University of Alberta

Tephrostratigraphy and paleoenvironments of the late Quaternary in eastern Beringia

by

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ABSTRACT

In this dissertation, tephrostratigraphy is used as the central method to address issues of chronology in the late Quaternary sedimentary record of eastern Beringia (non-glaciated Yukon and Alaska) at a variety of spatial and temporal scales. The Palisades, central Alaska, preserves paleoenvironmental records thought to span, with major unconformities, the Holocene to early Pleistocene (~2 Ma). Two paleomagnetic transects of normal polarity and tephrostratigraphic data show the Palisades are Middle to Late Pleistocene in age, with no major unconformities. Of 19 tephra beds identified, nine are Middle Pleistocene beds known from other sites. The Variegated (VT) tephra has a known distribution second only to the Old Crow tephra. Reference samples from Fairbanks, Alaska, are correlated by glass major and trace-element geochemistry, Fe-Ti oxide geochemistry, stratigraphy, and age data to eight other sites in eastern Beringia. A new infrared stimulated luminescence age of 106 ± 10 ka, stratigraphy, paleoenvironmental data, and independent ages from other sites place VT within Marine Isotope Stage (MIS) 5, likely MIS 5d. Halfway House, an exposure of primary loess west of Fairbanks, is one of the most studied exposures in Alaska, but has little chronologic control. A new tephrostratigraphic framework shows Halfway House contains a relatively complete MIS 6 to Holocene record, dated by the Old Crow (124 ± 10 ka), VT (106 ± 10 ka), Sheep Creek-Klondike (ca. 80 ka), Dominion Creek (77 ± 8 ka) and Dawson (ca. 30 cal ka BP) tephra beds. The Skalamælifell/post-Blake paleomagnetic excursion (94.1 ± 7.8 ka) provides independent age control, and adds to the increasing body of evidence that

Alaskan loess can record subtle variations in the Earth's geomagnetic field. This framework places high-resolution magnetic susceptibility profiles into context and shows loess accumulation is highly variable, casting doubt on the validity of correlating Alaskan susceptibility records to global $\delta^{18}O$ curves. The Alaskan White River Ash, eastern lobe (WRe; ~AD 840), is correlated to the European cryptotephra known as AD 860B. This correlation means WRe is present in northeastern Pacific marine cores, across the North American continent, in the NGRIP ice core from Greenland, and northern Europe.

ACKNOWLEDGMENTS

The motivation to complete this dissertation grew from my MSc research: trying to unravel the mysteries of the Middle Pleistocene was a challenge and I became addicted, particularly since there still exists an embarrassment of riches to be discovered. When I told Duane I wanted to continue working on what I had started, he warned me that it was a big task. Regardless of that initial warning, he has been the most supportive and encouraging supervisor I could have asked for on this great adventure. I have probably collected enough data to last a career, and perhaps that scratch is now only a gouge, but I don't regret it for a moment. I have been able to work in one of the most beautiful and fascinating places on Earth, doing something I love.

This research would not have been possible without funding from the Natural Sciences and Engineering Research Council of Canada (NSERC), Alberta Ingenuity, the Killam Trusts, the Geological Society of America, the Canadian Circumpolar Institute, and Northern Scientific Training Program.

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timeline without her speed and expertise. It feels like I have spent half a lifetime working on the (mostly) faithful JEOL, and it probably would have actually taken that long if not for all the help of Sergei Matveev and Tom Chacko. Mary-Jane, Judy, Judith, Marsha, Sherry, Angie, Colleen, all the ladies of the front office, past and present (plus Igor!), have been invaluable throughout my time here. Mark Labbe, thanks for being able to fix/help any situation I presented to you. I also want to generally acknowledge the Department of Earth and Atmospheric Sciences- while no place is perfect, we seem to have more than our fair share of great faculty, staff, and students. It has been a great place to work and live, and I will miss it. Beyond Edmonton, I want to thank Shari Preece for always being available for pretty much any question I have thrown at her, and Anders Carlson for providing me the space and time to complete this dissertation while a visiting scientist at the University of Wisconsin-Madison, and showing me that there are ‘mountains’ in the Midwest. Finally, I would like to thank my committee, in its various incarnations, for their insight and patience. David for taking interest in my work, Charley and Thomas, you’ve been there since the beginning for good reason, Vadim and Ted for teaching me the ways of geomagnetics, and Alex for bringing a unique slant to everything and being a great mentor.

Last, but most certainly not least, my time in Edmonton has been defined by the amazing friends I have made. They have kept me sane throughout the years: Hilary, Josh, Will, Nick, Stefan, Kati, Erin, Tyler, Chuck, Colin, Larry, Faye, Kurt, Steve, Angus, Ben, Mel, Mike, JF - through a late night glass of wine and/or beer (or two), disc golf, pottery, gardening, sausage parties, potlucks and so much more. Erin and Tyler, thank you for letting me use your home as my home while in Edmonton this last year. My family has always encouraged me by being so interested in what I do, thanks Eve for taking the plunge and visiting me in the field, and my Opa for always asking questions and buying a farm in a place that certainly pointed me in the direction I eventually took. Finally, Alberto Reyes has been the best field partner, captain, editor, cook, and chauffeur any aspiring Dr. could have wished for. Your quesadillas saved the day on more than one occasion (and still do).

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CHAPTER 1: INTRODUCTION

Beringia is a vast region encompassing parts of Siberia, Alaska and Yukon, its borders defined by the limits of glaciation over the course of the Quaternary to the east, and the Kolyma River to the west (Fig. 1.1; e.g. Hultén, 1939; Hopkins, 1967). The absence of glaciers and the presence of permafrost has resulted in an exceptionally well-preserved record of landscape and environmental change that extends into the Miocene (e.g. Hopkins et al., 1971; Froese et al., 2009; Matthews et al., 2003; White et al., 1997, 1999; Westgate et al., 1990, 2001). Late Cenozoic terrestrial records of such length are rare, and it is arguable that no other region contains such an abundance of vertebrate and invertebrate fossils, plant remains, and even ancient DNA so exceptionally preserved by permafrost (e.g. Guthrie, 1968: Zazula et al., 2005; Froese et al., 2009; Shapiro et al., 2004).

The climatic and environmental dynamics of the late Cenozoic are of significant interest because they encompass the onset of northern hemisphere glaciation, approximately 2.7 million years ago, when extensive continental glaciers expanded, periodically interrupted by periods as warm or warmer than today (interglaciations). Within that variability, the middle Pleistocene (780-125 ka) saw a shift to interglacials more typical of 'modern' climate, where the Earth's climate system settled into a pattern that shaped our modern landscape, flora and fauna (e.g. Ruddiman et al., 1986). These interglacials represent natural experiments of the earth's climate system, and can provide compelling analogues

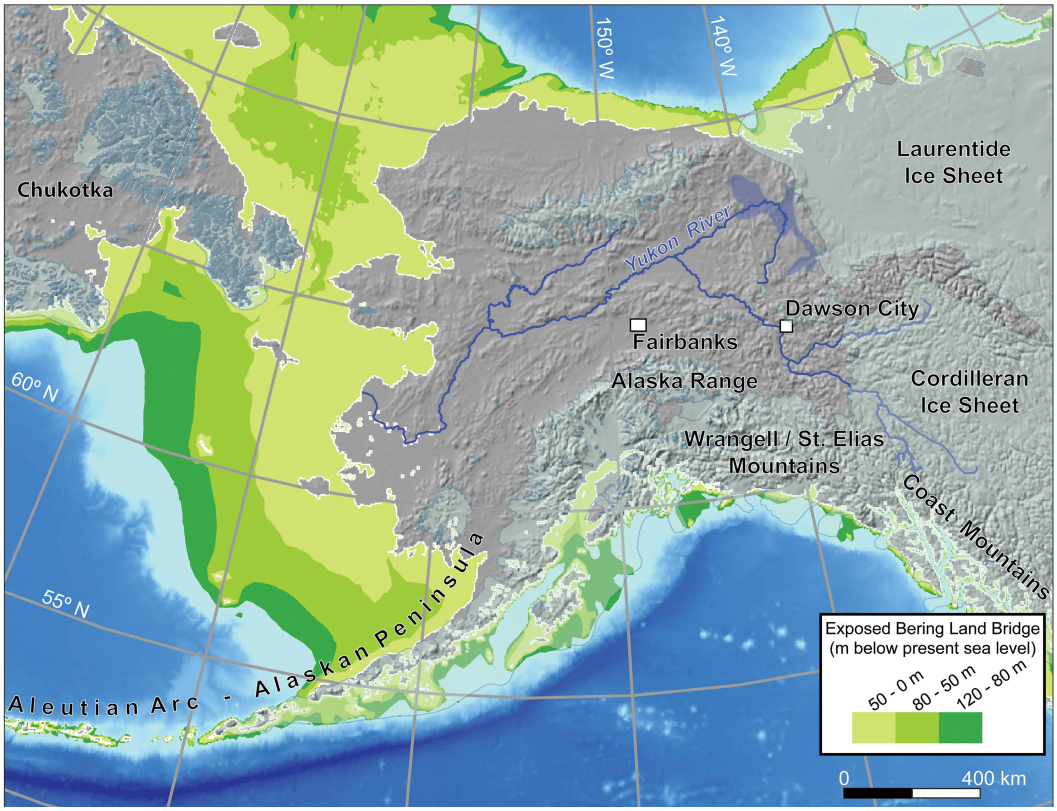

Figure 1.1. Eastern Beringia (Yukon and Alaska), part of western Beringia, and the exposed Bering land bridge during the last glacial maximum (~18 ka). Map modified from Froese et al. (2009).

for future warming (e.g. Howard, 1997). Additionally, as we potentially shift into non-analogue conditions of the Anthropocene, a better understanding of previous interglacial paleoclimates can provide a baseline for assessing the relative effects of natural and anthropogenic climate variability (Tzedakis et al., 2009). Much of our present knowledge of these intervals has been developed from ice cores and marine records, but the terrestrial sedimentary archives of Beringia provide a unique opportunity to supplement and build our knowledge from a complementary source.

While this dissertation is motivated by these large-scale problems, the focus of the project is chronological control. The most common obstacle encountered in the study of Beringian sedimentary records is the difficulty in robust chronologies. Western Beringia (i.e. eastern Siberia) largely relies on dating methods such as radiocarbon, luminescence, and small mammal biochronology, methods limited by their range (e.g. < 50 ka for radiocarbon) and/or poor precision (e.g. Sher et al., 1997; Arnold et al., 2008). However, eastern Beringia (Yukon and Alaska) has a geographic advantage by being downwind of the numerous volcanoes of the Aleutian-Arc-Alaska Peninsula and Wrangell volcanic field, resulting in the abundant volcanic ash (tephra) deposits within stratigraphic records (Fig 1.2; e.g. Preece et al., 1999, 2000, 2011a; Jensen et al., 2008).

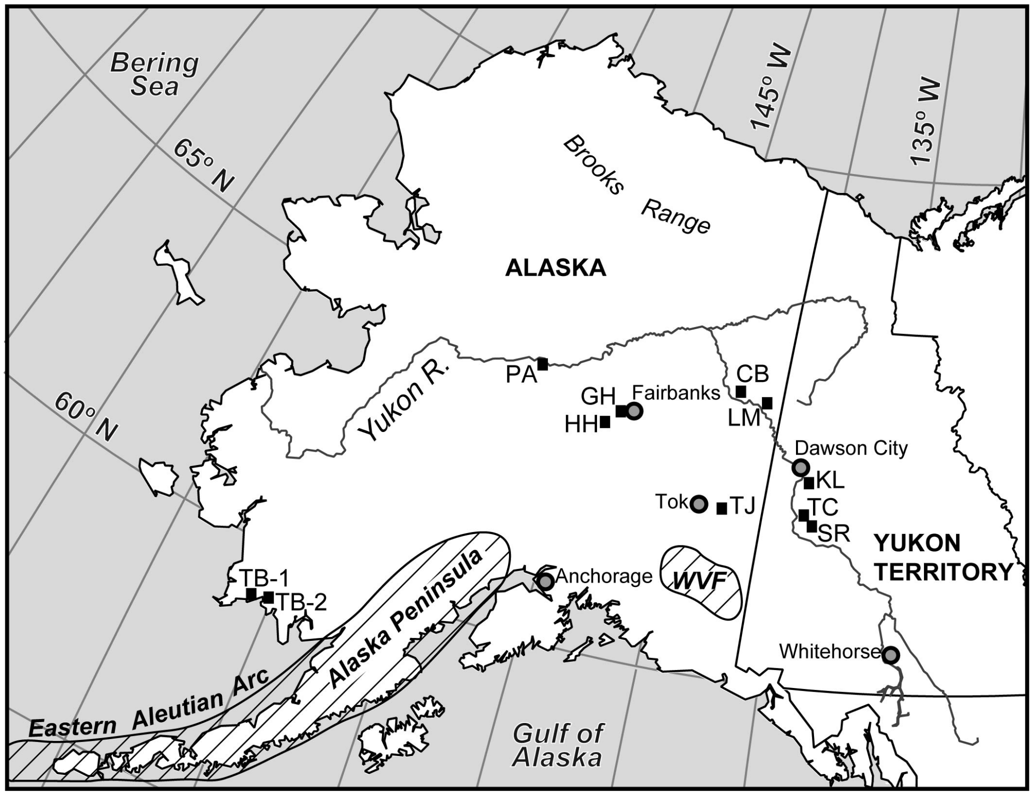

Figure 1.2. Location map of all sites discussed in the dissertation: TB-1/TB-2 = Togiak Bay, PA = Palisades, HH = Halfway House, GH = Gold Hill, TJ = Tetlin Junction, CB = Chester Bluff, LM = Little Montauk, KL = Jackson Hill, Hunker Creek and Hollis Mine, TC = Thistle Creek, SR = Stewart River. Tephra beds are sourced from the Aleutian Arc-Alaska Peninsula and Wrangell volcanic field (WVF).

Tephra beds aid interpretation of stratigraphic records in several ways: each tephra bed's unique geochemical fingerprint allows sediments associated with an individual bed to be correlated and compared at its most distal locations (e.g. Preece et al., 2011b; Lane et al., 2012), and some tephra beds can be dated, either directly (e.g. ^{40}Ar/^{39}Ar, glass fission-track; Kunk, 1995; Sandhu and Westgate, 1995; Sandhu et al., 2000), or indirectly (e.g. luminescence, radiocarbon; Demuro et al., 2008). A dated tephra bed provides invaluable chronologic control, particularly to sediments beyond the limit of indirect dating methods (e.g. radiocarbon, luminescence). Therefore, tephra are a key component in dating the sediments of eastern Beringia and are the focus of this dissertation.

The research presented here, with the exception of Chapter 5, is limited to the Middle (780-125 ka) and Late Pleistocene (125-10 ka). The focus on this time is a result of the scientific interest in it, and that tephrostratigraphic records for the Middle Pleistocene in particular, are poorly understood. Previous to this dissertation, only three tephra beds had been found both in the Yukon and Alaska, VT, Mosquito Gulch and Old Crow, of which only the Old Crow is Middle Pleistocene in age. To date, only one semi-continuous Middle Pleistocene record has been documented (c.f. Jensen et al., 2008), and the tephrostratigraphy from this site provides a basis for identifying other sediments and tephra of the same age at other locations. This dissertation has the following three objectives:

(1) Build a tephrostratigraphic framework for the Middle to Late Pleistocene for eastern Beringia to facilitate identification and correlation of sediments from

this time; and identify and characterize key, regionally distributed, tephra beds that will help develop this framework.

(2) Improve the chronology of these key tephra beds through dating by direct and/or indirect methods.

(3) Use the tephrostratigraphic framework to improve the chronology at sites that have important paleoenvironmental records, but poor age control.

These are ambitious objectives, and although this is an ongoing project where new sites and data continuously supplement our knowledge, this dissertation represents a large contribution towards achieving these goals.

Chapter Summaries

Chapter 2 re-examines the Palisades site in central Alaska. Fieldwork at the site was initially carried out under the auspices of collecting reference material for Mining Camp, EC and PAL tephra beds, supposed early Pleistocene tephra beds not in the University of Alberta reference collection. We also were investigating initial paleomagnetic results that suggested only sediments of normal polarity were present (i.e. < 780 ka), contradictory to the ages of previously reported tephra beds at the site. The normal polarity of the sediments was confirmed with two additional transects, and results were supported by the identification of several known and newly documented Middle Pleistocene tephra beds. This chapter presents a revision of the age of the Palisades, but the most important contribution is the characterization of several new, regionally-distributed, tephra beds of Middle Pleistocene age. This chapter is presently in review in *Quaternary Science Reviews* with co-authors Alberto Reyes (University of Wisconsin, Madison), Duane Froese (University of Alberta) and David Stone (University of Alaska, Fairbanks). I participated in the second field season at the Palisades (2007), collected the second paleomagnetic transect, and the majority of the tephra presented in this study. I was also responsible for all major-element geochemical analyses, as well as synthesis of the data and writing of the manuscript. DF and AR contributed stratigraphic descriptions and samples, DS completed the paleomagnetic analyses.

Chapter 3 focuses on the Variegated tephra (VT). We show though major and trace-element glass geochemistry, Fe-Ti oxide geochemistry and stratigraphy that the Aeolis Mountain tephra from southwestern Alaska, the Jackson Hill tephra from the Klondike, as well as samples from five additional sites across Alaska, all correlate to VT. The main contribution of this paper is that it clearly defines the stratigraphic context and geochemistry of VT, which has a known distribution that is second only to the Old Crow tephra. A new age determination for VT of 106 ± 10 ka, which is supported by independent age control and paleoenvironmental data from correlative sites, places VT in MIS 5, most likely MIS 5d. The chapter has been published in *Quaternary International* (Jensen et al., 2011) with co-authors Shari Preece (University of Toronto), Michel Lamothe (Université du Québec à Montréal), Nick Pearce (Aberystwyth University), Duane Froese (University of Alberta), John Westgate (University of Toronto), Janet Schaefer (Alaska Volcano Observatory) and Jim Begét (University of Alaska, Fairbanks). I conceived of the project and carried out sampling and stratigraphy for most of the sites, all major-element geochemistry of glass and Fe-Ti oxides, and the synthesis and writing. Co-authors contributed samples and/or data (DF, SP, JW, JS, JB), and provided analyses, such as optical luminescence dating (ML).

Chapter 4 is an example of how an established tephrostratigraphic framework can be used to provide new insight into long-standing problems. We revisit Halfway House, arguably the most studied loess locale in Alaska. We place this section into a chronostratigraphic framework with refined ages on known tephra beds, and the identification of new, dated beds. This chapter presents the identification of several tephra beds only previously known from the Klondike (e.g. Sheep Creek-Klondike, Dominion Creek, Dawson), demonstrating their presence in Alaska. I further use these data to refine loess accumulation models for interior Alaska. This revision shows that correlation of those records to global $\delta^{18}O$ curves is only partially supported. A version of Chapter 4 will be submitted to the *Geological Society of America Bulleti*n with co-authors Ted Evans, Duane Froese, and Vadim Kravchinsky, all of the University of Alberta. The project took place over the course of three field seasons, the previous season's results driving further work. DF and I conceived of the project, while VK suggested high-resolution paleomagnetic sampling. I completed all major-element geochemical analyses, stratigraphy, magnetic susceptibility measurements, and writing. TE and I analyzed paleomagnetic data.

Chapter 5 presents the correlation of the White River Ash, eastern lobe (WRE), to the European cryptotephra horizon known as the AD 860B tephra through similar age determinations and major-element geochemistry. This is a significant contribution in that it identifies a tephra bed that that is present in northeastern Pacific marine cores, across the North American continent, in the NGRIP ice core from Greenland, and across northern Europe. This chapter presents the tantalizing possibility that other Alaskan tephra beds, some the product of eruptions as large, if not larger, than the one that produced WRE, may be distributed much more widely than initially thought. A version of Chapter 5 will be submitted to *Science* as a Brevia with coauthors Sean Pyne-O'Donnell (Royal Holloway), Gill Plunkett (Queen's University, Belfast), Duane Froese (University of Alberta), Paul Hughes (University of Southhampton), Jonathan Pilcher (Queen's University, Belfast), and Valerie A. Hall (Queen's University, Belfast). The geochemical similarity between the tephra beds was initially noted by SPO, and the project was developed by myself, SPO, DF and GP. I carried out all subsequent geochemical analyses (except Petit, analyzed by PH), synthesis and writing. GP, JP, and VH provided 860B samples.

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CHAPTER 2: THE PALISADES IS A KEY MIDDLE PLEISTOCENE REFERENCE SITE

A version of this chapter has been submitted as:

Jensen, B.J.L., Reyes, A.V., Froese, D.G., Stone, D.B., The Palisades is a key reference site for the middle Pleistocene of eastern Beringia: new evidence from paleomagnetics and regional tephrostratigraphy. Quaternary Science Reviews, submitted August 8, 2012.

