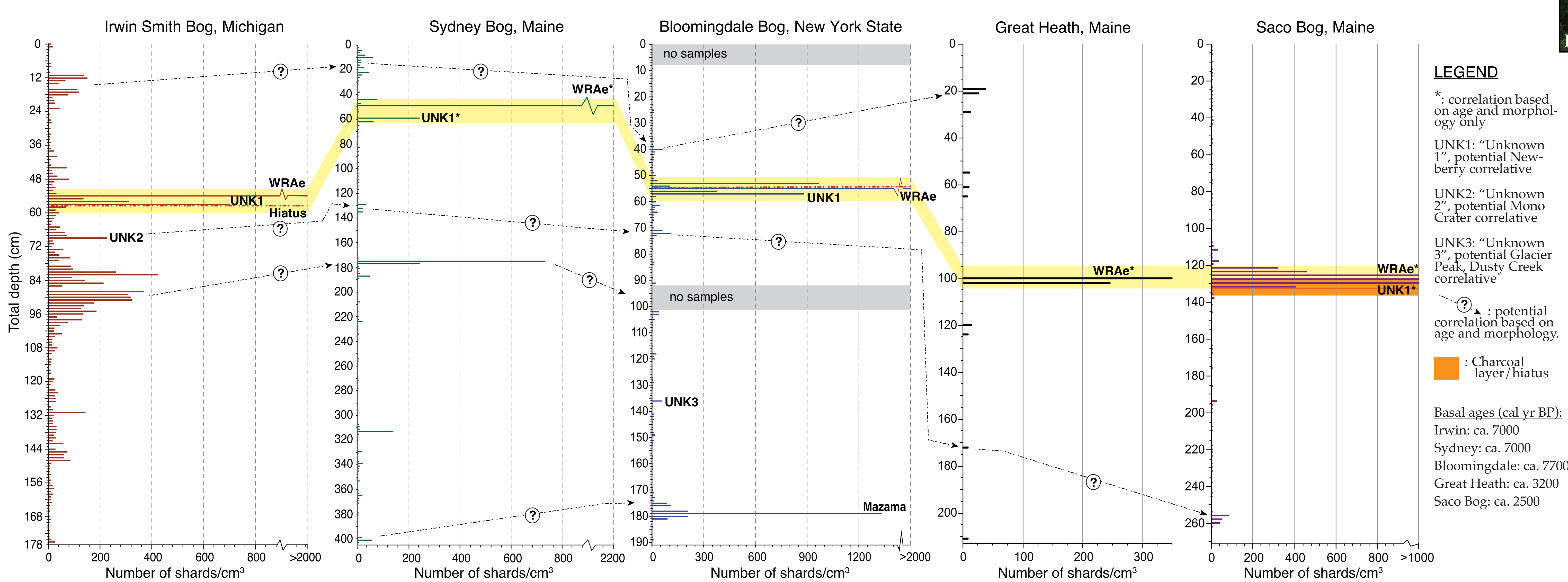
1. Cryptotephra (tephra not visible to the naked eye) form the foundation of the tephrostratigraphic frameworks used in Europe and there is no *a priori* reason why a crypto-tephrostratigraphy cannot be developed for eastern North America.
2. Five cores from ombrotrophic peat bogs in Michigan, upstate New York and Maine (right), were examined to test the feasibility of building a tephrostratigraphic framework for this region, while correlating the detailed paleoclimate records found in each core.
3. Initial examination was by mounting loss on ignition (LOI) samples at 1 to 3 cm resolution on slides and examining by light microscope.
4. Peaks were sub-sampled from the original cores and shards were extracted from the peat through a modified floatation method (e.g. Blockley et al., 2005).
5. Samples were mounted in acrylic pucks and analyzed by electron probe micro-analyses (EPMA). Conditions used were as follows: 10 µm beam, 6 nA current and 15 keV voltage.
6. Several samples were analyzed concurrently with reference material of suspected correlatives (White River Ash east and Mazama). All samples were analyzed with secondary standards Old Crow tephra and ID3506, a Lipari obsidian.


Great Heath (Blue Moutain Conservation)