Introduction

The Palisades, on the Yukon River in central Alaska (Fig. 2.1), is a steep, gullied exposure of perennially frozen loess with interbedded peat, forest beds, relict permafrost, and tephra beds (Begét et al., 1991; Matheus et al., 2003; Reyes et al., 2010a). Descriptions of this impressive bluff, known locally as "The Boneyard", first appeared over a hundred years ago (e.g. Russell, 1890; Spurr and Goodrich, 1898). However, only relatively recently has it been examined in depth. Yeend (1977) presented a detailed study of Miocene sediments underlying Pleistocene silts at a smaller bluff just west of the main Palisades exposure. Begét et al. (1991) discovered the Old Crow tephra (OCt; 124 ± 10 ka; Preece et al., 2011a) and an overlying wood-rich peat, which was identified as representing Marine Isotope Stage (MIS) 5. They also noted that there was likely an extensive middle Pleistocene record present since these units were generally found in the

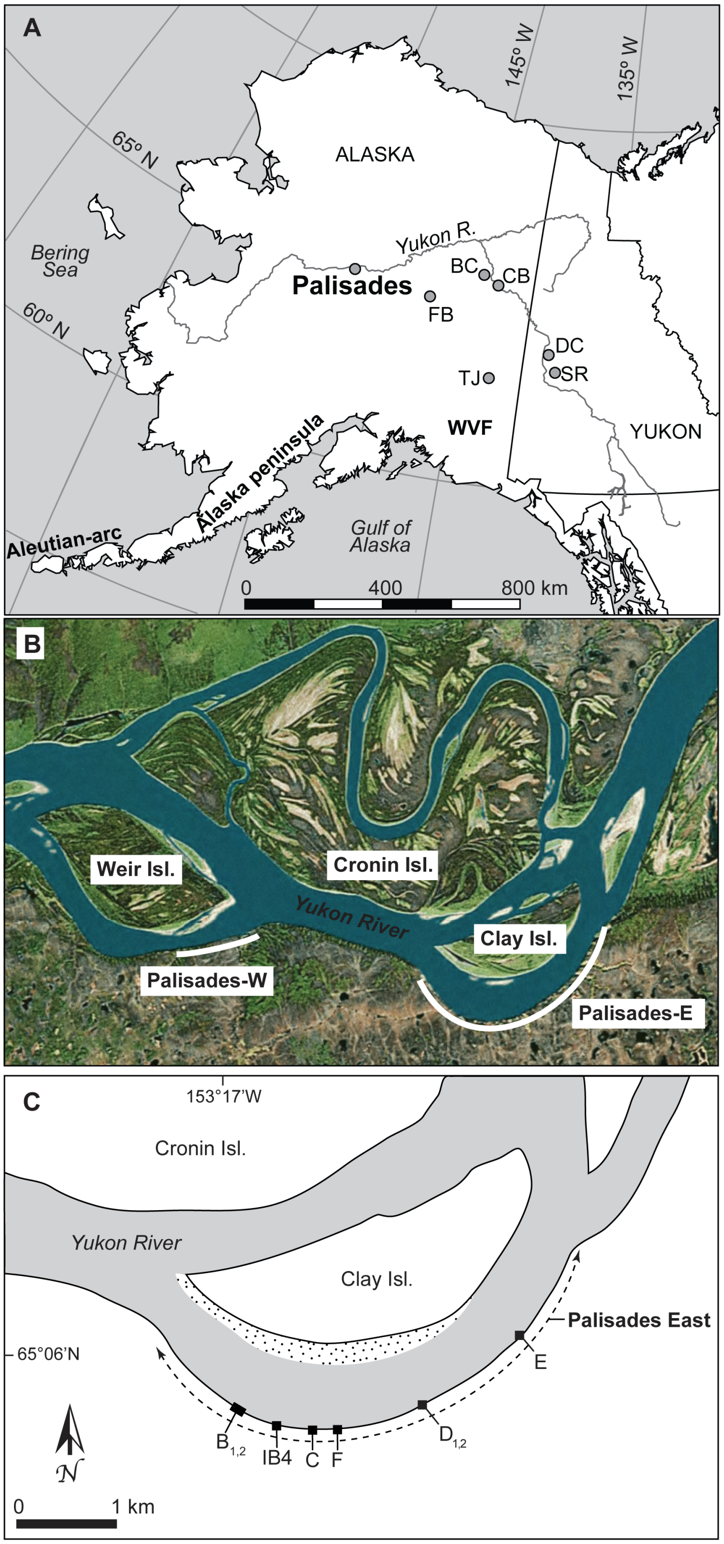

Figure 2.1. A- Location of the Palisades and other sites discussed in the text. FB = Fairbanks, BC = Birch Creek, CB = Chester Bluff, TJ = Tetlin Junction, DC = Dawson City, SR = Stewart River. WVF = Wrangell volcanic field **B-** Location map of the Palisades on the Yukon River; **C-** Locations of measured sections at Palisades East. Site naming is consistent with Reyes et al. (2010a,b) with the exception of previously undescribed Site F.

upper third of the exposure. Building on these earlier efforts, Reyes et al. (2010a, b) documented relict ice wedges at the Palisades that persisted through MIS 5e and described an *in situ* tundra surface buried by OCt.

Of particular relevance to this study, Matheus et al. (2003) mapped the Palisades from river level to the forested surface at the top of the bluff. They found multiple tephra beds below OCt, including Sheep Creek- Fairbanks (SC-F; 190 ± 20 ka; Berger et al., 1996), PA (2.02 ± 0.14 Ma; Preece et al., 1999), Engineering Creek (EC; ~2 Ma; Westgate et al., 2003), Mining Camp (MC; ~2 Ma; Westgate et al., 2003), and a then-newly described tephra bed, the Palisades tephra (PAL). The petrologic and geochemical characteristics of PAL and EC are very similar to PA, thus Matheus et al. (2003) considered these tephra to be co-magmatic and of similar age. The 2.02 ± 0.14 Ma glass fission-track age of PA and the interpretation of PAL as co-magmatic with PA, together with the presence of PAL across the majority of the Palisades, prompted Matheus et al. (2003) to argue that the lower third of the Palisades is earliest Pleistocene in age. Their "lower peat", stratigraphically associated with PAL, was therefore considered equivalent to the early Pleistocene Dawson Cut Forest Bed in Fairbanks, 260 km to the east (Matheus et al., 2003; Westgate et al, 2003; Péwé et al., 2009).

However, questions surfaced about the age of the Palisades when students, part of a NSF funded summer Research Experience for Undergraduates (REU) program at the University of Alaska, sampled seven short sections between river level and 26 meters near the eastern end of Palisades East. This sampling pattern was based on the expectation of finding evidence of the Brunhes-Matuyama reversal. However all samples showed normal magnetic directions (Opalka et al., 2004). In addition, neither PAL nor EC have ever been found in direct stratigraphic association with the fission-track-dated PA tephra (e.g. Matheus et al., 2003; Westgate et al., 2003; Péwé et al., 2009). The Palisades is thus a critical site for resolving these stratigraphic relations because the reference sites in the Fairbanks area are either destroyed or overgrown. In this paper we clarify and revise the chronostratigraphic framework for the Palisades through detailed paleomagnetic and tephrostratigraphic sampling. We show that the tephra record at the Palisades is much richer than previously thought; indeed, the new Palisades tephrostratigraphy is a critical link in the ongoing development of regional middle Pleistocene paleoenvironmental proxy records.

Site Description

The Palisades are on the south bank of the Yukon River in Nowitna National Wildlife Refuge, ~70 km downstream of Tanana village. The site consists of two main exposures (Fig. 2.1); Palisades East is the main, 8 km-long bluff, while Palisades West is a 3 km long bluff that is largely vegetated and has received relatively little attention (Yeend, 1977; Reyes et al., 2010b). We limit our attention here to Palisades East.

Palisades East forms a heavily gullied, cliff-like exposure that is generally ~40-45 m in height, but ranges from ~25 m high at Site E to ~ 55-60 m high at

Site D (Fig. 2.1). It is difficult to access safely, with many near-vertical exposures and overhanging blocks of frozen sediment that frequently break free into the Yukon River, creating small waves that travel upriver to Clay Island.

Methods

Stratigraphy

We measured elevations of distinct stratigraphic features at accessible exposures using a Lasertech 200XL laser range finder, which has a nominal precision of 0.1 m. Elevations were also collected by repeated measurements with a barometric altimeter; agreement between sections measured by both methods are within 1-3 m. Additional error is also introduced because all measured sections are heights relative to river level at the time, which can vary by several meters over the course of a season, or even weeks.

The cliff-like configuration of the site and slump blocks present few opportunities to complete stratigraphic logs from the top to bottom of the section. Only one section was logged in detail from river level to a height of 32 m above river level (m.a.r.l.) (Fig. 2.1, 2.2; Site B_1). All other sections were generally less than 10 m in length. Several tephra samples were grab samples collected to track the continuity of deposits across Palisades East. Wherever possible, we collected OCt, SC-F and PAL to facilitate correlation among measured sections.

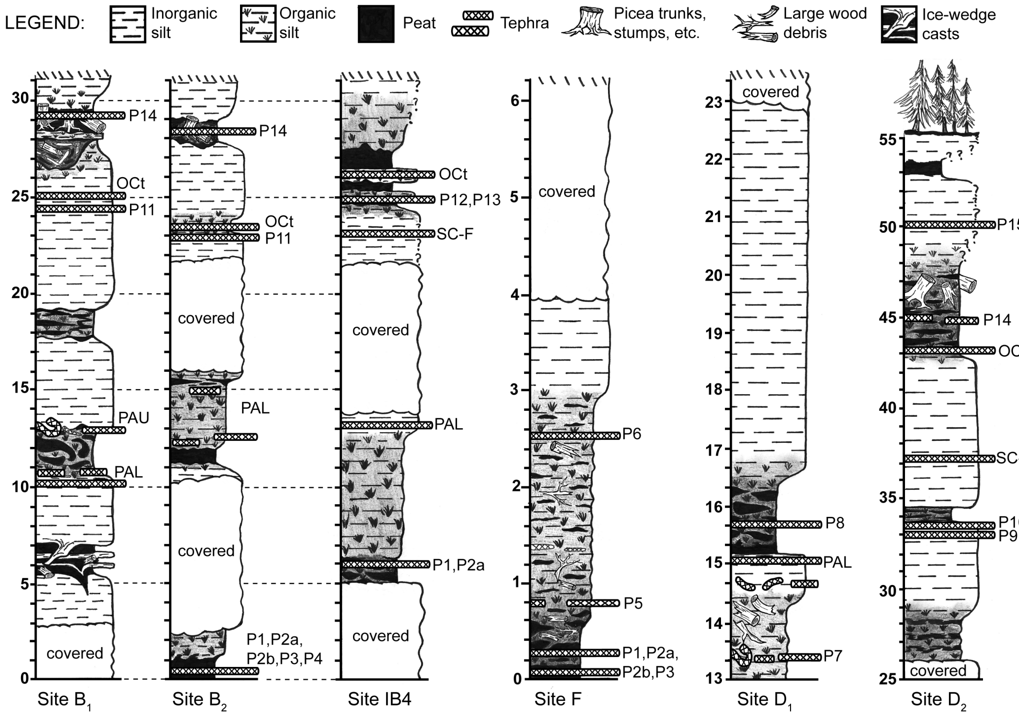

Figure 2.2. Stratigraphic logs of measured sections at Palisades East, from west (left) to east (right). **P#** = tephra beds first described in this study (i.e. P1 = Palisades-1); **?** = areas where poor access limited descriptions; **Site B_1**: Location of main paleomagnetic transect; **Site B_2:** Composite of four sections logged within 300 m of Site B_1, PAL was present semi-continuously across this area, above and below peat, at ~13-15 m.a.r.l; **Site IB4:** PAL and P10/P11 were sampled below a mapped transect of SC-F and OCt; **Site F:** The most accessible exposure of the river level peat with multiple tephra beds visible, all samples collected within 10 m laterally; **Site D_1**: Second paleomagnetic transect, from ~13-17 m, and location of a primary bed of PAL with preserved root-casts; **Site D_2:** Composite of three gullies mapped above Site D_1, all within ~200 m of one another. No stratigraphic logs are provided for Sites C and E, stratigraphic descriptions at these locations were limited to the upper peat, OCt and/or SC-F; for details see Reyes et al. (2010a,b).

Paleomagnetic measurements

Paleomagnetic samples were collected in two transects: one at 10 to 20 cm intervals at Site B_1 in 2005, and the other at ~5 to 15 cm intervals from 13-17 meters above river level through a primary deposit of PAL at Site D_1 in 2007 (Fig. 2.1, 2.2). Oriented samples were collected in 2.5 cm diameter cylinders that were pushed into the walls of vertically excavated trenches with the axis of the cylinder horizontal. The 2005 samples were measured in a 2G Enterprises cryogenic magnetometer starting with the natural remanent magnetization (NRM) followed by seven levels of alternating field (AF) demagnetization ending at 100 mT. The 2007 samples were measured at the California Institute of Technology, also using a 2G Enterprises cryogenic magnetometer. The resulting directions were then displayed on a Zidjerfeld (1967) three-dimensional plot to identify the magnetic component that decays to the origin. These characteristic magnetizations were determined using a line-fit technique (Kirschvink, 2003), and the tabulated results were then filtered using a maximum angular deviation MAD cut off value of 5 to remove unstable components and measurements.

Major-element glass geochemistry

Major-element glass geochemistry of individual glass shards was determined by wavelength dispersive spectrometry on a JEOL 8900 electron microprobe at the University of Alberta. Analytical conditions for the microprobe were 15 keV accelerating voltage, 6 nA beam current, and a beam diameter of 10 μm. A Lipari obsidian (ID 3506/ UA 5831) and Old Crow tephra were used as secondary standards (Kuehn et al., 2011). Reported data are a compilation of multiple analyses. Most tephra samples that were considered potential correlatives to previously identified tephra beds were later re-analyzed concurrently with reference material to minimize potential variation caused by minor differences in calibration and standardization over time (c.f. Westgate et al., 2008). All samples are assigned a laboratory number during processing. Samples with UA prefixes were processed and analyzed at the University of Alberta, while those with UT prefixes are splits from reference material originally processed and analyzed at the University of Toronto tephrochronology laboratory by J. Westgate and S. Preece.

Results

General stratigraphy

We mapped multiple sections across Palisades East (Fig. 2.1). With the exception of Sites B_1, F and D_1, stratigraphic logs are composites of several smaller measured sections within ~200 m of each other. Figure 2.3 presents a composite stratigraphic log of Palisades East, with all tephra beds and major organic horizons in relative stratigraphic order. Unless otherwise noted, all elevations are relative to river level at the time of description. We did not examine in detail the latest Pleistocene and Holocene deposits near the top of the Palisades, but rather focused on sediments between river level and the prominent MIS 5e "upper peat" of Matheus et al. (2003).

The stratigraphy of the lower third of the bluff is complicated by the presence of slumped blocks and colluvium, although two main features are traceable across most of Palisades East. The lowermost traceable unit is a

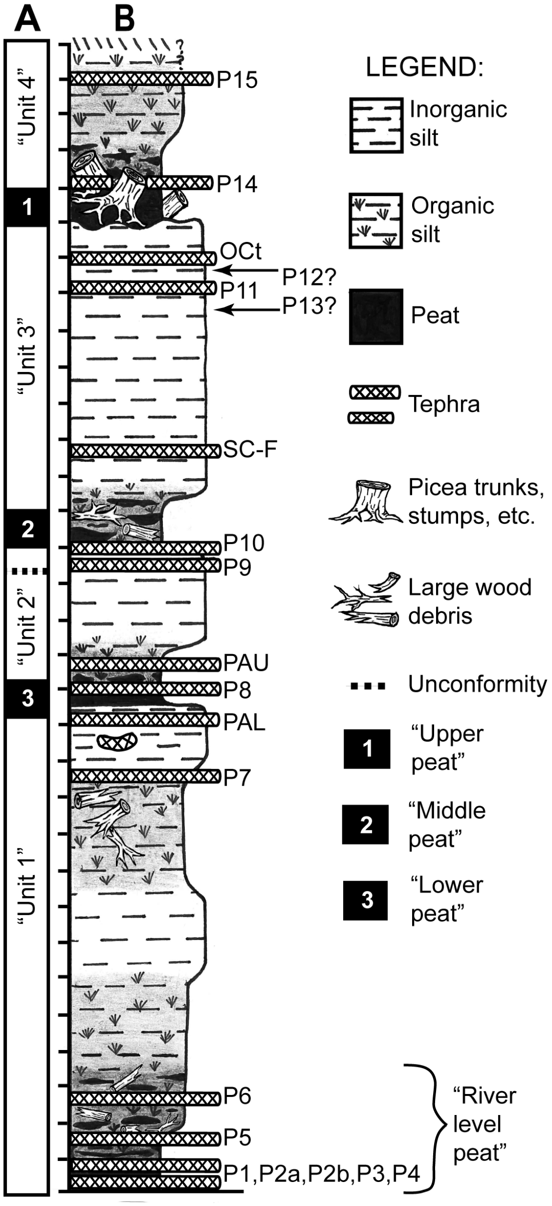

Figure 2.3. Composite stratigraphic log of Palisades East. Scale is relative; elevations of stratigraphic markers can vary by as much as 10 m at different measured sections. **A-** The general lithostratigraphic framework of Matheus et al. (2003); **B-** A revised composite log developed from this study. P12 and P13 were not found in section with P11, thus stratigraphic order is uncertain. P1 to P4 are mixed within multiple samples, thus relative stratigraphic order is unknown.

compressed peat that grades up into organic-rich silt, which commonly contains large woody macrofossils, *Picea* needle fragments, and tephra beds. This peat and associated tephra are generally at river level, but rise locally to ~6 m (e.g. Site IB4, Fig. 2.2). Hereafter, we term these deposits the "river-level" peats. At Site B_1 it is not clear if the interbedded peat and organic-rich silt at ~ 6-7 m, which contains ice-wedge casts, is part of the river-level peat since no tephra beds were found to confirm the correlation (Fig. 2.2, Fig. 2.4c).

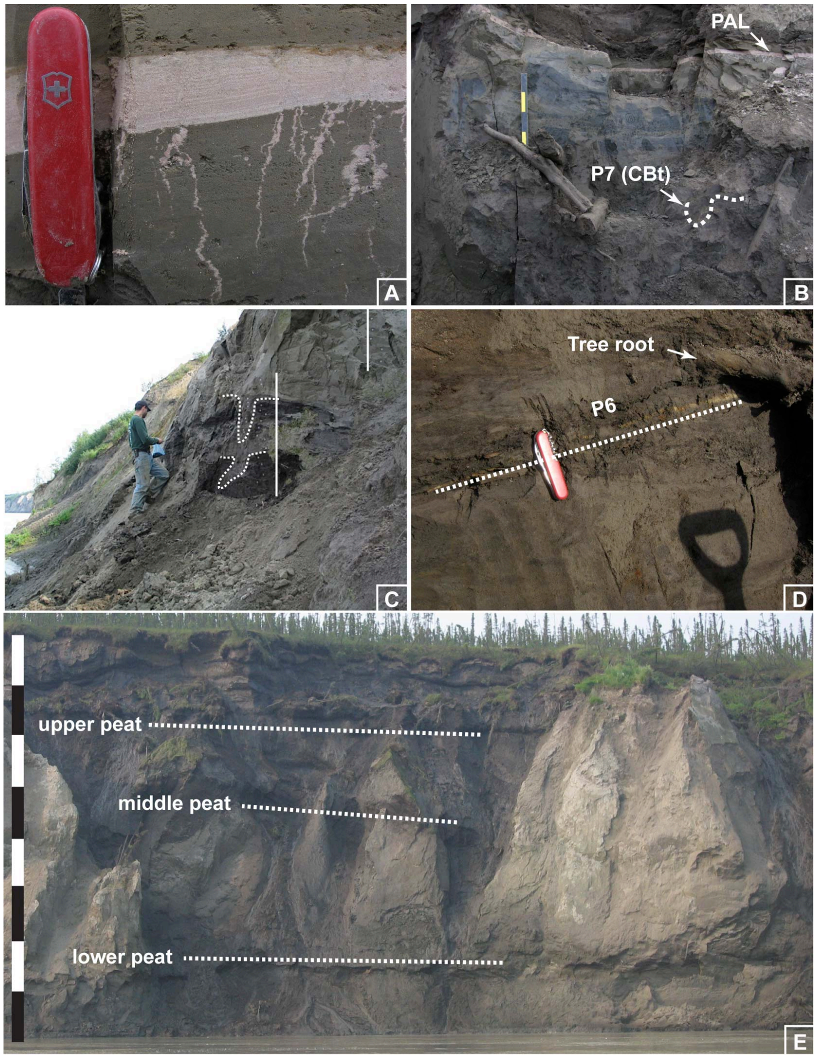

Figure 2.4. **A**- Primary bed of laminated PAL with root casts at Site D_1; **B**- PAL at Site D_1; the paleomagnetic profile at this site begins ~ 20 cm below CBt/P7 and ends above the "lower peat" of Matheus et al. (2003), which overlies PAL at the top of the photograph; **C-** The base of the paleomagnetic transect at Site B_1, indicated by vertical solid lines. Dashed lines outline ice wedge casts that crosscut peat; **D-** P6, highlighted by the dashed line, forms the only traceable bed in the lower peat at Site F. Knife handle = 9 cm. **E**- Steep frozen silt near Site B_1, with laterally continuous peat beds. Height of exposure is ~45 m, each bar ~6 m.

The second traceable feature across much of Palisades East is the PAL tephra (Matheus et al., 2003) and an associated overlying peat and organic-rich silt up to 3 m thick, found at ~13-15 m (Fig. 2.2). PAL tephra is < 20 cm below or reworked into the base of this thick organic unit. We consider this unit to be equivalent to the "lower peat" of Matheus et al. (2003), and use the term throughout this paper. In some locations PAL has been found above a peat (e.g. Site B_2), but the apparently conflicting stratigraphy is clarified at Site D_1 where PAL is present below the lower peat, but also above another distinct organic-rich bed comprising organic-rich silt and large wood macrofossils (Fig. 2.2, 2.4b). However, due to a lack of continuously exposed sections from PAL to river level, the stratigraphic relationship between the organic unit directly below PAL and the river-level peat is not clear. Available data suggest the river-level peat, the organic-rich silt below PAL, and the lower peat are discrete units (e.g. Fig. 2.3), but further mapping when the Yukon River is at low levels would help resolve this stratigraphy.

The ~190 ka SC-F tephra is commonly present within inorganic loess at ~20-23 m, between the lower peat and upper peat of Matheus et al. (2003) and stratigraphically above a semi-continuous organic unit that is probably equivalent to their "middle peat". With the exception of sites B_1 and D_2, we did not map sections with prominent expression of the "middle peat". The SC-F tepha is present three meters above the middle peat at site D_2, with two additional new tephras just below or within the peat.

Old Crow tephra and the MIS 5e forest bed/peat are prominent and generally continuous, though at variable elevation above river level, across much of Palisades East (Matheus et al., 2003; Reyes et al., 2010a). The MIS 5e forest bed/peat, which locally contains rooted, upright *Picea* stumps, is typically separated from the underlying OCt by ~3-7 m of massive inorganic silt with some organic-rich silty interbeds. At the upstream end of Palisades East (Site E; Fig. 2.1), the bluff is considerably lower, and OCt is at ~13 m. Here, thaw slumping reworked a mixed-age assemblage of organic detritus, spanning non-finite to middle Holocene ^{14}C dates, into stratigraphic association with OCt (Reyes et al., 2011). Moving downstream, the Palisades rise in height to a maximum of ~60 m near Site D (Fig. 2.1, 2.2), where OCt is at ~ 45 m. More commonly, bluff height is 40-45 m, and OCt is present ~25-30 m above river level.

Tephrostratigraphy and major-element glass geochemistry

We collected and processed 68 tephra samples over two field seasons in 2005 and 2007. From these, we identified 19 unique tephra beds. Four of the 19 have been identified in previous studies from the Palisades: OCt, SC-F, PAU and PAL (Begét et al., 1991; Matheus et al., 2003). We correlate two Palisades tephra to beds that are well-known from other sites in Alaska: Halfway House tephra (HHt; MIS 5d?) and Chester Bluff tephra (CBt; >124 ± 10 ka, < 500 ± 100 ka) (Jensen et al., 2008; Jensen et al., 2011a; Preece et al., 2011b). One of the Palisades tephra beds correlates to Valley Creek tephra in the Klondike area of central Yukon, where the stratigraphic context of this bed is poorly understood (Morison et al., 1998). Twelve tephra beds are described here for the first time.

Of those, four can be correlated to undescribed beds at other sites in Alaska and are named formally here.

We classify each tephra bed according to a scheme, proposed by Preece et al. (1992, 1999), that divides Yukon-Alaska tephra beds into Type I, Type II, and "other" tephra. Type I tephra are derived from the Aleutian Arc, and can typically be identified by their predominantly platy glass morphology, and relatively low abundance of phenocrysts that are largely comprised of plagioclase, pyroxenes, and Fe-Ti oxides. In contrast, Type II tephra, derived from the Wrangell volcanic field and northern-most Alaska Peninsula volcanoes, have frothy, inflated pumice and > 20% phenocrysts that are predominantly plagioclase, hornblende and Fe-Ti oxides. Geochemically, Type I tephra beds typically contain higher concentrations of FeOt and TiO_2, and lower Al_2O_3 and CaO, than Type II beds at the same SiO_2 weight percent (wt %). Tephra that do not fit in this scheme are simply listed as 'other." Here we describe each Palisades tephra bed from oldest to youngest. Complete geochemical results for all glass shards, including reference samples, are provided in accompanying supplementary data.

Palisades-1 (P1). This tephra, together with Palisades-2a/2b, -3, and -4, is found within multiple samples collected near river level at Site F, and in grab samples from sites B_2 and IB4 (Fig. 2.2); these are collectively termed the 'river level' tephra beds. All were small, reworked wisps of tephra within the river level peat, which at Site F is a compact peat at river level that grades upward into organic-rich silt with interbedded peat pods and abundant plant macrofossils. We identified two main geochemical populations in all samples; two minor geochemical populations were identified that, due to potential correlations to other tephra beds elsewhere in Yukon/Alaska, are considered unique tephra. All samples contained abundant detrital shards with no clear geochemical affinity to any of the identified populations. P1 is the most well-defined geochemical population in these samples, representing a high SiO_2 wt % rhyolite with relatively high FeOt and low Al_2O_3 wt% (Fig. 2.5; Table 2.1). The glass geochemistry, together with a morphology dominated by blocky bubble-walled shards and pumice, suggests a Type I classification.

The P1 tephra bed is correlative to several samples collected by one of us (B.J.L.J.) at other sites in Alaska. It was first identified at the Alyeska Pipeline viewing area (UA 1679) on the Steese Highway near Fairbanks. Later it was recognized in previously unreported samples from Chester Bluff (UA 1542; pop. 3 in UA 1070, 1071, and 1072), and a newly documented sample (pop. 2 in UA 1448) from a section on the Alaska Highway near its junction with the Taylor Highway ("Tetlin Junction" site, c.f. Schaefer, 2002). The tephra is found within organic-rich silt and/or peat units at all of these sites (Fig. 2.6). At the Alyeska Pipeline site, large detrital logs with ring-porous anatomy were collected above the tephra sample. The major-element geochemistry of all samples is indistinguishable (Fig. 2.5; Table 2.1, 2.2), as is the glass morphology. Mineralogy is not diagnostic for this tephra because the small samples contained abundant detrital material. The consistency of the geochemistry, stratigraphy, and additional correlations discussed below, lead us to assert that P1 is a regionally

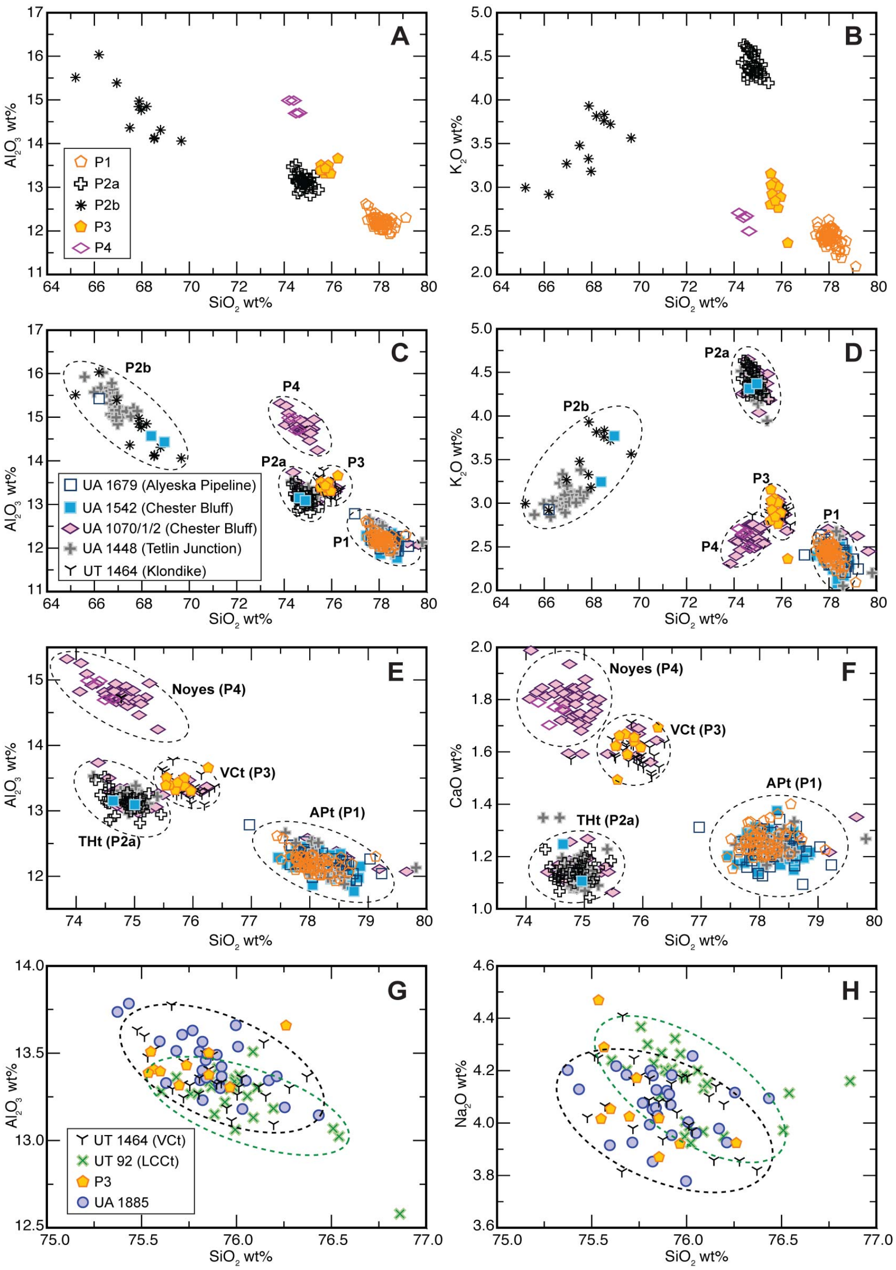

Figure 2.5. Bivariate plots of major-element glass geochemistry for newly identified 'river-level' tephra beds that have been correlated to other sites in Yukon and Alaska; **A,B-** Data from the Palisades 'river-level' tephra; **C,B-** Data from the Palisades 'river-level' tephra, together with reference samples of correlative tephra beds elsewhere in Yukon/Alaska. UA 1679 is the designated reference sample for the Alyeska Pipeline tephra (APt). UA 1542 is APt, but also contains several shards of Taylor Highway tephra (THt) and P2b. UA 1070, 1071, and 1072 contain all the rhyolitic 'river-level' tephra beds, and is the designated reference sample for Noyes tephra. UA 1448 is the designated reference sample for THt, but also contains P2b and APt; **E,F-** A close-up of the rhyolitic 'river-level' tephra beds, indicating discernable differences in major element geochemistry; **G,H-** Reference samples for VCt and LCCt plotted against P3 and UA 1885, a new sample collected at a placer mine in the Klondike goldfields south of Dawson City. Subtle differences in Al_2O_3 and Na_2O wt% suggest that P3 and UA 1885 likely correlate to VCt, rather than LCCt.

Table 2.1. Major-element geochemistry of newly described tephra beds

Sample		**SiO_2**	**TiO_2**	**Al_2O_3**	**FeO_t**	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**Cl**	**H_2O_{diff}**	**n**
Palisades-1	MEAN	78.08	0.22	12.20	1.30	0.06	0.20	1.26	4.11	2.42	0.16	5.18	62
(Alyeska)	STDEV	0.31	0.04	0.13	0.08	0.03	0.02	0.05	0.22	0.10	0.03	0.95	
Palisades-2a	MEAN	74.80	0.27	13.16	1.83	0.05	0.22	1.15	3.89	4.41	0.24	5.20	33
(Taylor)	STDEV	0.28	0.05	0.16	0.10	0.02	0.03	0.04	0.17	0.13	0.03	0.97	
Palisades-2b	MEAN	67.83	1.11	14.73	4.44	0.07	1.10	3.02	4.13	3.50	0.08	2.12	13
	STDEV	1.17	0.10	0.63	0.33	0.04	0.16	0.37	0.28	0.34	0.03	2.29	
Palisades-3	MEAN	75.77	0.20	13.43	1.47	0.05	0.32	1.63	4.07	2.87	0.20	4.73	11
(VCt)	STDEV	0.22	0.03	0.10	0.07	0.03	0.02	0.05	0.18	0.21	0.02	0.83	
Palisades-4	MEAN	74.43	0.18	14.84	1.39	0.07	0.45	1.76	4.21	2.63	0.05	5.82	4
(Noyes)	STDEV	0.18	0.03	0.17	0.05	0.04	0.05	0.04	0.06	0.09	0.02	0.39	
Palisades-5	MEAN	74.48	0.39	13.60	2.03	0.08	0.35	1.47	4.69	2.76	0.16	5.80	38
	STDEV	0.33	0.04	0.15	0.08	0.04	0.03	0.04	0.19	0.09	0.03	1.13	
Palisades-6	MEAN	71.05	0.43	14.49	3.27	0.12	0.38	1.58	5.26	3.21	0.22	5.58	29
	STDEV	1.08	0.19	0.28	0.34	0.04	0.21	0.47	0.45	0.20	0.05	2.00	
Palisades-7	MEAN	74.14	0.24	14.80	1.44	0.04	0.45	1.88	4.15	2.82	0.04	5.58	59
(CBt) Pop.1	STDEV	0.52	0.04	0.30	0.15	0.03	0.08	0.13	0.16	0.11	0.02	1.61	
Palisades-7	MEAN	77.79	0.32	12.59	1.13	0.04	0.25	0.78	3.32	3.76	0.03	5.07	7
(CBt) Pop.2	STDEV	1.24	0.14	0.90	0.27	0.04	0.09	0.38	0.56	0.54	0.02	1.21	
Palisades-7	MEAN	74.53	0.25	14.56	1.41	0.04	0.43	1.76	4.07	2.92	0.04	5.53	66
(CBt) All	STDEV	1.29	0.06	0.79	0.19	0.03	0.10	0.38	0.34	0.35	0.02	1.57	
Palisades-8	MEAN	77.52	0.33	11.88	1.59	0.04	0.26	1.33	3.67	3.12	0.26	4.96	28
	STDEV	0.39	0.04	0.14	0.10	0.02	0.04	0.10	0.20	0.08	0.06	0.79	
Palisades-9	MEAN	66.33	0.45	16.65	4.18	0.14	1.36	4.70	4.52	1.47	0.19	2.38	37
Pop.1	STDEV	1.18	0.04	0.39	0.45	0.03	0.16	0.45	0.25	0.13	0.03	1.64	
Palisades-9	MEAN	77.43	0.20	12.72	1.23	0.09	0.21	1.26	3.53	3.08	0.25	5.38	5
Pop.2	STDEV	0.35	0.07	0.25	0.14	0.02	0.03	0.19	0.29	0.32	0.04	1.12	
Palisades-10	MEAN	69.38	0.65	15.24	3.70	0.15	0.90	3.11	4.67	1.99	0.20	2.70	15
	STDEV	1.30	0.09	0.55	0.22	0.04	0.14	0.61	0.17	0.14	0.03	0.00	
Palisades-11	MEAN	76.16	0.04	14.20	0.56	0.14	0.10	1.04	3.98	3.68	0.09	6.79	96
(Boneyard)	STDEV	0.32	0.03	0.20	0.07	0.03	0.03	0.05	0.32	0.37	0.05	1.04	
Palisades-12	MEAN	75.46	0.38	12.91	1.93	0.04	0.36	1.82	4.21	2.69	0.20	3.14	13
	STDEV	0.26	0.06	0.08	0.09	0.03	0.03	0.06	0.09	0.06	0.03	1.20	
Palisades-13	MEAN	77.39	0.11	12.78	0.78	0.07	0.11	0.68	4.03	3.94	0.11	5.43	34
	STDEV	0.47	0.03	0.25	0.10	0.03	0.03	0.08	0.15	0.17	0.04	0.56	
Palisades-14	MEAN	68.53	0.70	15.29	4.19	0.10	1.09	3.71	4.48	1.71	0.19	2.01	89
Pop.1	STDEV	0.56	0.05	0.18	0.24	0.04	0.09	0.23	0.24	0.07	0.04	1.39	
Palisades-14	MEAN	74.35	0.43	13.41	2.29	0.07	0.44	1.94	4.14	2.71	0.22	3.56	3
Pop.2	STDEV	0.23	0.02	0.09	0.11	0.02	0.01	0.17	0.05	0.15	0.02	1.96	
Palisades-15	MEAN	73.17	0.47	14.18	2.48	0.13	0.55	1.97	5.01	1.87	0.13	1.93	82
(HHt)	STDEV	1.31	0.08	0.33	0.48	0.03	0.16	0.43	0.38	0.11	0.02	1.43	

Palisades-1: UA 1481, 2084, 2110, 2162, 2164, 2165, UA 1314

Palisades-2a: UA 1481, 2110 , 2162, 2164, 2165, UA 1314; *Palisades-2b:* UA 2110, 2162

Palisades-3: UA 1481, 2084, 2110, 2162 (1), 2164; *Palisades-4:* UA 2162

Palisades-5: UA 2084, 2164; *Palisades-6:* UA 2085; *Palisades-7*: UA 1308; *Palisades-8:* UA 1309

Palisades-9: UA 1467, 1468; Palisades-10: UA 1469; *Palisades-11*: UA 1126, 2082

Palisades-12/13: UA 2167; Palisades-14: UA 1147, 1197, 1476, 1477, 1478; *Palisades-15*: UA 1492, 2134

Table 2.2. Major-element geochemistry of reference samples and previously reported Palisades tephra

Sample		SiO_2	TiO_2	Al_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	Cl	H_2O_{diff}	n
HHt	MEAN	73.37	0.48	14.15	2.40	0.13	0.54	1.89	4.94	1.85	0.14	3.41	24
	STDEV	1.46	0.08	0.29	0.57	0.03	0.18	0.50	0.26	0.11	0.02	1.88	
OCt	MEAN	75.40	0.29	13.06	1.74	0.06	0.28	1.51	3.72	3.67	0.27	4.41	283
	STDEV	0.27	0.05	0.15	0.07	0.03	0.03	0.05	0.19	0.10	0.03	1.57	
SC-F	MEAN	72.03	0.26	15.86	1.88	0.05	0.67	2.71	4.60	1.92	0.03	2.61	20
	STDEV	0.67	0.06	0.21	0.20	0.03	0.16	0.18	0.14	0.07	0.02	1.58	
PAL	MEAN	73.52	0.30	13.46	2.11	0.06	0.32	1.52	3.87	4.25	0.60	4.32	23
Pop.1	STDEV	0.43	0.04	0.20	0.14	0.03	0.04	0.12	0.13	0.11	0.05	0.48	
PAL	MEAN	71.15	0.44	14.41	2.78	0.08	0.50	2.17	4.06	3.89	0.52	4.41	2
Pop.2	STDEV	0.42	0.01	0.43	0.02	0.09	0.03	0.03	0.10	0.09	0.11	0.53	
PAL	MEAN	73.33	0.32	13.54	2.16	0.06	0.33	1.57	3.88	4.22	0.59	4.33	25
All	STDEV	0.78	0.05	0.34	0.23	0.03	0.06	0.21	0.14	0.14	0.06	0.47	
CBt	MEAN	74.29	0.24	14.59	1.38	0.04	0.44	1.80	4.26	2.91	0.05	5.40	67
Pop.1	STDEV	0.38	0.04	0.20	0.11	0.03	0.07	0.11	0.19	0.09	0.03	1.85	
CBt	MEAN	78.16	0.23	12.31	0.93	0.04	0.18	0.82	3.00	4.30	0.04	6.01	13
Pop.2	STDEV	0.93	0.09	0.61	0.26	0.03	0.12	0.38	0.52	0.58	0.02	1.30	
CBt	MEAN	74.92	0.24	14.22	1.30	0.04	0.40	1.64	4.06	3.14	0.05	5.50	80
All	STDEV	1.52	0.05	0.90	0.22	0.03	0.12	0.41	0.54	0.57	0.03	1.78	
APt	MEAN	78.19	0.21	12.22	1.22	0.05	0.20	1.23	4.11	2.41	0.16	6.12	54
	STDEV	0.38	0.04	0.16	0.08	0.03	0.03	0.05	0.22	0.09	0.03	1.37	
TT	MEAN	74.91	0.29	13.19	1.78	0.05	0.22	1.15	3.86	4.33	0.25	4.88	34
	STDEV	0.21	0.05	0.12	0.07	0.03	0.02	0.07	0.13	0.13	0.03	0.63	
Noyes	MEAN	74.75	0.17	14.77	1.38	0.05	0.43	1.79	4.00	2.59	0.05	6.34	42
	STDEV	0.33	0.03	0.18	0.09	0.03	0.04	0.10	0.21	0.09	0.05	1.80	
VCt	MEAN	75.84	0.22	13.42	1.41	0.05	0.30	1.60	4.07	2.89	0.20	7.48	28
	STDEV	0.31	0.04	0.30	0.07	0.03	0.02	0.05	0.14	0.06	0.03	0.89	
PA	MEAN	73.55	0.38	13.01	2.36	0.05	0.33	1.51	3.45	4.68	0.68	5.79	90
Pop.1	STDEV	1.28	0.07	0.52	0.31	0.03	0.11	0.28	0.32	0.29	0.11	1.03	
PA	MEAN	64.75	0.76	16.19	4.47	0.09	1.36	3.93	4.46	3.50	0.49	3.21	11
Pop.2	STDEV	1.40	0.09	0.35	0.58	0.03	0.27	0.50	0.18	0.25	0.09	1.80	
PA	MEAN	72.59	0.42	13.35	2.59	0.06	0.45	1.77	3.56	4.55	0.66	5.50	101
All	STDEV	3.04	0.14	1.12	0.75	0.03	0.35	0.82	0.44	0.46	0.12	1.39	
EC	MEAN	69.84	0.60	14.47	3.20	0.09	0.73	2.56	4.14	3.84	0.54	3.00	16
Pop.1	STDEV	0.29	0.05	0.17	0.12	0.03	0.06	0.12	0.26	0.11	0.06	1.83	
EC	MEAN	72.36	0.53	13.47	2.59	0.06	0.48	1.78	3.83	4.36	0.55	4.52	12
Pop.2	STDEV	0.90	0.06	0.39	0.15	0.02	0.08	0.29	0.20	0.22	0.08	1.45	
EC	MEAN	70.92	0.57	14.04	2.94	0.08	0.62	2.22	4.01	4.06	0.54	3.66	28
All	STDEV	1.41	0.06	0.58	0.33	0.03	0.14	0.44	0.28	0.30	0.07	1.82	
Mining Camp*	MEAN	77.09	0.14	13.46	1.04	0.07	0.28	1.53	3.60	2.59	0.21	5.89	24
	STDEV	0.34	0.07	0.22	0.10	0.03	0.04	0.15	0.18	0.14	0.04	1.23	

*Analyses from Pewe et al. 2009

HHt = UA 1453; *OCt* = UA 1434; *SC-F* = UA 207; *PA*L = UT 1280, 1281; *CBt* = UT 1873, 1894, UA 1049 1050; *Alyeska Pipeline (APt)* = UA 1679; *Taylor (TT)* = pop.1 of UA 1448; *Noyes* = pop.1 of UA 1070, 1071, 1072; *Valley Creek* = UT 1464; *PA* = UA 355, 1327, UT 497; *Engineering Creek (EC)* = UA 351

distributed tephra bed, named here the Alyeska Pipeline tephra (APt).