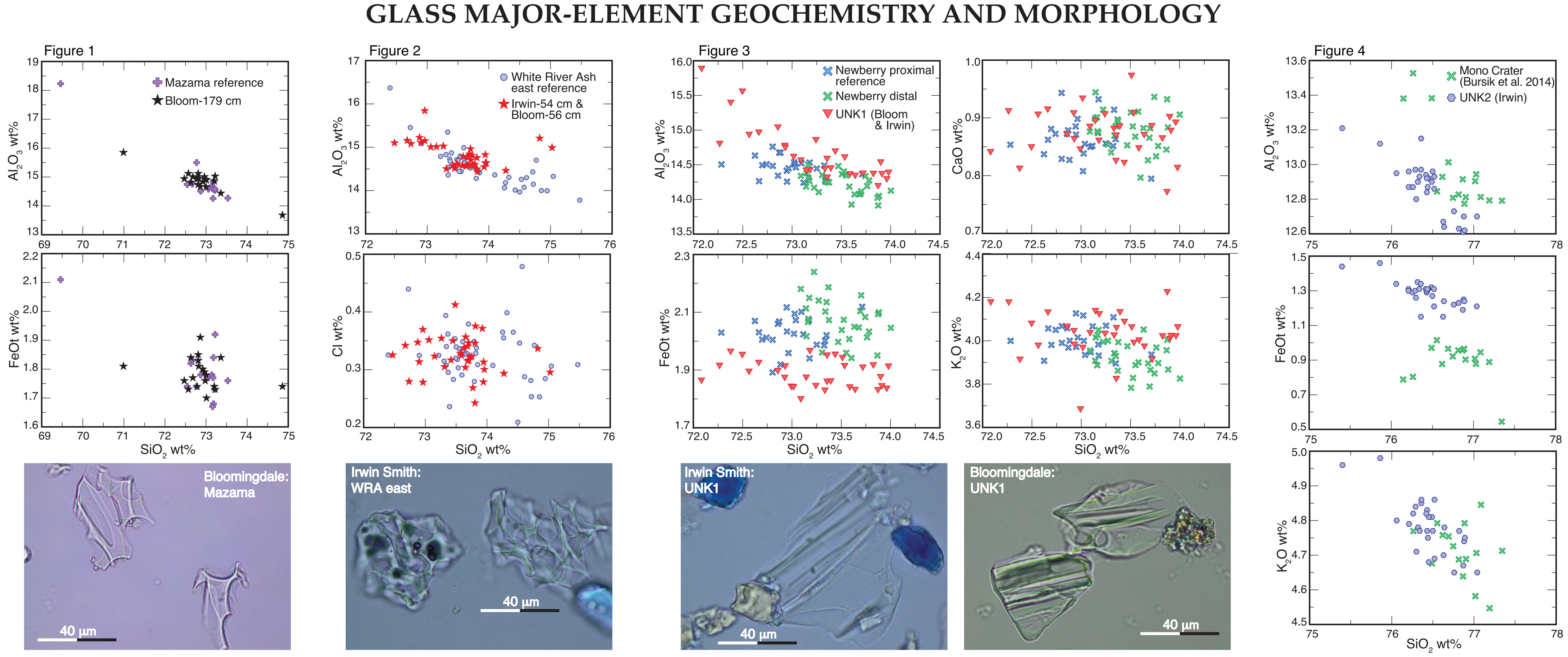

Bloomingdale Bog (NY State parks)


Saco Bog (Steve Lagasse)

GLASS SHARD COUNTS FOR PEAT CORES



GLASS MAJOR-ELEMENT GEOCHEMISTRY AND MORPHOLOGY



RESULTS AND DISCUSSION

1. Detailed examination of each core shows that all contain multiple tephra horizons spanning from the early Holocene (left)
2. Age control, glass shard morphology, and initial major-element geochemical analyses confirm the presence of Mazama (~7600 yr BP; *Zdanowicz et al., 1999*) at the base of Irwin Smith, and White River Ash, eastern lobe (*WRAe; AD 833-850; Jensen et al., in press*), in Irwin Smith and Bloomingdale (Fig. 1, 2). WRAe is also likely present in Saco, Great Heath and Sydney Bogs.
3. UNK1 appears to be as widely distributed in this area as WRAe, and may correlate to the Newberry 1400 cal yr BP event (Fig. 3). Morphological and age data from Great Heath and Saco Bog indicates WRAe and UNK1 are also present at these sites. Slight variation between UNK1 and reference samples may be because they are from different analytical runs.
4. UNK2 displays characteristics that suggest it may be from Mono Crater, and age models confirm that this is a possibility (*Bursik et al., 2014*). The offset between this particular Mono Crater sample and UNK2 in the FeOt biplot suggests they do not match, but all other oxides plot closely, thus re-analyses of both samples under the same instrumental conditions is necessary.
5. UNK3 appears to be a Glacier Peak tephra, although only 6 shards were successfully analyzed. Age models and initial chemistry suggest that the "Dusty Creek assemblage" (*~5800 cal yr BP; Foit et al. 2004*) may be a possibility.
6. Major-element geochemical analyses are required to characterize the remaining tephra, but peaks are present at time intervals where other studies have identified Mount St. Helens layer T (*Mackay unpublished data*), St. Helens We, East Lake and Aniakchak (*Pyne-O'Donnell et al., 2012*). Additional horizons are present around the time of several other known large eruptions from the Cascades and Alaskan volcanoes, such as St. Helens set Y, Hayes (i.e. Jarvis tephra), and Augustine (G, C and I).
7. Finally, in light of the recent correlation of WRAe to the European crypto-tephra AD860B (*Jensen et al., in press*), "unconventional" distal sources cannot be discounted, such as Kamchatka, Mexico and Japan.

References and Contact Information

1- School of Geography, Archaeology, and Palaeoecology, Queen's University Belfast, Belfast, UK; **email = bjjensen@ualberta.ca**
2- Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Alberta, Canada
3- Department of Earth and Environmental Sciences, Lehigh University, Bethlehem, PA USA

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