Palisades-2a/b (P2a/P2b). P2a is the second major geochemical population extracted from the river level samples. It is a Type I rhyolite with tight geochemical populations, and glass morphology that is predominantly tricuspate and bubble-walled shards with minor thick-walled pumice. The P2 glass shards also correlate to distinct geochemical populations in mixed samples from the Tetlin Junction site (pop. 1 in UA 1448) and Chester Bluff (pop. 2 in UA 1070/71/72, two shards in UA 1542) (Fig. 2.5, 2.6; Table 2.1, 2.2). Because this geochemical population was first identified in UA 1448, from the Tetlin Junction site, and is the main population in that sample, this regionally correlated bed is named the Taylor Highway tephra (THt).

P2b is a subpopulation of dacitic glass present in two of the river level samples. Trends exhibited in this subpopulation, particularly for K_2O wt%, suggest that P2b may represent a lower SiO_2 wt% population of P2a/THt, although it is geochemically plausible that it may be a unique tephra bed, or even a sub-population of P1/APt. Several shards from APt at Chester Bluff (UA 1542) and the Alyeska Pipeline viewing site (UA 1679) plot with this population. The third major geochemical population present in UA 1448 from the Tetlin Junction site also partially plots within P2b's compositional range (Fig. 2.5c,d).

Palisades-3 (P3). We identified a minor geochemical sub-population in several of the river level samples (Table 2.1), which was subsequently identified in the similarly mixed tephra sample from Chester Bluff (pop.4 in UA 1070, 1071, 1072). These samples plot well with concurrent analyses of reference samples for the Valley Creek tephra (VCt, UT 1464, Preece et al., 2011b) and Last Chance Creek tephra (LCCt, UT 92, Preece et al., 2000, 2011b), both from the Klondike region of west-central Yukon. These two Klondike tephra have nearly identical major-element geochemistry and are more reliably distinguished

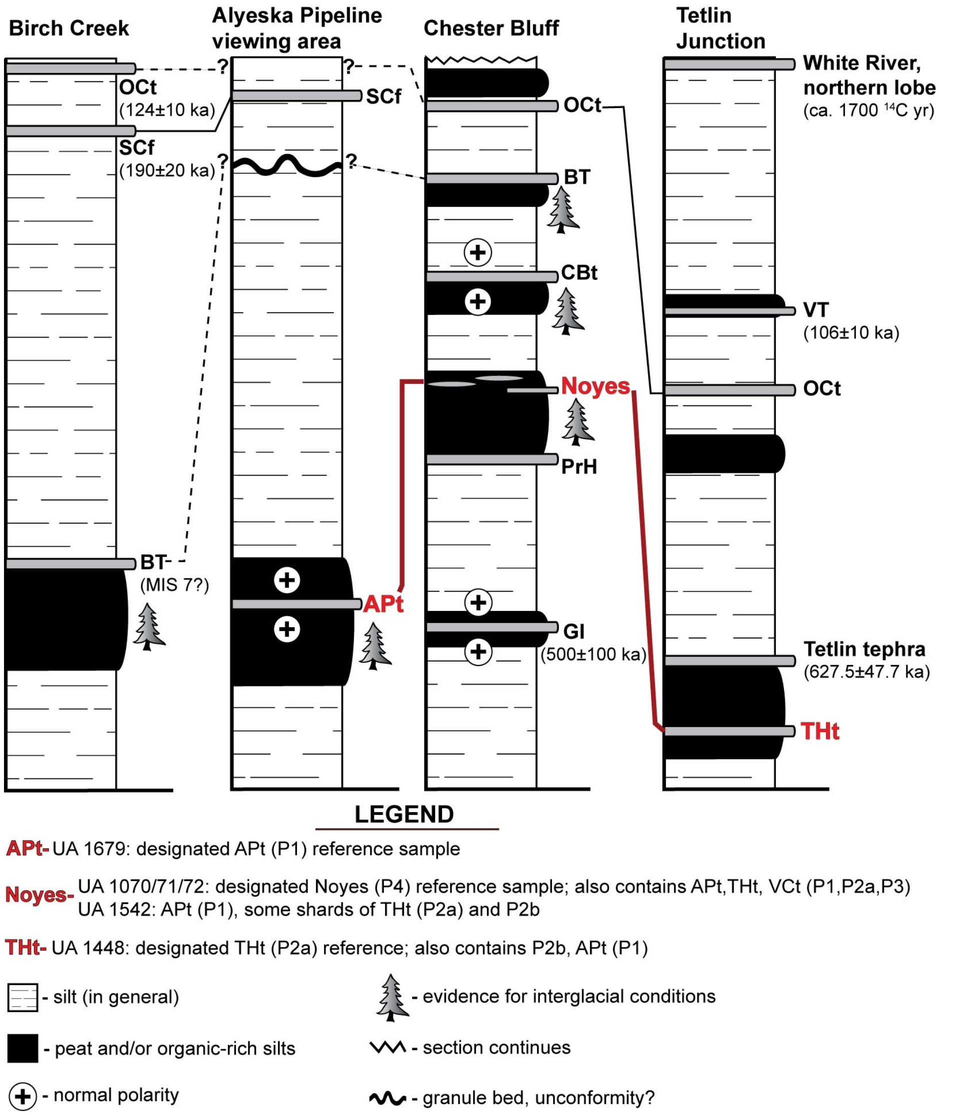

Figure 2.6. Simplified stratigraphic logs of Birch Creek, the Alyeska Pipeline viewing area exposure, Chester Bluff, and the Tetlin Junction site. Portrayed are the major organic units, several of which likely represent interglacial conditions (Jensen et al., 2009, 2011b), and the newly identified, regionally correlated tephra beds (APt, THt and Noyes), and their stratigraphic position relative to other significant tephra beds.

by trace-element composition (c.f. Preece et al., 2011b). However, based on concurrent analyses of VCt and LCCt with some of the river level samples containing this population, subtle differences are present in Al_2O_3 and Na_2O wt% that suggest a more likely correlation with VCt (Fig. 2.5g, h; Table 2.1, 2.2). It is difficult to generalize about P3 glass morphology due to the low number of shards, but analyzed P3 shards were remarkably consistent with VCt glass morphology, which is largely a mixture of inflated and thick-walled platy glass. Thus, limited glass geochemistry and morphology support a correlation of P3 to VCt.

Palisades-4 (P4). This minor sub-population of glass was identified on the basis of only four shards, though we interpret it as a unique tephra due to the geochemical correlation of these four analyses to the primary population in UA 1070, 1071, and 1072 from Chester Bluff, a suite of samples that also contains P1/APt, P2a/THt, and P3/VCt (Fig. 2.5). The major-element glass geochemistry of this tephra bed is consistent with a Type II classification; it is similar to, but clearly distinct from, CBt, which is ~9 m above P4 at Chester Bluff (Fig. 2.6). Because of its apparent regional distribution, here we name this bed the Noyes tephra, for a historical cabin site on the Yukon River near Chester Bluff, where the bed was first discovered.

Palisades-5 (P5). This tephra was collected as two samples (UA 2084, 2164) ~75 cm above river level at Site F, in the river level peat complex (Fig. 2.2). Samples UA 2084 and 2164 contain glass geochemical populations of several of the lowest tephra beds, but none of these lowest beds contain shards of P5. UA 2164 was sampled from a single mm-scale wisp of tephra. Sample UA 2084 was collected from several small creamy-white pods <0.5 cm thick and <5 cm long, which were reworked within organic-rich silt ~50 cm above the compact peat at river level. P5 is a Type I rhyolite with a tight distribution, similar to THt, but with higher Na_2O and lower Cl and K_2O wt% (Fig. 2.7; Table

2.1). Glass morphology is almost entirely tricuspate and bubble-walled shards with some thick-walled pumice. It does not correlate to any known tephra from Yukon or Alaska.

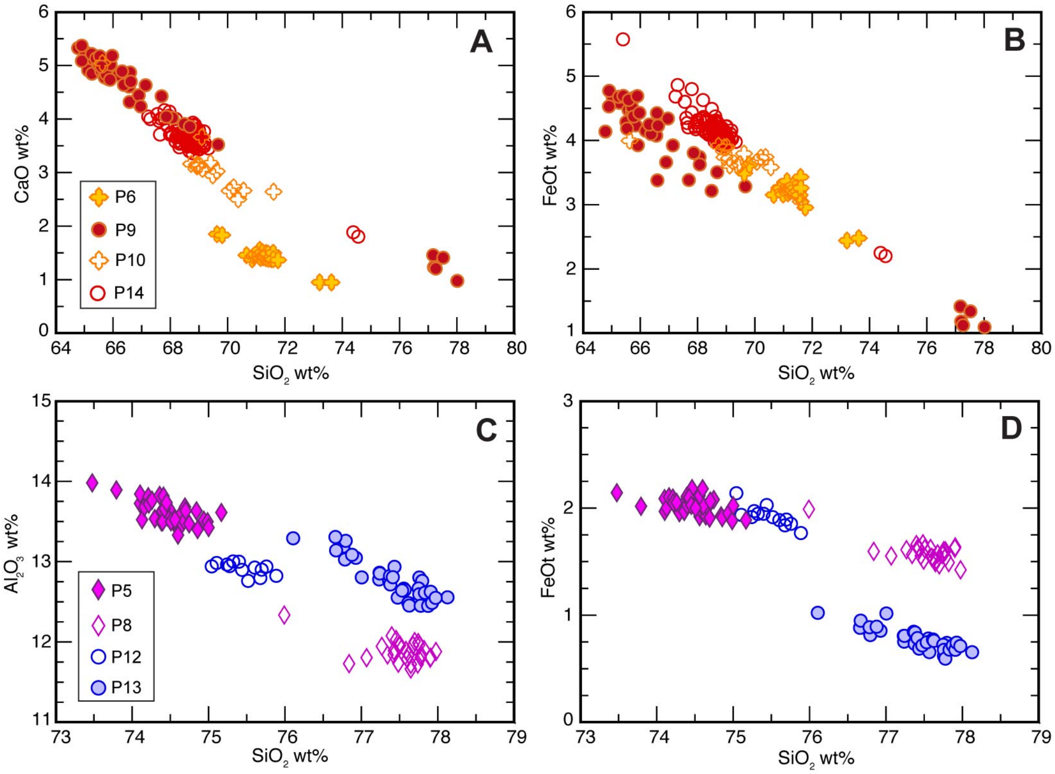

Figure 2.7. Bivariate plots of major-element glass geochemistry for tephra beds at Palisades East that are newly described and not correlated to other sites; **A,B** – Dacitic and rhyo-dacite tephra beds; **C,D**- Rhyolitic tephra beds.

Palisades-6 (P6). This tephra bed (UA 2085) was the only sample collected in the river level peat (Site F) that formed a distinct, traceable unit ~ 2 m above river level (Fig. 2.4). It is creamy yellow in colour, up to 1 cm thick, and laterally continuous within organic-rich silt that contains abundant plant macrofossils and peat lenses, grading down to compact peat at river level. It is ~1 m above the numerous reworked blebs of tephra that collectively comprise the lowermost tephra beds at the Palisades (ie. P1 to P5). The P6 bed is a lower SiO_2

wt % rhyolite (Fig. 2.7; Table 2.1) with glass morphology that is almost exclusively thin tricuspate and bubble-walled shards, and mineralogy dominated by plagioclase and pyroxene, leading to a Type I classification. It does not correlate to any known tephra from Yukon or Alaska.

Palisades-7 (P7). We collected one sample of P7 at Site D_1 (UA 1308), where it was present as a wispy, white, discontinuous lamina <0.1 cm thick, reworked into the upper 20 cm of an organic-rich silt bed containing large wood fragments (Fig. 2.2, 2.4b). Geochemically it is a Type II tephra bed that is correlated to the Chester Bluff tephra (CBt) (Jensen et al., 2008).

The reference bed of CBt at Chester Bluff, on the Yukon River in east-central Alaska (Fig. 2.1; Jensen et al., 2008), is found either directly above or within a major organic unit. Primary deposits of CBt at Chester Bluff are thick (up to 30 cm) and complex, consisting of several layers that vary in glass morphology and geochemistry (Jensen et al., 2008). Shard morphology is predominantly thin-walled frothy pumice with some distinct thick-walled pumice. Blocky pumice with abundant microcrysts is generally limited to the lower, pink layer of CBt at the reference locale, which also contains a high SiO_2 wt% population (i.e. CBt-2 of Jensen et al., 2008). Although mineralogical comparisons are complicated by the distinctly finer texture of the Palisades sample, glass morphology is strikingly similar to the Chester Bluff reference material. More importantly, the full range of major-element geochemistry was noted in Palisades sample UA 1308, including several shards identical to the high SiO_2 wt% geochemical population attributed to CBt-2 (Fig. 2.8c, d; Table 2.1, 2.2). This tephra bed has recently been identified in a suite of samples from Thistle Creek, in the south Klondike, Yukon, greatly expanding its known distribution (S.J. Preece, pers comm.).

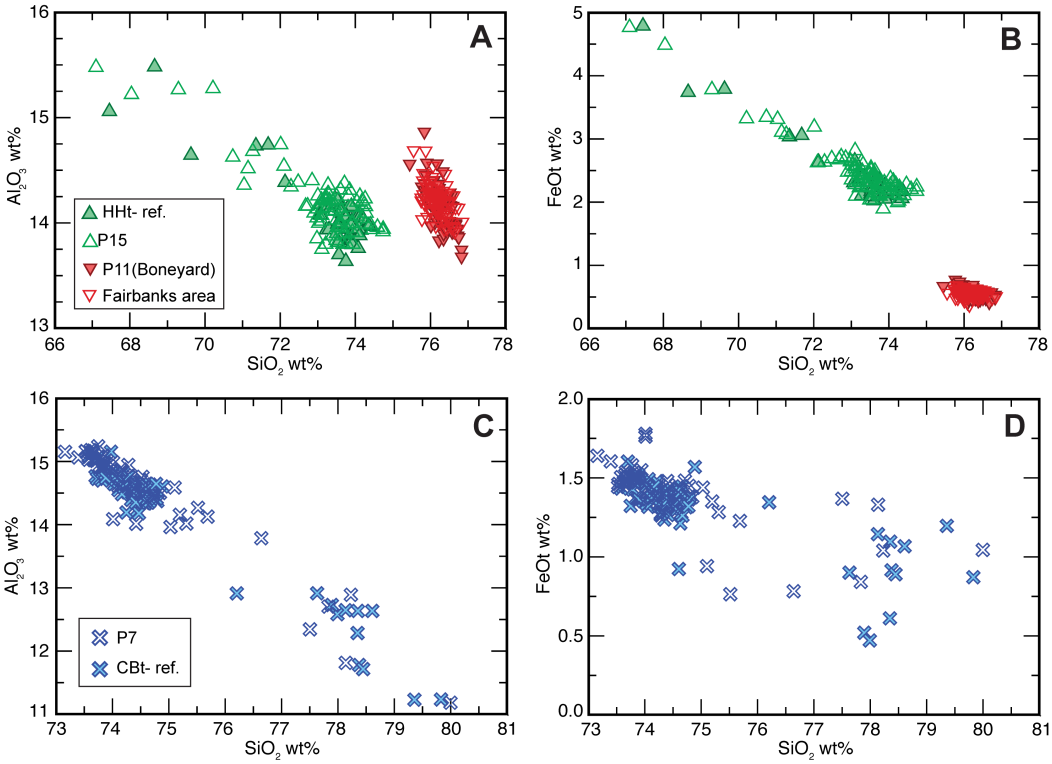

Figure 2.8. Bivariate plots of major-element glass geochemistry for newly identified Palisades tephra beds that are stratigraphically above the river level peat and correlate to other sites in Alaska; **A,B-** HHt reference sample (UA 1453) plotted against P15 (UA 1462, 2134), and the reference sample for P11 (Boneyard tephra, UA 1126) plotted against Fairbanks area samples from Halfway House (UA 1874) and Largent Mine, near Ester (UA 1609)**; C,D** – CBt reference samples from Chester Bluff (UA 1049/1050,UT1873/1894; Jensen et al., 2008) and P7 (UA 1308).

PAL. Together with OCt, this strikingly pink tephra is one of the most prominent tephra beds found at the Palisades. We collected PAL at all logged sites across Palisades East, except Site F, and as two opportunistically collected samples while tracing the tephra laterally across the exposure. It was generally found below a peat, although organic-rich silt and peat deposits were also found below it at several sites (Fig. 2.2). Site D_1, which contains a primary bed of PAL complete with root casts and laminations (Fig. 2.4a), appears to be the least disturbed measured section. There, PAL is overlain by a 1 m thick peat bed, while organic-rich silt with large woody macrofossils is present ~2 m below the tephra (Fig. 2.2, 2.4b). Primary beds of PAL are 2-5 cm thick, but locally the bed is reworked to thicknesses of 10-20 cm. The tephra was first described by Matheus et al. (2003) at the Palisades, with major-element glass geochemistry reported by Westgate et al. (2003). PAL is a Type I tephra bed, with a broad compositional range from ~ 69.5-74.5 SiO_2 wt%, with a slight gap around 72 wt% (Fig. 2.9; Table 2.2, 2.3). Glass morphology is diverse, and includes tri-cuspate and bubble-walled shards, and blocky to frothy pumice. Our analyses of six samples of PAL are indistinguishable from concurrent analyses of the UT 1201 reference material collected by Matheus et al. (2003) (Fig. 2.9). Our correlations are also supported by consistent stratigraphic context across the Palisades. PAL does bear striking morphological, geochemical, and mineralogical similarities to the PA and EC tephra beds of Fairbanks (Westgate et al., 2003), but they can be distinguished on the basis of SiO_2, Al_2O_3, and K_2O wt% (Fig. 2.9).

PAU. We have tentatively identified PAU tephra from a sample collected at Site B_1 (UA 1263). A pink tephra like PAL, it was found cryoturbated, 2-10 cm thick, into the upper contact of a 3 m thick wood-rich peat (Fig. 2.2). This tephra is geochemically indistinguishable from PAL, except that it appears to have a smaller geochemical range (Fig. 2.9a, b), and the average composition is

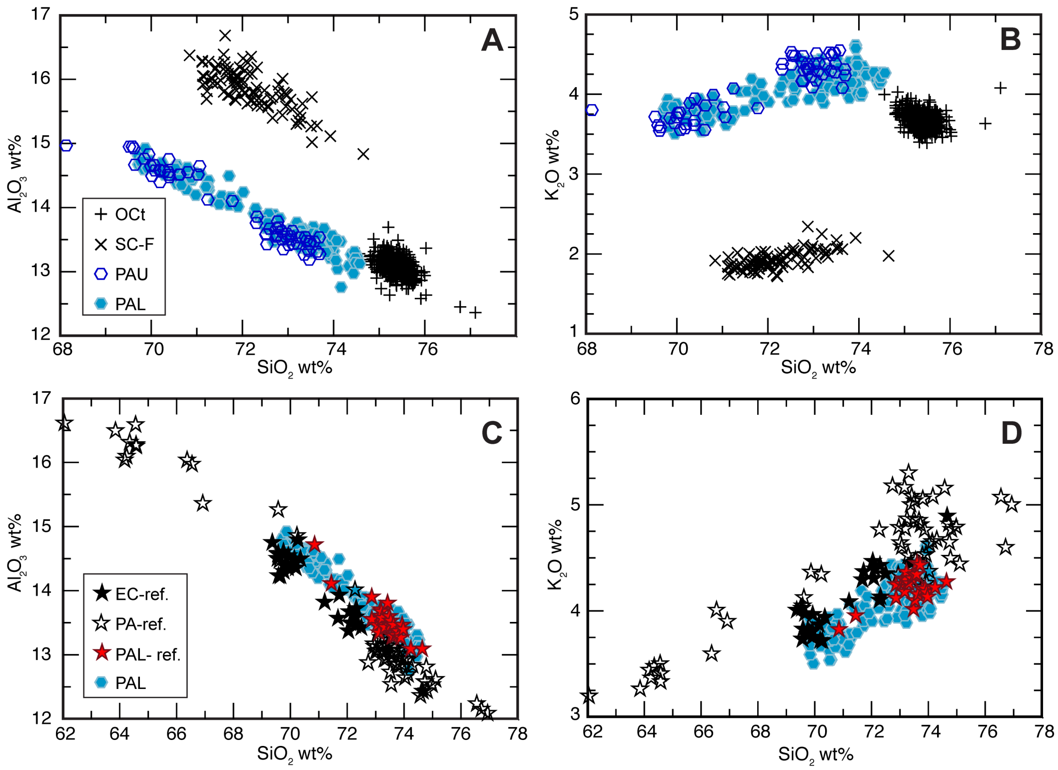

Figure 2.9. Bivariate plots of major-element glass geochemistry of tephra beds previously described at Palisades East; **A,B-** Tephra beds previously described by Matheus et al., (2003); **C,D-** PAL plotted against reference samples of tephra beds of similar composition; EC (UA 351) and PA (UA 355, UA 1327, UT 497), and a PAL reference sample (UT 1201).

Table 2.3. Major-element geochemistry of known tephra beds

Sample		SiO$_2$	TiO$_2$	Al$_2$O$_3$	FeO$_t$	MnO	MgO	CaO	Na$_2$O	K$_2$O	Cl	H$_2$O$_{diff}$	n
OCt	MEAN	75.38	0.29	13.08	1.76	0.06	0.29	1.49	3.69	3.67	0.28	4.16	328
	STDEV	0.31	0.04	0.19	0.08	0.03	0.03	0.07	0.16	0.12	0.03	1.53	
SC-F	MEAN	72.24	0.26	15.79	1.93	0.05	0.67	2.59	4.45	1.97	0.04	3.52	94
	STDEV	0.88	0.05	0.52	0.22	0.03	0.11	0.29	0.24	0.28	0.04	1.87	
PAU	MEAN	73.05	0.35	13.54	2.21	0.06	0.34	1.59	3.97	4.34	0.55	6.30	35
Pop.1	STDEV	0.39	0.05	0.20	0.14	0.03	0.04	0.09	0.15	0.13	0.05	1.60	
PAU	MEAN	70.23	0.54	14.61	3.01	0.08	0.64	2.40	4.32	3.73	0.44	4.63	25
Pop.2	STDEV	0.70	0.06	0.22	0.24	0.03	0.09	0.20	0.15	0.14	0.04	1.86	
PAU	MEAN	71.87	0.43	13.99	2.54	0.07	0.46	1.93	4.12	4.09	0.50	5.61	60
All	STDEV	1.50	0.11	0.57	0.44	0.03	0.16	0.43	0.23	0.33	0.07	1.89	
PAL	MEAN	73.48	0.33	13.48	2.16	0.05	0.32	1.56	3.85	4.21	0.56	4.51	108
Pop.1	STDEV	0.61	0.06	0.22	0.19	0.03	0.06	0.14	0.20	0.15	0.05	1.09	
PAL	MEAN	70.69	0.50	14.48	2.91	0.07	0.57	2.30	4.20	3.81	0.48	3.04	52
Pop.2	STDEV	0.66	0.07	0.22	0.18	0.03	0.09	0.18	0.22	0.15	0.06	1.56	
PAL	MEAN	72.58	0.39	13.81	2.40	0.06	0.40	1.80	3.96	4.08	0.53	4.04	160
All	STDEV	1.45	0.10	0.51	0.40	0.03	0.14	0.38	0.26	0.24	0.07	1.44	

Old Crow (OCt): UA 1124, 1125, 1129, 1198, 1299, 1300, 1303, 1304, 1313, 1422, 1423, 1461, 1463, 1466, 1471, 1473, 1475, 1480, 2083, 2163

Sheep Creek-Fairbanks (SC-F): UA 1297, 1301, 1460, 1464, 1472, 1474

PAU: UA 1263; PAL: UA 1199, 1200, 1201, 1305, 1306, 1307 similar to PAU as published by Matheus et al. (2003) (Table 2.2, 2.3). However, we did not have access to PAU reference material to confirm this correlation with concurrent microprobe analyses. Matheus et al. (2003) report PAU above a peat bed at several measured sections. In contrast, of the seven pink tephra that we collected from similar stratigraphic contexts, UA 1263 was the only tephra that was not identified as PAL.

Palisades 8 (P8). This unique tephra bed (UA 1309) was sampled in the paleomagnetic transect at Site D_1, in a reworked peat ~2 m above PAL tephra. Palisades-8 is yellow-white and discontinuous, forming thin wisps up to 0.2 cm thick and 20 cm long. It has high SiO_2 wt% with relatively high FeOt and low Al_2O_3 wt% (Fig. 2.7c, d; Table 2.1), suggesting a Type I designation. However, glass morphology is inconclusive, consisting primarily of blocky, thick-walled pumice, with some frothy pumice and platy glass. It does not correlate to any known tephra from Yukon or Alaska.

Palisades 9 (P9). This tephra (UA 1467, 1468) is present at two of the three gullies that comprise Site D_2, including one gully where it is ~10 cm below P10. The tephra is present as pink-orange semi-continuous pods ~0.5-3 cm thick that are within, or up to 40 cm below, the base of the Matheus et al. (2003) middle peat (Fig. 2.2). Major-element geochemistry suggests a Type I classification. Most analyzed shards are dacitic, with rare rhyolitic shards that likely represents a second geochemical population from the same eruption (Fig. 2.7a, b; Table 2.1). This is consistent with the many Type I tephra beds that have bimodal major-element glass geochemistry (e.g. Finney et al., 2008, Jensen et al., 2008, Kaufman et al., 2012). Glass morphology is distinct; the dominantly thick-walled pumice contains such abundant microcrysts that vesicles are deformed, and pure glass analyses are difficult. Some brown glass is present, and mineralogy consists of plagioclase, which is frequently zoned, and pyroxene. It does not correlate to any known tephra from Yukon or Alaska.

Palisades 10 (P10). This tephra (UA 1469) was only found at one of three gullies that comprise Site D_2 (Fig. 2.2). It forms white, discontinuous mm-scale wisps within organic-rich silt directly below the ~1 m-thick middle peat (Fig. 2, 3; Matheus et al., 2003). It is a rhyo-dacitic Type I tephra bed, consisting of thick walled pumice, tri-cuspate and bubble-walled shards. Mineralogy was difficult to determine because of the large amount of detrital material in the small sample (Fig. 2.7a, b; Table 2.1). It does not correlate to any known tephra beds from Yukon or Alaska.

Sheep Creek-Fairbanks. Originally described in the Fairbanks region, SC-F is a Type II tephra bed that is typically found several meters below OCt within inorganic loess (e.g. Berger et al., 1996; Preece et al., 1999). We collected SC-F ~ 6 m below OCt at Sites IB4, C, and D_2 (Fig. 2.1, 2.2), and earlier collected it in similar stratigraphic context at Palisades West (Reyes et al., 2010b). Only at Site D_2 was SC-F found above the middle peat unit of Matheus et al. (2003). The six samples identified as SC-F were all analyzed concurrently with reference material, or a sample that had previously been identified as SC-F, to minimize miscorrelation stemming from the numerous late Quaternary Sheep Creek-type tephra beds known from elsewhere in eastern Beringia (Westgate et al., 2008).

All Palisades samples had major-element geochemistry (Fig. 2.9a, b; Table 2.2, 2.3), glass morphology, and mineralogy consistent with SC-F.

Palisades-11 (P11). This bed was found within inorganic loess 50-75 cm below OCt at two measured sections at Site B (UA 1126, 2082; Fig. 2.2). It is a diffuse, discontinuous, grey tephra with a maximum thickness of 0.3 cm. Its stratigraphic position relative to SC-F is uncertain since they have not been found in the same section. However, we tentatively place SC-F stratigraphically below P11 because at all sites where it is found, P11 is within 1 m of OCt, while SC-F is generally 2-6 m below OCt (Fig. 2.2, 2.3). P11 has unique glass geochemistry, with relatively high Al_2O_3 wt% and low FeO_t wt% compared to other Yukon-Alaska tephra beds at this SiO_2 wt % range, including Type II beds. The glass morphology is also distinct, consisting almost entirely of blocky, thick-walled pumice, often elongate, with common microcryts and small, evenly distributed vesicles. Phenocrysts are rare and are dominantly plagioclase with minor amphibole. Since our work at the Palisades in 2005 and 2007, one of us (B.J.L.J.) has sampled this tephra at two sites near Fairbanks: at Halfway House, a well studied site ~75 km west of Fairbanks (e.g. Preece et al., 1999), and a new Gold Hill Loess exposure at the Largent placer mine near Ester, 12 km west of Fairbanks. Both of these newer samples are geochemically indistinguishable from P11 (Fig. 8a, b), have the same distinct glass morphology, and are found within inorganic loess ≤ 1 m below OCt. Given the regional distribution of this tephra bed, we formally name it the Boneyard tephra, based on the informal local name for the Palisades, where it was first discovered.

Palisades-12 and 13 (P12/P13). We identified two unique tephra within one sample from a yellowish diffuse bed up to 0.5 cm thick, in a cryoturbated peaty bed ~ 1.2 m below OCt at Site IB4 (UA 2167; Fig. 2.2). These tephra were not found in association with P11, thus their stratigraphic order is not clear. Both P12 and P13 are rhyolitic, but they form two distinct, coherent geochemical populations that do not fall on trends that would be expected if they were two populations from a single eruption (Fig. 2.7c, d). Both have glass morphology typical of Type I tephra beds, dominated by platy glass, tricuspate shards and thick-walled pumice. Glass geochemistry of P12 supports this Type I classification. However, P13 is a high (>77) SiO_2 wt% tephra bed that is in a compositional range of Type I and Type II tephra where they tend to overlap, thus its classification would require further geochemical investigations (e.g. Westgate et al., 2009; Preece et al. 2011b). Neither of these two tephra correlate to any known bed from Yukon or Alaska.

Old Crow tephra. This tephra can be traced across both Palisades East and West, and is generally present in most measured sections; we identified 20 unique occurrences of OCt at Palisades. OCt is always located stratigraphically below (≤ 6 m), or locally re-worked into, the MIS 5e peat/forest bed. Its tightly-constrained rhyolitic composition (Fig. 2.9a, b), glass morphology, and stratigraphic context are well-documented at the Palisades (Begét et al., 1991; Matheus et al., 2003; Reyes et al., 2010a, 2010b, 2011) and elsewhere in eastern Beringia (e.g. Preece et al., 2011a).

Palisades-14 (P14). This unique tephra bed was found at Site B, within both the paleomagnetic transect (UA 1147, 1197) and at an adjacent gully (UA 1477, 1478), and at Site D_2 (UA 1476). At all three sites it is found within the MIS 5e forest bed (~28-30 m above river level; ~45 m at Site D_2), which contains large *Picea* logs that are locally upright and rooted (Reyes et al., 2010b). The tephra is white to pink, and is present as discontinuous pods up to 1 cm thick. Similar to P9, P14 has Type I dacitic composition with a minor rhyolitic component (Fig. 2.7a, b). Glass shards are typically tri-cuspate or bubble-walled. Pumice is also present and commonly elongate, and brown glass is present. Mineralogy consists largely of orthopyroxene and plagioclase. It does not correlate to any known tephra from Yukon or Alaska.

Palisades-15 (P15). Two samples in the eastern half of the Palisades correlate to the Halfway House tephra (HHt), known from the Fairbanks region. Sample UA 2134 was collected ~25 m above river level on the west side of a major gully that forms Site E (Reyes et al., 2011). The white tephra bed was reworked into pods up to 2.5 cm thick and 30 cm long, 15 cm above a cryoturbated peaty soil with a distinct B-horizon. The tephra was not in direct stratigraphic association with any other tephra, though OCt was found on the eastern side of the gully ~15 m above river level (Reyes et al., 2011). Further west, at Site D_2, we collected UA 1462 ~50 m above river level and stratigraphically above OCt and the inferred MIS 5e peat (Fig. 2.2). Both samples are rhyolitic Type I tephra beds, with glass morphology dominated by tri-cuspate and bubble-walled shards and thick-walled pumice. Glass shards are relatively blocky, and microcrysts were common. HHt is named after its reference section at Halfway House, ~50 km west of Fairbanks on the George Parks Highway (Preece et al., 1999). At this site it is present above OCt and the MIS 5e soil, but ~75 cm below a second paleosol that has been interpreted as representing a younger warm sub-stage of MIS 5 (Jensen et al., 2011a). Thus, HHt likely dates to the last interglaciation *sensu lato*, potentially MIS 5d (Preece et al., 1999; Jensen et al. 2011a). The stratigraphic context of UA 2134 and 1462 at Palisades, together with glass major-element geochemistry and glass morphology that are indistinguishable from reference material, indicate a robust correlation to Halfway House tephra (Fig. 2.8a, b; Table 2.2, 2.3).

Paleomagnetic measurements

Inclination and declination values for the two paleomagnetic transects at Sites B_1 and D_1 are shown in Figure 2.10 (all data available in supplementary). These results show that, with the exception of a short event in Site B_1, all samples are normally magnetized and suggest that most of the Palisades sediments were deposited during the Brunhes chron (i.e. < 780 ka). The single reversal between 26 and 27 m above river level at Site B_1 is unambiguous in both declination and inclination measurements (Fig. 2.10, 2.11), and likely represents a short excursion event during the Brunhes. The apparent noise in the declination data (Fig. 2.10) for the lower part of the record is due in part to the low intensity of the horizontal component of the geomagnetic field. This is a result of the steep

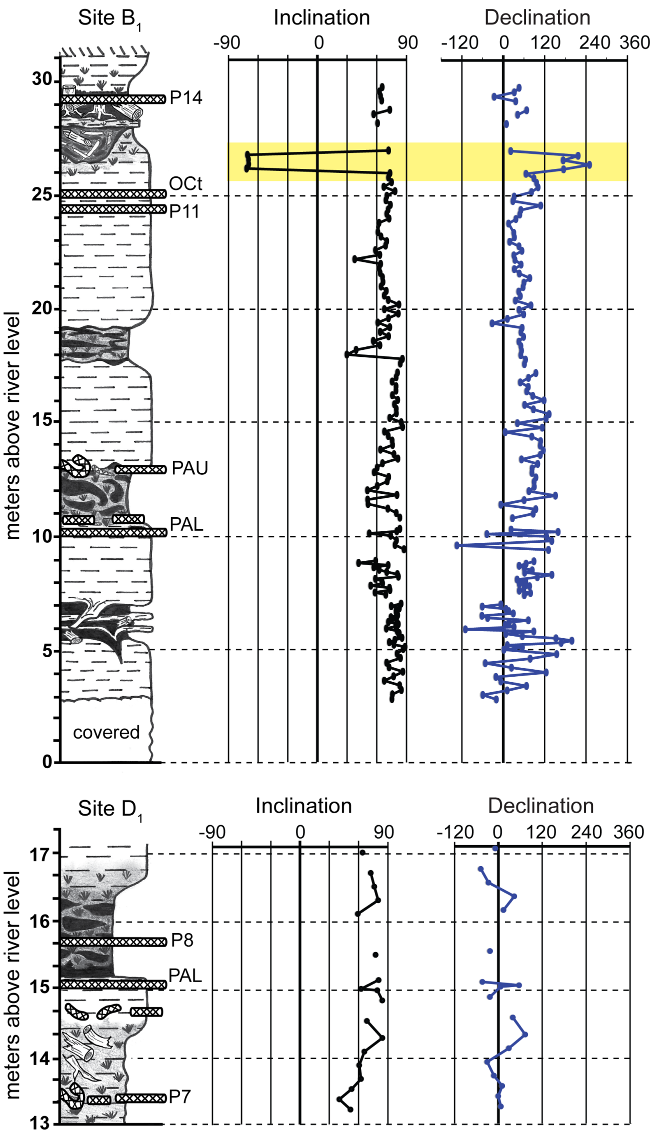

Figure 2.10. Paleomagnetic results plotted with stratigraphic logs from the measured transect. Gaps are the result of samples excluded due to MAD values >5, or sections were the organic content of section did not allow for the collection of a sample. The brief reversal that likely represents the Blake event is highlighted in yellow.

inclinations for this part of the transect, which allow the field direction to pass through vertical and, thus, simulate declination reversals. This can be seen clearly in the stereographic projection of the data (Fig. 2.11).

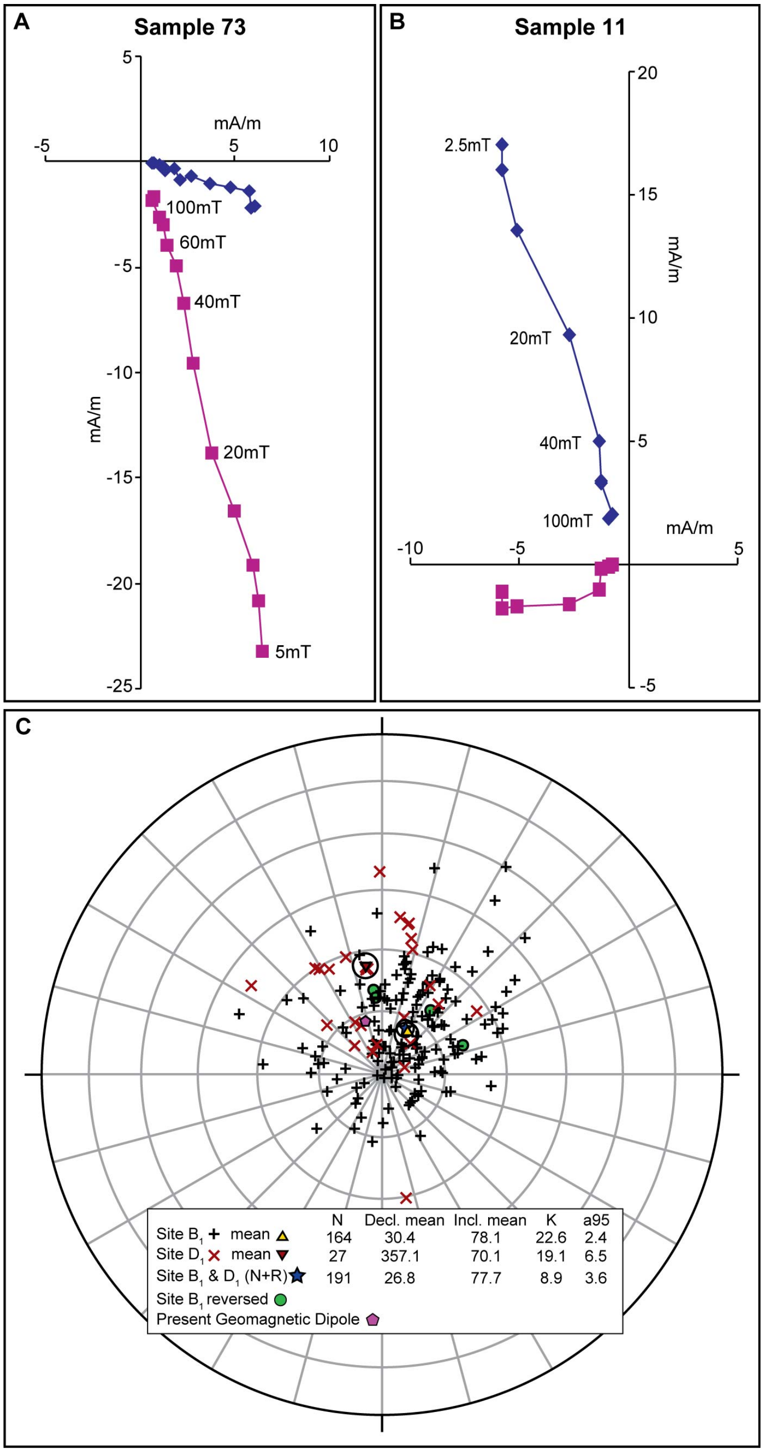

Figure 2.11. A, B: Z-plot orthogonal projections for samples 11 (reversed) and 73 (normal) showing typical behavior of samples during demagnetization. Axes for declination (diamonds) are NS, EW, North up. Axes for inclination (squares) are projected onto the plane containing the mean vector, thus showing the true inclination with respect to the horizontal (i.e. normal field down). **C:** Steroplot showing all samples analyzed in this study.

Discussion

Stratigraphy

Matheus et al. (2003) presented a stratigraphic framework for Palisades East, which included five lithostratigraphic units, three prominent peat horizons (i.e. upper, middle and lower), and at least one major unconformity separating early Pleistocene and late-middle Pleistocene sediments (Fig. 2.3a). Our new tephrostratigraphy is consistent with much of the Matheus et al. (2003) framework, with key adjustments in the lower third of the Palisades stratigraphic record (Fig. 2.3b).

Starting at the base of the Palisades, below the "unconformity", are their Units 1 and 2, separated by the lower peat (Fig. 2.3a). The lower peat, as described by Matheus et al. (2003), generally lies above PAL, and ranges from river level to 14 m. We suggest that the river level peat is, instead, a separate unit that can be traced across most of the Palisades. This river level peat is likely only fully exposed at low river levels, and is rich in woody macrofossils. Several of the tephra samples collected at this level contained abundant *Picea* needle fragments, which suggests that like the upper, middle and lower peats at the Palisades, it represents an interval of interglacial climate (Matheus et al., 2003). Our separation of the lower and river level peats is supported by the tephrostratigraphy, where unique suites of tephra are associated stratigraphically with the river level peat and the lower peat. An additional line of evidence in support of unique river level and lower peats is the presence of a semi-continuous organic unit - comprising organic-silt, cryoturbated peat blebs, large wood fragments - between PAL and the river level peat. Unfortunately, sediments from river level to PAL are poorly exposed or inaccessible, so the continuity and stratigraphic context of the organic unit directly below PAL is not yet firmly established.

Between the lower and middle peat, Matheus et al. (2003) argue that the presence of one, or possibly several, large unconformities is required to reconcile the relatively seamless stratigraphy of alternating peat (interglacial) and massive silt (glacial) units, with their identification of the early Pleistocene PA (2.02 ± 0.14 Ma), EC and MC tephra beds, and interpretation of PAL tephra as similarly aged. The absence of PA, EC and MC tephra beds at our multiple measured sections, together with our paleomagnetic and tephrostratigraphic evidence, suggests early Pleistocene sediments are not present across much of the Palisades. Therefore, the invocation of one or more large unconformities spanning many 100,000s of years is not necessary.

The ‘unconformity’ defines the contact between Unit 2 and Unit 3 of Matheus et al., (2003); OCt, SC-F and the discontinuous peat underlying SC-F (i.e. middle peat, tentatively assigned to MIS 7) are within Unit 3, which is predominantly massive loess (Matheus et al., 2003; Fig. 2.3). The MIS 5e peat/forest-bed (i.e. upper peat) defines the contact between Unit 3 and Unit 4. Unit 4, above the MIS 5e peat/forest-bed, was assigned to MIS 2-4 by Matheus et al. (2003). However, the presence of HHt at Sites D_2 and E suggests that sediments dating to younger sub-stages of MIS 5 are present locally. Unit 5 of Matheus et al. (2003) represents Holocene loess and peat accumulation and is not described here.

Paleomagnetism

The normal polarity of Palisades sediments at both transects suggests that they fall within the Brunhes chron (> 780 ka). At Gold Hill in Fairbanks, the glass fission-track age of PA tephra (ca. 2 Ma), and its presence in loess with reverse magnetic polarity, place PA firmly in the 2.58-0.78 Ma Matuyama reversed chron (Westgate et al., 1990). Thus, PAL cannot be co-magmatic with PA because sediment surrounding PAL at Sites B_1 and D_1 are magnetically normal.

The small reversal above OCt (124 ±10 ka), and ~20 cm below the MIS 5e upper peat, probably represents the well-defined Blake event (e.g. Smith and Foster, 1969; Fig. 2.10). Various age determinations for the Blake event include an estimate of 123 ± 3 ka from North Atlantic and Arctic marine sediment cores (Lund et al., 2006), and a mean $^{40}Ar/^{39}Ar$ age of 120 ± 16 ka on globally distributed lava flows (Singer and Hoffman, 2005). There are a number of similar reversals between the Blake event and the Brunhes-Matuyama boundary, most of which are very short and could be difficult to find in loess deposits. However, some of these transient events, such as the Pringle Falls event (211±13 ka) and a series of events ca. 600-500 ka (e.g. Laj and Channell, 2007; Singer et al., 2008), may be present in Alaskan loess records. The paleomagnetic record of Westgate et al. (1990) from the Gold Hill Loess near Fairbanks, Alaska, shows a short reversal about 2 meters below OCt, which would place it close to the expected location for the Pringle Falls reversal. Recent high resolution re-sampling of Gold Hill and Halfway House has identified additional events, including a likely candidate for the Skálamælifell event (ca. 96 ka, Jicha et al., 2011), but shows no record of the Blake (Jensen et al., 2011b; Evans et al., 2011, 2012). Paleomagnetic records from Imuruk Lake on the Seward Peninsula, lacustrine deposits at Koyukuk Bluff (KY11) in west-central Alaska, and loess at Halfway House, show an excursion just below OCt that was originally interpreted as the Blake (Westgate et al, 1983, 1985; Schweger and Matthews, 1985). However, new age determinations and paleoecological constraints on OCt place it in latest MIS 6 (Reyes et al., 2010b; Preece et al., 2011), which suggests that the Blake event almost certainly postdates the deposition of OCt. Thus, these previously recognized excursions must represent an older event, such as Pringle Falls, and our recognition of a brief magnetic reversal event at Palisades East may represent the first discovery of the Blake in Yukon and Alaska.

Regional tephra correlations

Problematic at the time of analyses was the repeated occurrence of samples that contained multiple populations of tephra beds, raising the possibility that some samples could have been contaminated during collection and processing steps. However, systematic contamination seems unlikely because many of the samples were collected and analyzed over the course of five years. We further reject the possibility of systematic sample contamination because the mixed-population samples correlate to other similarly mixed tephra from other sites in the region. Some of these other mixed tephra, such as three samples collected from a single peat unit at Chester Bluff (UA 1070, 1071, 1072), were analyzed much earlier but not formally described because of their glass geochemistry was initially inconclusive (e.g. Fig. 3 of Jensen et al., 2008, the "undescribed tephra"). Indeed, the existence of samples from multiple sites that contain the same mixed glass populations provides robust evidence for the correlations. The identification of these new tephra beds at previously studied sites now adds additional age constraints to sediments in the lower third of Palisades East.

Age control on 'river level' tephra beds

We correlate Palisades tephra bed P1 to Alyeska Pipeline tephra (APt), which we also recognize as a geochemical population present in five additional samples from two other sites elsewhere in eastern Beringia. The APt reference locale is a partially overgrown exposure of interbedded organic units and loess, ~13 m high, behind the Alyeska Pipeline viewing area on the Steese Highway near Fairbanks. The tephra is in cryoturbated organic-rich silt and peat with large wood fragments. Six metres of overlying silt separate APt from a ~10 cm thick bed of angular pebbles, granules and oxidized silt that is interpreted as an unconformity. The Sheep Creek-Fairbanks tephra is 3 m above this unconformity, providing a minimum age to the section (Fig. 2.6). Six paleomagnetic samples were collected through APt that are normally magnetized (see supplementary data).

APt is also present in four samples from two measured sections at Chester Bluff, in eastern Alaska (Jensen et al., 2008). Three of the samples (population 3 of UA 1070, 1071, 1072) were collected from a dry compressed peat 9 m below CBt and 11 m above GI tephra (500 ± 100 ka; Preece et al., 2011b). A fourth APt sample (UA 1542) was found at the second section within thin alternating beds of peat and inorganic silt that grade down into thick peat containing Preido Hill tephra (PrH), a tephra that is also present at the first site, below UA 1070/71/72, but above GI (Jensen et al., 2008; Fig. 2.6).

APt is also present as the secondary population in a tephra (UA 1448) collected at the Tetlin Junction site within organic-rich sandy silt. The sample containing APt is 1.5 m below the Tetlin tephra, which is dated by $^{40}Ar/^{39}Ar$ on hornblende to 627.5 ± 47.7 ka (Schaefer, 2002; Fig. 2.6). The main population in UA 1448, named Taylor Highway tephra (THt), correlates to tephra P2a at Palisades and also forms a distinct population in Chester Bluff samples UA 1070, 1071, and 1072. This cross-correlation places APt and THt between the Tetlin (627.5 ± 47.7 ka) and GI (500 ± 100 ka) tephra beds (Fig. 2.6). The apparent inverted ages for Tetlin and GI tephra are reconcilable given their large 1σ uncertainty terms.

Another ‘river level’ tephra, P3, correlates to Valley Creek tephra (VCt; Fig. 2.5), a tephra bed first identified in the lower reaches of the Stewart River basin in Yukon, within colluvium that unconformably overlies pre-Reid (a local term for undifferentiated pre- MIS 6 glaciations; e.g. Ward et al., 2008) outwash gravels (Morison et al., 1998, Preece et al., 2011b). It has also recently been identified in a ~1 km long discontinuous placer mining cut on Dominion Creek, in the Klondike goldfields south of Dawson City, Yukon (UA 1885; Fig. 2.5). There, VCt is cryoturbated within normally magnetized peaty organic-rich silts (see supplementary data). This exposure also contains PrH at its upstream end, and the Gold Run (740 ± 60 ka), Hollis (700 ± 70 ka), and Hollis 2 (630 ± 80 ka) tephra beds at its furthest downstream end (Westgate et al., 2009, 2011). Although VCt is not in direct stratigraphic association with these beds, their normal magnetization and presence in the same exposure support a middle Pleistocene age estimate for VCt. It is important to note that LCCt, which is hard to differentiate from VCt by major-element geochemistry alone (Fig. 2.5), was originally collected at a placer mining exposure informally known as MIBEN2 (Preece et al., 2000). The reference sample for PrH was also collected at the MIBEN2 cut, at a different time, but in a similar stratigraphic context. Thus, both LCCt and VCt are stratigraphically linked to PrH in the Klondike region and at Chester Bluff, suggesting that LCCt and VCt are middle Pleistocene in age (Preece et al., 2000, 2011b; Jensen et al., 2008).

We correlate four shards of P4 tephra at Palisades to Noyes tephra, which is the main geochemical population in Chester Bluff samples UA 1070, 1071, and 1072. These Chester Bluff samples also contain populations of APt (P1), THt

(P2a), and VCt (P3), lending further support to the tentative geochemical correlation of P4 to Noyes tephra.

To summarize, the ‘river level’ tephra beds correlate to external sites where they are deposited in sediments that are unequivocally middle Pleistocene in age. These tephra are younger than GI (500 ± 100 ka) but older than Tetlin (627.5 ± 47.7 ka), and in sediments with normal polarity. The presence of multiple tephra beds in individual samples is likely the result of two factors: (1) several large eruptions occurring over a relatively short period of time, and (2) reworking and mixing due to a slower rate of loess deposition over interglacial periods (e.g. Muhs et al., 2003).

The age of Chester Bluff tephra

Our new tephrostratigraphy at the Palisades is relevant to the age of Chester Bluff tephra (CBt). This tephra has now been recognized along a ~500 km long transect from the Palisades, through its reference locale at Chester Bluff in east-central Alaska (Jensen et al., 2008), to the south Klondike, Yukon (S.J. Preece, pers. comm.) (Fig. 2.1). At its reference locale of Chester Bluff, CBt is above - and locally reworked into - a prominent interglacial peat bed (Bigelow, 2003; Jensen et al., 2011b; Fig. 2.6). The peat and tephra are within normally magnetized sediments, and Old Crow (124 ± 10 ka) and GI (500 ± 100 ka) tephras provide minimum and maximum ages, respectively (Froese et al., 2003; Jensen et al., 2008; Fig. 2.6). The Biederman tephra (BT) is present above CBt at Chester Bluff and Birch Creek (Jensen et al., 2009), a site in east-central Alaska (McDowell and Edwards, 2001). At both sites BT is in the same stratigraphic position; below OCt, and cryoturbated within the upper contact of a peaty organic-rich silt bed. The SC-F tephra is also present between OCt and BT at Birch Creek (Fig. 2.6). The peaty organic-rich silt associated with BT at Birch Creek is rich in *Picea* macrofossils, including well-preserved logs. Pollen samples from the equivalent unit at Chester Bluff contain up to 38 % *Picea* pollen, suggesting this organic silt/peat unit represents an interglacial with a minimum age of MIS 7, based on the presence of SC-F above BT at Birch Creek. Thus, the corresponding minimum age for CBt is early MIS 8 or late MIS 9 (Jensen et al., 2009; Jensen et al., 2011c), with a loose maximum age provided by GI tephra at Chester Bluff, and the underlying APt/P1, THt/P2a, VCt/P3 and Noyes/P4 beds at the Palisades and Chester Bluff.

Conclusion

Palisades East is an ~8 km long exposure of perennially frozen sediments, predominantly loess, interbedded with multiple peat and forest beds, tephra, relict ice and vertebrate fossils. This site contains several tephra beds previously described in the literature, including Halfway House tephra (MIS 5), Old Crow tephra (124 ± 10 ka), SC-F (190 ± 20 ka), and CBt (minimum age ca. MIS 9) (Berger et al., 1996; Jensen et al., 2008, 2011a,c; Preece et al., 2011a).

We have identified four tephra beds at multiple Palisades sections near river-level that correlate to Chester Bluff in east-central Alaska (Jensen et al, 2008), the Alyeska Pipeline viewing area in Fairbanks, the Tetlin Junction site on the Alaska Highway near Tok (Schaefer, 2002), and the Klondike goldfields south of Dawson City, Yukon. The correlated tephra beds include three previously undescribed beds we here named the Alyeska Pipeline (APt), Taylor Highway (THt) and the Noyes tephra beds. The fourth is correlated to Valley Creek tephra (VCt), known from the Klondike region. All four of these tephra are present in magnetically normal sediments and are stratigraphically associated with other dated middle Pleistocene tephra beds. In particular, APt and THt are found stratigraphically below Tetlin tephra (627.5 ± 47.7 ka), and above GI (500 ± 100 ka). We also described and identified a new regionally distributed bed, the Boneyard tephra, within ~75 cm of OCt. This tephra is also present at two sites in the Fairbanks region. Finally, we described and identified an additional eight new tephra beds that have not yet been reported elsewhere, including a new tephra bed (P14) within the MIS 5e forest bed.

In our re-examination of Palisades East we were able to recollect PAL and PAU, but did not locate the PA, EC or MC tephra described by Matheus et al (2003). Rather than the dating to the early Pleistocene, PAL must be older than ~200 ka but younger than ~500 ka, based on: the direct stratigraphic association between PAL and the underlying APt, THt, and CBt beds; two paleomagnetic transects through PAL that yielded normal polarity; and the presence of SC-F above PAL. Small pockets of older sediments are almost certainly present at Palisades East, to account for the presence of PA tephra.

The small reversal event present in loess above OCt and directly below of the MIS 5e forest bed likely represents the Blake geomagnetic event. This is the first reported occurrence of this excursion in Alaskan loess records, and joins a growing body of evidence that excursions may be more common in these loess records than previously thought (e.g. Westgate et al, 1990; Evans et al., 2011; Jensen et al., 2011b).

Multiple organic-rich silt/peat deposits interpreted as interglacials, placed in context of the inferred ages of CBt, APt and THt, suggest that Palisades East contains an extensive middle Pleistocene paleoenvironmental record that likely contains few, if any, major unconformities. This is a rarely preserved time in eastern Beringia and is usually only seen in fragments, Chester Bluff is the only other known site to contain a similar semi-continuous record. These interglacial records, the correlation of CBt, APt, THt, VCt, and Noyes tephra across hundreds of kilometers, and the addition of ten newly identified tephra beds within the context of these tephra and dated beds such as OCt and SC-F, make the Palisades a key reference site for the middle Pleistocene across the Yukon and Alaska.

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CHAPTER 3: THE VARIEGATED (VT) TEPHRA ACROSS YUKON AND ALASKA

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Introduction

Widely dispersed tephra beds, such as the Vedde Ash in western Europe and the Old Crow tephra in Yukon and Alaska, play an important role in correlating and dating regionally distributed paleoenvironmental and stratigraphic records (e.g. Westgate et al., 1983; Mangerud et al., 1984, Reyes et al., 2010a). Tephrochronology plays a fundamental role in interpreting stratigraphic records in the non-glaciated regions of Yukon and Alaska, collectively eastern Beringia. This region and its geological archives are critical to understanding the evolution of the Arctic by providing an opportunity to examine terrestrial paleoenvironmental records. Restricted glaciation in this region has resulted in the preservation of long, near-continuous sedimentary records that frequently contain exceptional paleobotanical and faunal records by virtue of their common association with permafrost (e.g. Westgate et al., 1990; Zazula et al., 2007;

Froese et al., 2009; Matheus et al., 2003). Sedimentary records of this age are often difficult to date and correlate since much of the material is too old for commonly used dating techniques such as radiocarbon dating. Fortunately, one of the most unique aspects of sedimentary records in eastern Beringia is the common presence of distal tephra beds (e.g. Preece et al., 1999, 2000; Jensen et al., 2008; Péwé et al., 2009). Each tephra bed has unique geochemical, petrologic and morphologic components that allow correlation of sediments across hundreds to thousands of kilometers, and some can be directly dated by either glass fission-track or $^{40}Ar/^{39}Ar$ methods (e.g. Kunk, 1995; Sandhu and Westgate, 1995; Sandhu et al., 2000).

The majority of tephra studies in eastern Beringia have focused on establishing individual records at specific locales (e.g. Preece et al., 1999, 2000; Schaefer, 2002; Mathues et al., 2003; Jensen et al., 2008). There has been limited success in correlating disparate sites to one another through recognition of regionally extensive tephra beds. To date, the Old Crow tephra (124 ± 10 ka) is the only bed that has been established firmly as a regional marker horizon across eastern Beringia (e.g. Westgate et al., 1985; Preece et al., in press). Recognizing widely distributed tephra beds is an important aspect of tephrochronology as it facilitates correlation, dating and comparison of paleoenvironmental records (e.g. Lowe, 2001; Muhs et al., 2001; Newnham et al., 2003). This study presents the geochemistry, stratigraphic setting, and refines age constraints on the regionally distributed Variegated or VT tephra.

First described by Preece et al. (1999) at the Halfway House and Gold Hill sites near Fairbanks, VT tephra has since been collected and analyzed, although not necessarily identified as VT tephra, at several other sites across Alaska and Yukon. In this paper, we establish the widespread distribution of VT tephra at ten sites ranging from western Alaska through central Yukon using stratigraphic, geochemical, petrographic, and chronological data. And further, we argue that the VT tephra is an important regional stratigraphic marker in eastern Beringia, with an areal distribution and bulk tephra volume that places it among the largest eruptions in Yukon and Alaska.

Methods

Stratigraphy

Previously reported stratigraphic sections at Gold Hill, Halfway House and Jackson Hill were re-examined, and in the case of Gold Hill, a new site several 100 meters from the original was logged and sampled. All other sites were sampled and logged in detail, with the exception of Togiak Bay and Tetlin Junction, which were not accessible and overgrown, respectively. Stratigraphic information at these sites relies on previously published data.

Major-element geochemistry

All major-element geochemical analyses are grain discrete and, with the exception of the Tetlin Junction sample and the Fe-Ti oxide analyses for Togiak Bay-1 and Gold Hill I samples, were carried out on a JEOL superprobe 8900 at the University of Alberta by wavelength dispersive spectrometry. Glass analytical conditions are as follows: 15 keV accelerating voltage, 6 nA beam current, and a beam diameter of 10 μm. A well characterized Lipari obsidian and Old Crow tephra were analyzed concurrently as secondary standards. Reported data are a compilation of multiple analyses (see Tables 3.2 and 3.3), but each sample was analyzed with reference material from Halfway House and/or Gold Hill to facilitate comparison and minimize potential variation caused by minor differences in calibration and standardization over time. The Tetlin Junction sample was analyzed at the University of Alaska, Fairbanks, with a Cameca SX-50 under similar analytical conditions using Old Crow tephra as a secondary standard. Fe-Ti oxide analytical conditions are as follows: 20 keV accelerating voltage, 10 nA beam current, and a beam diameter of 1 μm. The Togiak Bay-1 and Gold Hill I samples were analyzed at the University of Toronto with a Cameca SX-50 using 15 keV accelerating voltage, 25 nA beam current, and a beam diameter of 1 μm. As with glass analyses, all samples were analyzed with reference material to avoid potential variation between data collected at different times.

Trace-element geochemistry

Trace-element data for the most geographically separate samples of Togiak Bay, Gold Hill and Jackson Hill were determined on purified glass separates using fully quantitative solution nebulization inductively coupled plasma mass spectrometry (ICP-MS) following Pearce et al. (2004). USGS reference material and the well-characterized Old Crow tephra were analyzed with each sample to facilitate comparison.

Infrared stimulated luminescence (IRSL) dating

Samples for IRSL dating were collected at Halfway House in the same location as thermoluminescence samples collected and analyzed by Berger (2003). The original trench was widened and deepened to create fresh surfaces. Luminescence samples were collected in PVC tubing and packaged in opaque black plastic. Bulk samples from surrounding sediments were collected for dose rate and moisture content measurements.

In the laboratory, the 62-88 μm grain-size fraction was extracted from each sample. Feldspars were isolated using standard densimetric techniques. Natural luminescence was assessed using 24 aliquots, from which 6 of each batch were then dosed to build up the luminescence regeneration growth curve. The equivalent dose was evaluated following the methods developed in Montréal (cf. Lamothe, 2004) using a modified version of the single-aliquot regenerative-dose (SAR) technique first introduced by Murray and Wintle (2000). For feldspar, the same preheat (280°C) for both dose and test dose was utilized (Auclair et al., 2003; Huot and Lamothe, 2003; Lamothe, 2004).

As feldspars are prone to fading; the equivalent dose is lower than the total acquired dose in the environment since deposition. The latter is then assessed from anomalous fading measurements, from which the g value is obtained. This value corresponds to the loss of luminescence per decade of time. The radiation dose received by the feldspars since deposition is calculated using the DRC ("Dose Rate Correction") equation (Lamothe et al., 2003) and a fading-corrected age is thus obtained. The DRC method is based on the assumption that the stable luminescence intensity following irradiation in the laboratory can be extrapolated to a time for which the laboratory dose rate is equal to the environmental dose rate. The correction method developed by Huntley and Lamothe (2001) is not used, as the method is known to be applicable only to the linear portion of the growth curve.

Luminescence signals were detected using a TL/OSL-DA-15 Risø reader, with a ^{90}Sr beta source calibrated at 6.98 Gy/min. Blue-violet luminescence emission has been detected through a Schott BG39/Corning 7-59 filter combination. Measurements carried out on the Risø DA15 reader are from a strong 100 sec IR illumination, depleting more than 90 % of the signal.

Sites and Stratigraphy

Samples were collected from ten sites across eastern Beringia, from southwestern Alaska to the Klondike area, central Yukon (Fig. 3.1; Table 3.1). Although variations in stratigraphy exist at these sites, there are similarities across many: the samples overlie Old Crow tephra when found in section together, and commonly underlie a prominent paleosol or organic-rich sediments (Fig. 3.2).

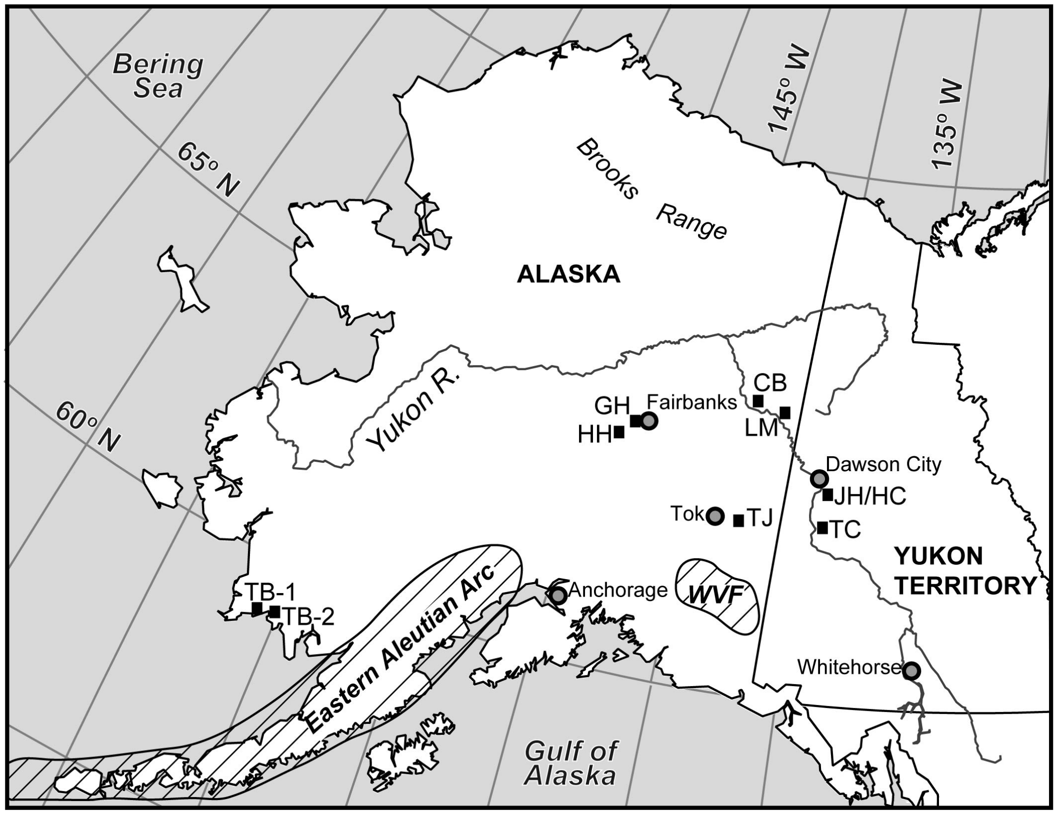

Figure 3.1. Locations of sites. From west to east: TB-1 = Togiak Bay, Aeolis Mountain locale, TB-2 = Togiak Bay, MIS 5 exposure, HH = Halfway House, GH = Gold Hill, TJ = Tetlin Junction, CB = Chester Bluff, LM = Little Montauk, JH = Jackson Hill, HC = Hunker Creek, TC = Thistle Creek. WVF = Wrangell volcanic field.

Table 3.1. Summary of sample locations

Sample	Location	Latitude and Longitude	Summary of stratigraphic context of VT
UT 1435	Togiak Bay-1, Alaska	58.903 N, 160.748 W	50 cm thick occurrence within a 19 m thick diamicton (Kaufman et al., 2001)
UT 1409	Togiak Bay-2, Alaska	58.967 N, 160.260 W	At the base of a peat unit containing a *Picea* peak (Kaufman et al., 2001)
UA 1425	Halfway House, Alaska	64.705 N, 148.502 W	Within inorganic silt, 40 cm below a paleosol
UT 822	Gold Hill I/Ib, Alaska	64.856 N, 147.929 W	Within inorganic silt, near base of paleosol (Preece et al., 1999; Berger, 2003)
UA 1344	Gold Hill IV, Alaska	64.856 N, 147.929 W	Gold Hill 4: within B-horizon of paleosol
UA 1097	Chester Bluff, Alaska	65.335 N, 142.732 W	Within inorganic silt, ~10 m above Old Crow
UA 1100	Little Montauk, Alaska	65.104 N, 141.417 W	Within inorganic silt, below a ~1 m thick organic-rich silt
96TOK-1-5	Tetlin Junction, Yukon	63.198 N, 142.178 W	Base of paleosol (Schaefer, 2001)
UT 1562, 1637, UA 1580	Jackson Hill, Yukon	64.023 N, 139.361 W	Within inorganic silt with some organic blebs
UA 1579	Hunker Creek, Yukon	64.017 N, 139.147 W	Within frozen organic-rich silt
UT 1813	Thistle Creek, Yukon	63.067 N, 139.317 W	Within frozen organic-rich silt

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Togiak Bay

The samples of interest at Togiak Bay are found at two separate coastal bluff exposures. They were correlated to one another and named the Aeolis Mountain tephra after a peak near the most westerly exposure (Kaufman et al., 2001). This site will herein be called Togiak Bay-1 (TB-1; sample UT 1435) (Fig. 3.1). At this site, UT 1435 is within a 19 m thick wedge of diamicton consisting of locally derived clasts, and is up to 50 cm thick, the thickest of the study samples (Kaufman et al., 2001). It was subsequently correlated to a tephra bed at a second coastal bluff (Togiak Bay-2, TB-2; sample UT 1409) comprised of stratified clay, silt, sand, and organics capped by a basalt flow (Fig. 3.2) (Kaufman et al., 2001). UT 1409 is found at ~ 5.1 m asl, is up to 5 cm thick, and is found as two discrete layers. The lower layer consists of a finer-grained, thicker bed, while the upper layer is a coarser, phenocryst and pumice-rich layer.

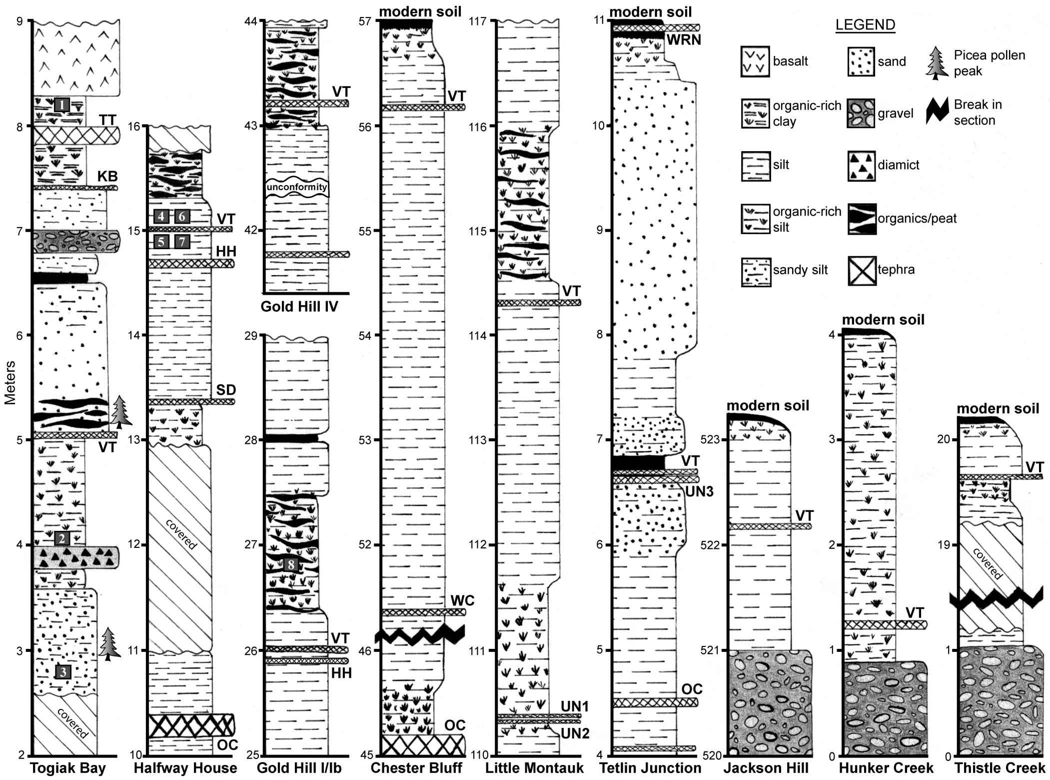

Figure 3.2. Stratigraphic sections for sample localities. Togiak Bay stratigraphy adapted from Kaufman et al. (2001), Tetlin Junction stratigraphy from Schaefer (2002). Gold Hill I/Ib is a composite stratigraphic log of two sections described by Preece et al. (1999) and Berger (2003). Numbers represents locations of luminescence ages. **1** = 70±10 ka; **2** = 119±10 ka; **3** = 151±13 ka (Kaufman et al., 2001); **4** = 103±11 ka; **5** =101±11 ka (this study); **6** = 76.7±6.7 ka (Oches et al., 1998); **7** = 78.8±6.1 ka; **8** = 77.5±9.2 ka (Berger, 2003). Thermoluminescence ages 6, 7, and 8 were used to calculate Berger's (2003) weighted mean age for VT tephra. Tephra bed abbreviations: TT = Togiak tephra; KB = Kulukak Bay tephra; HH = Halfway House; SD = SD; UN = unknown; WC = Woodchopper Creek; OC = Old Crow tephra. Scale is in meters above local base level except for Jackson Hill and Togiak Bay, which are in m.asl.

This second exposure was divided into three separate lithostratigraphic units, with UT 1409 marking the boundary between the upper two units. The lower lithofacies is comprised of fine-to-medium sand, while the middle unit is predominantly massive silt and clay that increases in organic content towards the tephra bed. The base of the third unit, directly above the tephra bed, consists of beds of fibrous peat and silty-sand grading into inorganic sand. There are two additional tephra beds in this sequence, the Togiak tephra and Kulukak Bay tephra, 3 and 2.5 m above UT 1409, respectively (Kaufman et al, 2001). Old Crow tephra has been found at several other exposures in the area along Togiak Bay, but not in direct association with UT 1435 or UT 1409 (Kaufman et al., 2001).

Fairbanks region

VT tephra was first collected and described at Gold Hill and Halfway House (Preece et al., 1999). Halfway House, a road cut on the Parks Highway ~50 km southwest of Fairbanks, exposes ~10 m of primary loess interbedded with several paleosols and tephra beds (Figs. 1 and 2). VT tephra is present ~5.75 m above the base of the exposure, within relatively inorganic loess, above Old Crow tephra and a well-developed paleosol. Halfway House (HH) tephra is 25 cm below VT, while 40 cm above VT tephra a second paleosol, up to 50 cm thick, is present (Fig. 3.2). Both VT and HH tephras have diffuse contacts but are discrete beds up to 3 and 10 cm thick, respectively. Both tephra beds can be followed continuously across the exposure suggesting minimal post-depositional disturbance.

Gold Hill is a 40-60 m thick exposure of loess that extends for several kilometers alongside the Parks Highway between the western edge of Fairbanks and the village of Ester. It was created by placer mining from the 1950s through the 1970s and was described by Troy Péwé (e.g. Péwé, 1955; Preece et al., 1999).

The section of interest at Gold Hill is a ~0.5 km portion that is within the University of Alaska, Fairbanks, Troy L. Péwé Climatic Change Permafrost Reserve (Figs. 3.1 and 3.2). At Gold Hill I, the furthest west of four original trenches examined at this site (cf. Preece et al., 1999), VT tephra is found in the same stratigraphic setting as at Halfway House. The tephra is present within relatively inorganic loess, below a paleosol, and above the HH tephra. Here, VT tephra is reworked and forms pods up to 10 cm thick and occurs as pink and grey layers that are locally disturbed by post-depositional processes (Preece et al., 1999). At Gold Hill Ib, a newer trench excavated several meters laterally east from the original, VT tephra is similarly present below a distinct paleosol, although HH tephra is absent (Berger, 2003). Gold Hill IV, the furthest east of the Gold Hill trenches, was initially studied for the Pliocene to middle Pleistocene tephra beds present in the lower ~33 m of this trench (Preece et al., 1999). Recent excavations near the top of the exposure located multiple tephra samples, including one that had glass geochemistry similar to VT tephra (UA 1344). UA 1344 is reworked within a B-horizon of a ~40 cm thick paleosol at 43.5 m. It is discontinuous across the exposure, rarely reaching a thickness of 0.5 cm, and is not associated with any previously described beds.

East-central Alaska

Additional study samples were collected from two sites along the Yukon River in Yukon-Charley Rivers National Preserve, east-central Alaska: Chester

Bluff (sample UA 1097), located near the confluence of the Yukon and Charley Rivers, and Little Montauk (sample UA 1100), located less than a kilometer upstream from Montauk Bluff (Fig. 3.1).

The Chester Bluff stratigraphy consists of a 10 m high bedrock terrace, overlain by ~10 m of paleo-Yukon river gravels, up to ~10 m of outburst flood deposits, capped by 30-40 m of loess (Fig. 3.2) (Froese et al., 2003; Jensen et al., 2008). The loess contains multiple tephra beds and paleosols. VT tephra (UA 1097) was identified as such only through glass geochemistry. The tephra bed is present within 1 m of the surface within loose inorganic loess, heavily disturbed by modern root penetration. It is light grey, up to 0.5 cm thick with diffuse contacts, and can be followed for several metres across the section. Old Crow tephra is present ~11 m below UA 1097, with one prominent organic-rich silt unit present between the tephra beds (Jensen et al. 2008).

Little Montauk consists of a series of loess bluffs on a 60 m high bedrock terrace. UA 1100 is found within 2 m of the surface of the only bluff examined at this site (Fig. 3.2); it is up to 1 cm thick with a sharp lower contact and diffuse upper contact. At this site, UA 1100 is continuous across the section until obscured by colluvium. The host sediments consist of inorganic silt, directly underlying an organic-rich weathered silt unit.

Tetlin Junction

The Tetlin Junction exposure is a road-cut along the Alaska Highway approximately 27 km southeast of the junction of the Alaska and Taylor Highways (Fig. 3.1). At this site multiple tephra beds are interbedded with sand, silt and organic horizons (Fig. 3.2). The sample of interest, 96TOK-1-5, is present near the middle of the exposure within massive silt, directly below a 25 cm thick paleosol. Old Crow tephra is ~ 5m below 96TOK-1-5 (Schaefer, 2002).

The Klondike, Yukon Territory

The final study samples were collected from three sites in the Klondike area. Jackson Hill, 5 km east of Dawson City, was initially described by Sandhu et al. (2000), who identified a tephra bed within 2 m of loess sitting unconformably on early Pleistocene/Pliocene gravel. It was named the Jackson Hill tephra (UT 1637, UT 1562, UA 1580) (Sandhu et al., 2000). The Jackson Hill tephra is semi-continuous across the exposure and generally 0.5-1 cm thick, but can form pods up to 4 cm thick. The loess containing the tephra bed contains disseminated pods of organic-rich silt.

On lower Hunker Creek, ~15 km east of Dawson City, the study sample (UA 1579), a diffuse bed up to 0.5 cm thick, was located in a placer mining exposure within a 4 m thick exposure of ice and organic-rich silt.

Thistle Creek is a site in the south Klondike, ~100 km south of Dawson City. At Thistle Creek, the study sample (UT 1813) is located near the top of a ~20 m, poorly exposed, placer-mining cut. The tephra bed is reworked and 1.5 to

8 cm thick. As at Hunker Creek, it is within ice and organic-rich silt, and not directly associated with any other tephra beds. However, it should be noted that Thistle Creek is the site of a well-documented association of Old Crow tephra with a marine isotope stage (MIS) 5e forest bed (Reyes et al., 2010a). The exposure with UT 1813 is ~30 m upstream from the Old Crow/MIS 5e exposure, and the tephra is present within the top ~75 cm of the section, significantly higher in section than Old Crow tephra.

Results

Yukon and Alaska tephra beds

The main sources of tephra beds in eastern Beringia are the Wrangell volcanic field (WVF) and the eastern Aleutian arc (Fig. 3.1). These two general sources provide the basis for a simple classification scheme, which defines two geochemically distinct types of tephra beds, Types I and II (Preece et al., 1992, 1999). Tephra beds that do not fit into either category are referred to as ‘other’ (Preece et al., 1992). Type I tephra beds are common throughout the eastern Aleutian arc except at Hayes Volcano, which produces Type II tephra beds (Preece and Hart, 2004; Westgate et al., 2008). Most Type II tephra beds are from the WVF, whereas Type I tephra beds are only known from the eastern Aleutian arc, although recently several tephra beds that do not fit the classification scheme have been documented (Westgate et al., 2009; Preece, Pearce and Westgate unpublished data). In many cases, classification of a distal tephra bed into the Type I or II categories is easily achieved based on glass morphology and mineralogy alone (Preece et al., 1992). Type I distal tephra beds tend to have a blocky glass morphology that consists of bubble-wall shards and pumice with low vesicularity and large vesicles. They may contain brown glass, and have less than 20% phenocrysts. Orthopyroxene and plagioclase are the most common phenocrysts, with Fe-Ti oxides, clinopyroxene, biotite, apatite and zircon present in minor and trace amounts. Pumice from Type II distal tephra beds tends to be highly vesicular, frothy, and thin-walled. They contain more than 20% phenocrysts, which often gives a "salt and pepper" appearance in the field. Phenocrysts are predominately hornblende and plagioclase, with minor and accessory Fe-Ti oxides, oxyhornblende, orthopyroxene, apatite and zircon. Glass composition of Type I tephra beds typically contains higher concentrations of FeO_t, TiO_2, Cs, Hf and Sc, and lower Al_2O_3, CaO and Sr, than Type II tephra beds. Chondrite-normalized rare-earth element (REE) spider diagrams for Type I tephra beds have well-developed, negative, europium (Eu) anomalies and relatively gentle slopes with La/Yb (w/w) less than about 13. Type II glass composition has REEs with higher La/Yb (w/w) ratios, and steeper slopes on spider diagrams, and show no or weakly developed Eu-anomalies (Preece et al., 1992, 1999, 2000).

Glass morphology and mineralogy

The glass morphology of the study samples display many characteristics typical of Type I tephra beds, such as bubble-wall shards, pumice with large vesicles and brown glass. However, frothy, highly vesicular pumice is relatively common, unlike typical Type I beds such as Old Crow and Dawson tephra beds (Westgate et al., 2000; Preece et al., in press) (Fig. 3.3). The mineralogy of all study samples is similar and typical of Type I tephra beds. There are few phenocrysts (<20%), consisting predominantly of plagioclase and orthopyroxene phases. Minor and trace minerals include Fe-Ti oxides, clinopyroxene and apatite.

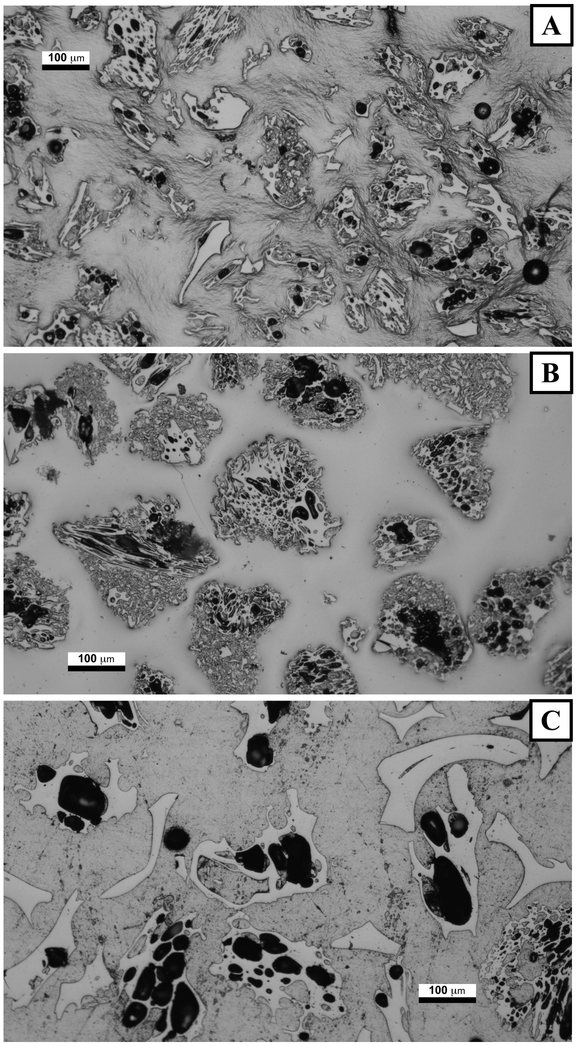

Figure 3.3. Reflected light images of VT glass morphology compared to two classic examples of Type I and II tephra beds. **A** = VT (UA 1097); **B** = Biederman tephra (Type II); **C** = Old Crow tephra (Type I).

The major-element glass compositions of the study samples range from dacite to rhyolite, with ~64-72 SiO_2 weight percent (wt%) (Fig. 3.4). For all samples the majority of analyses fall between 69.5 and 71.5 wt% and bivariate plots show no discernable difference between samples, which all plot in a well-defined cluster (Fig. 3.4, Table 3.2). In all samples but TB-1 and TB-2, there exists a minor dacite subpopulation (< 69 wt % SiO_2) (Fig. 3.4).

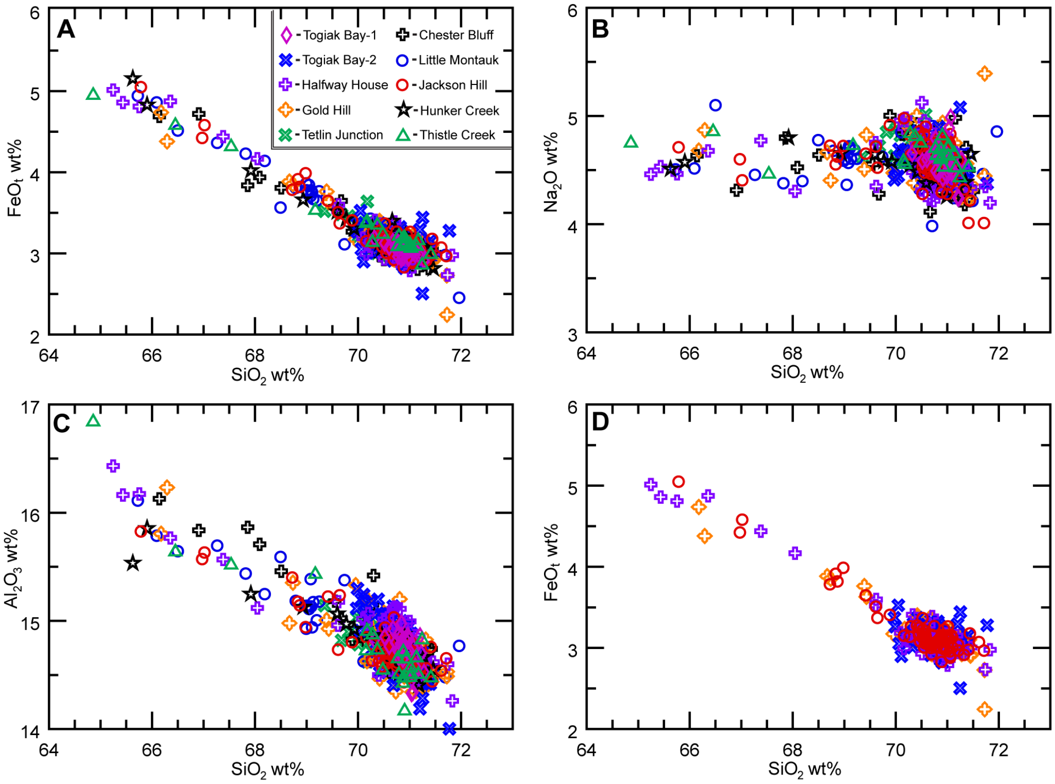

Figure 3.4. Bivariate plots displaying glass major-element geochemistry. A, B, and C include data from all localities; D is simplified to facilitate easier comparison and only contains data from Gold Hill, Halfway House, TB-2, and Jackson Hill. Oxides of Al, Na and Fe are displayed as during crystallization of a magma they are depleted by different sets of minerals and would likely illustrate variations in trend and concentration between different tephra beds.

Table 3.2. Major-element glass geochemistry

Sample		SiO_2	TiO_2	Al_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	Cl	H_2O_{diff}	n
Togiak Bay-1	MEAN	70.90	0.57	14.73	3.04	0.11	0.62	2.35	4.59	2.94	0.16	3.94	28
(UT 1435)	STDEV	0.21	0.04	0.17	0.08	0.03	0.04	0.07	0.16	0.06	0.03	1.74	
Togiak Bay-2	MEAN	70.75	0.57	14.78	3.10	0.10	0.63	2.39	4.56	2.95	0.16	2.42	53
(UT 1409)	STDEV	0.39	0.05	0.29	0.17	0.02	0.06	0.12	0.15	0.08	0.03	1.81	
Halfway House	MEAN	70.51	0.58	14.83	3.17	0.10	0.69	2.47	4.57	2.92	0.16	2.52	79
(UA 1425)	STDEV	1.36	0.08	0.41	0.49	0.03	0.20	0.42	0.21	0.21	0.04	1.66	
Gold Hill I	MEAN	70.64	0.56	14.66	3.24	0.10	0.71	2.49	4.54	2.91	0.16	2.68	18
(UT 822)	STDEV	1.28	0.07	0.36	0.43	0.02	0.20	0.41	0.18	0.19	0.03	1.34	
Gold Hill IV	MEAN	70.76	0.57	14.72	3.11	0.10	0.65	2.41	4.58	2.94	0.16	2.73	70
(UA 1344)	STDEV	0.92	0.06	0.33	0.30	0.04	0.12	0.27	0.23	0.20	0.04	1.93	
Chester Bluff	MEAN	70.42	0.59	14.86	3.21	0.11	0.70	2.48	4.56	2.92	0.15	3.31	49
(UA 1097)	STDEV	1.12	0.06	0.38	0.39	0.04	0.16	0.31	0.20	0.16	0.02	1.77	
Little Montauk	MEAN	70.11	0.59	14.87	3.34	0.11	0.74	2.63	4.57	2.88	0.16	2.77	64
(UA 1100)	STDEV	1.33	0.06	0.36	0.49	0.03	0.21	0.43	0.18	0.20	0.04	1.72	
Tetlin Junction*	MEAN	70.16	0.63	14.89	3.30	-	0.74	2.32	4.78	3.01	0.17	-	16
	STDEV	0.39	0.13	0.15	0.20	-	0.07	0.13	0.14	0.11	0.03	-	
Jackson Hill	MEAN	70.48	0.59	14.75	3.22	0.10	0.70	2.52	4.57	2.90	0.17	2.65	72
(UA 1580, UT 1562, 1637)	STDEV	1.02	0.05	0.27	0.38	0.03	0.16	0.31	0.21	0.17	0.03	1.36	
Hunker Creek	MEAN	70.17	0.59	14.82	3.33	0.10	0.73	2.72	4.53	2.83	0.17	2.13	27
(UA 1579)	STDEV	1.48	0.06	0.33	0.54	0.03	0.22	0.54	0.13	0.21	0.03	1.21	
Thistle Creek	MEAN	70.15	0.60	14.82	3.35	0.09	0.72	2.60	4.66	2.86	0.16	3.21	23
(UT 1813)	STDEV	1.65	0.08	0.57	0.53	0.04	0.21	0.55	0.12	0.24	0.03	1.72	

*Analyzed at the University of Alaska, Fairbanks, microprobe laboratory, using the same analytical protocals and secondary standard Old Crow tephra.

Notes: n = number of analyses; FeO_t = total Fe as FeO; averages include zero values; H_2O_{diff} = water by difference; STDEV = standard deviation. Standardization by mineral and glass standards.

Normalized on a water-free basis.

Fe-Ti oxide minerals in VT tephra are almost exclusively titano-magnetites, with TiO_2 contents ranging from approximately 7.5 to 13.9 wt% (Fig. 3.5, Table 3.3). Within this range there is a dominant population at 12.8 to 13.9 wt% TiO_2, and a second minor population at ~10 wt% TiO_2 in most samples (Fig. 3.5, Table 3.3). Apart from these two populations, there is a wide range of titano-magnetite compositions that may reflect minerals inherited from previous magma batches, magma mixing or detrital grains. The dominant titano-magnetite population is indistinguishable between the study samples with population means overlapping within one standard deviation; however, there is greater variation in minor sub-populations among the study samples (Fig. 3.5; Table 3.3). A minor ilmenite component was found in four samples: TB-1 (UT 1435), TB-2 (UT 1409), Gold Hill I, and Jackson Hill (UA 1580) (Fig. 3.5, Table 3.4). The majority of the ilmenite analyses have TiO_2 contents between 44 and 46 wt%, although scattered analyses range from ~33.5 up to ~52 wt% (Fig. 3.5).

Titano-magnetite and ilmenite compositions can be used to estimate the oxygen fugacity and temperature of the magma providing the minerals are in equilibrium with one another. Previous studies on Alaskan tephra beds have

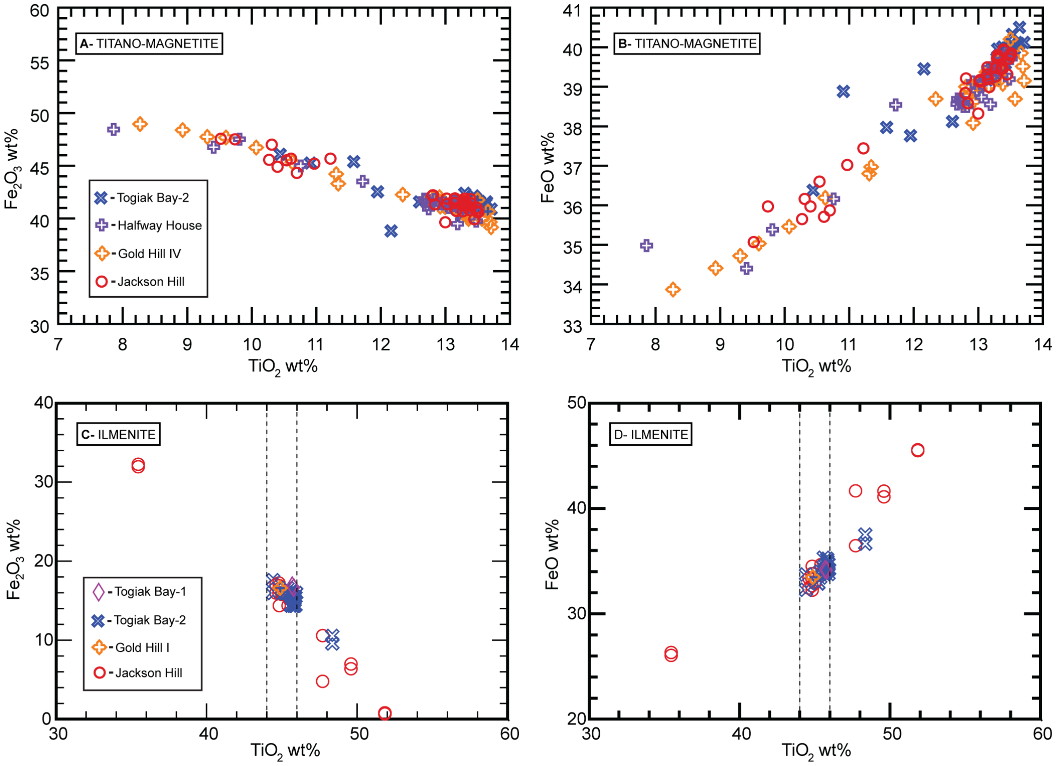

Figure 3.5. A and B are bivariate plots of titano-magnetite data from Gold Hill IV and Halfway House in comparison to TB-2 and Jackson Hill. C and D are bivariate plots of ilmenite data from Gold Hill I, Jackson Hill, TB-1 and TB-2. The dashed line represents the population in equilibrium with the main population of titano-magnetite (~13 wt% TiO_2) used to calculate fO_2 and eruption temperatures.

Table 3.3. Summary of titano-magnetite data

Sample		SiO_2	TiO_2	Al_2O_3	Cr_2O_3	V_2O_3	Fe_2O_3	FeO	MgO	MnO	CaO	Total	FeO_t	n
Togiak Bay-2	MEAN	0.11	13.02	2.31	0.04	0.41	40.83	39.46	2.44	0.66	0.11	99.39	76.20	48
Main-pop	STDEV	0.08	0.39	0.06	0.02	0.06	0.87	0.60	0.08	0.02	0.08	0.71	0.71	
Togiak Bay-2	MEAN	0.15	9.46	3.27	0.06	0.47	46.42	35.69	3.04	0.48	0.15	99.18	77.46	4
Sub-pop	STDEV	0.15	1.12	0.34	0.02	0.09	1.43	0.98	0.59	0.04	0.15	0.97	0.98	
Togiak Bay-2	MEAN	0.12	12.51	2.44	0.04	0.42	41.63	38.92	2.52	0.64	0.12	99.36	76.38	52
All	STDEV	0.09	1.37	0.36	0.02	0.07	2.19	1.49	0.31	0.07	0.09	0.75	0.87	
Halfway House	MEAN	0.11	13.30	2.31	0.03	0.40	41.01	40.03	2.44	0.67	0.11	100.42	76.94	60
Main-pop	STDEV	0.19	0.40	0.09	0.02	0.02	0.86	0.70	0.08	0.02	0.19	0.97	0.81	
Halfway House	MEAN	0.08	10.97	2.78	0.04	0.49	45.28	38.01	2.49	0.54	0.08	100.76	78.62	6
Sub-pop	STDEV	0.07	0.51	0.11	0.01	0.05	0.52	1.17	0.57	0.06	0.07	0.89	0.68	
Halfway House	MEAN	0.11	13.09	2.35	0.03	0.40	41.40	39.85	2.45	0.66	0.11	100.45	77.09	66
All	STDEV	0.18	0.79	0.17	0.02	0.04	1.49	0.95	0.18	0.04	0.18	0.96	0.93	
Gold Hill IV	MEAN	0.13	13.14	2.34	0.04	0.43	40.52	39.66	2.52	0.64	0.12	99.56	76.13	51
Main-pop	STDEV	0.18	0.42	0.06	0.03	0.13	1.23	0.89	0.21	0.06	0.12	0.72	0.78	
Gold Hill IV	MEAN	0.10	9.84	3.25	0.05	0.49	46.27	35.72	3.13	0.50	0.16	99.52	77.36	15
Sub-pop	STDEV	0.06	1.05	0.44	0.03	0.08	2.04	1.19	0.39	0.06	0.25	0.75	0.72	
Gold Hill IV	MEAN	0.13	12.39	2.54	0.04	0.45	41.83	38.76	2.66	0.61	0.13	99.55	76.41	66
All	STDEV	0.16	1.52	0.44	0.03	0.12	2.82	1.92	0.36	0.08	0.16	0.72	0.92	
Jackson Hill	MEAN	0.10	13.23	2.31	0.04	0.40	40.93	39.74	2.47	0.66	0.10	99.97	76.58	49
Main-pop	STDEV	0.06	0.21	0.04	0.02	0.01	0.73	0.53	0.08	0.01	0.06	0.76	0.69	
Jackson Hill	MEAN	0.09	10.43	3.14	0.04	0.49	45.46	36.53	3.04	0.53	0.09	99.86	77.44	20
Sub-pop	STDEV	0.06	0.50	0.23	0.02	0.06	1.09	0.76	0.21	0.04	0.06	0.91	0.98	
Jackson Hill	MEAN	0.10	12.42	2.55	0.04	0.43	42.25	38.81	2.63	0.62	0.10	99.94	76.83	69
All	STDEV	0.06	1.32	0.40	0.02	0.05	2.23	1.59	0.29	0.06	0.06	0.80	0.87	
Thistle Creek	MEAN	0.12	13.11	2.32	0.04	0.40	40.94	39.57	2.51	0.66	0.12	99.78	76.41	48
Main-pop	STDEV	0.06	0.36	0.06	0.02	0.02	1.01	0.57	0.10	0.02	0.06	0.77	0.76	
Thistle Creek	MEAN	0.12	9.66	3.16	0.05	0.45	46.42	36.09	2.85	0.51	0.12	99.43	77.86	22
Sub-pop	STDEV	0.06	1.62	0.29	0.04	0.16	2.68	1.07	0.46	0.06	0.06	0.66	1.74	
Thistle Creek	MEAN	0.12	12.02	2.58	0.04	0.41	42.67	38.47	2.62	0.61	0.12	99.67	76.87	70
All	STDEV	0.06	1.87	0.42	0.03	0.09	3.07	1.79	0.31	0.08	0.06	0.75	1.33	
Chester Bluff	MEAN	0.11	13.11	2.28	0.03	0.40	41.05	39.56	2.47	0.65	0.11	99.78	76.51	34
Main-pop	STDEV	0.06	0.22	0.05	0.02	0.02	0.58	0.47	0.05	0.02	0.06	0.48	0.43	
Chester Bluff	MEAN	0.20	9.27	3.16	0.06	0.49	47.04	35.89	2.78	0.48	0.11	99.49	78.22	30
Sub-pop	STDEV	0.50	1.66	0.34	0.04	0.13	3.10	1.20	0.41	0.07	0.06	0.99	1.93	
Chester Bluff	MEAN	0.15	11.31	2.69	0.04	0.44	43.86	37.84	2.61	0.57	0.11	99.64	77.31	64
All	STDEV	0.35	2.24	0.50	0.03	0.10	3.70	2.05	0.32	0.10	0.06	0.77	1.60	
Little Montauk	MEAN	0.17	13.02	2.29	0.03	0.39	40.12	39.45	2.51	0.66	0.21	98.85	75.55	41
Main-pop	STDEV	0.16	0.41	0.08	0.02	0.02	1.29	1.07	0.16	0.03	0.26	1.03	0.93	
Little Montauk	MEAN	0.13	10.74	2.91	0.04	0.46	44.32	36.78	2.86	0.55	0.15	98.94	76.66	20
Sub-pop	STDEV	0.07	1.13	0.45	0.02	0.06	2.09	1.49	0.31	0.06	0.15	0.88	1.15	
Little Montauk	MEAN	0.16	12.27	2.49	0.03	0.41	41.50	38.58	2.63	0.62	0.19	98.88	75.92	61
All	STDEV	0.14	1.30	0.39	0.02	0.05	2.54	1.75	0.27	0.07	0.23	0.98	1.13	

Notes: n = number of analyses; FeOt = total Fe as FeO; averages include zero values; STDEV = standard deviation. Speciation of Fe-Ti oxides into ilmenite-hematite and magnetite-ülvospinel solid solution series is after Carmichael (1967).

yielded tightly clustered temperature and oxygen fugacities that vary significantly between chemically similar tephra beds. For example, Old Crow, Dawson and

DL tephra beds have similar glass geochemistry. Twenty-one estimates from Old Crow tephra yield an average of 874 ± 5 °C and 0.82 ± 0.02 $\log_{10} fO_2$ ΔNNO, two estimates from Dawson tephra yield and average of 867 ± 12 °C and 0.46 ± 0.04 $\log_{10} fO_2$ ΔNNO, and two estimates from DL tephra yield and average of 866 ± 9 °C and 0.17 ± 0.04 $\log_{10} fO_2$ ΔNNO (Preece et al., 2011). Similarly, Sheep Creek tephra beds from Mount Drum, Alaska, have unique temperatures and oxygen fugacities. Nine estimates of SCt-C tephra have an average of 772 ± 20 °C and 1.34 ± 0.14 $\log_{10} fO_2$ ΔNNO, and five estimates of SCt-K have an average of 789 ± 22 °C and 1.59 ± 0.01 $\log_{10} fO_2$ ΔNNO. SCt-A and SCt-F are more similar with one estimate from SCt-A yielding 825 °C and 1.57 $\log_{10} fO_2$ ΔNNO, and one estimate from SCt-F yielding 836 °C and 1.52 $\log_{10} fO_2$ ΔNNO (recalculated using Ghiorso and Evans, 2008, from data in Westgate et al., 2008). Amongst the study samples, only the main titano-magnetite population at ~13 wt% and the main ilmenite population between 44 and 46 wt% were found to fulfill the equilibrium constraints of Bacon and Hirschmann (1988) (Table 3.4).

Table 3.4. Summary of ilmenite data

Sample			SiO_2	TiO_2	Al_2O_3	Cr_2O_3	V_2O_3	Fe_2O_3	FeO	MgO	MnO	CaO	Total	FeO_t	n
Togiak Bay-1*	Equilibrium	MEAN	0.03	45.74	0.28	0.04	0.28	16.77	34.18	3.44	0.82	0.02	101.61	49.28	2
(UT 1435)		STDEV	0.01	0.07	0.02	0.01	0.04	0.16	0.06	0.09	0.02	0.00	0.01	0.21	
Togiak Bay-2	Equilibrium	MEAN	0.06	45.59	0.27	0.01	0.12	15.86	33.76	3.63	0.76	0.05	100.10	48.03	12
(UT 1409)		STDEV	0.02	0.43	0.01	0.01	0.02	0.74	0.61	0.15	0.02	0.03	0.50	0.42	
	All	MEAN	0.05	45.80	0.25	0.01	0.11	15.09	34.30	3.61	0.77	0.05	100.06	47.88	14
		STDEV	0.02	0.85	0.05	0.01	0.02	1.69	1.08	0.17	0.05	0.02	0.48	0.65	
Gold Hill-I* (UT 822)	Equilibrium		0.02	44.92	0.29	0.03	0.32	16.51	33.43	3.41	0.76	0.10	99.78	48.29	1
Jackson Hill	Equilibrium	MEAN	0.09	44.91	0.29	0.00	0.12	16.49	32.90	3.73	0.77	0.12	99.43	47.73	6
(UA 1580)		STDEV	0.03	0.28	0.03	0.01	0.01	0.69	0.54	0.18	0.02	0.10	0.29	0.38	
	All	MEAN	0.12	45.41	0.21	0.03	0.14	14.30	35.24	2.96	0.78	0.12	99.32	48.10	10
		STDEV	0.15	4.17	0.10	0.06	0.09	8.15	5.34	1.20	0.11	0.15	0.55	2.49	

Notes: n = number of analyses; FeOt = total Fe as FeO; averages include zero values; STDEV = standard deviation. Speciation of Fe-Ti oxides into ilmenite-hematite and magnetite-ülvospinel solid solution series is after Carmichael (1967). Equilibrium= grains in equilibrium with titanomagnetites and used for geothermometry calculations.

* Analyzed at the University of Toronto.

For these samples, equilibrium compositions were used to calculate estimates by the method of Ghiorso and Evans (2008). The temperature and oxygen fugacity estimates of the samples from TB-1 (UT 1435), TB-2 (UT 1409), Gold Hill I (UT 822) and Jackson Hill (UA 1580) are indistinguishable yielding an average temperature of 940 °C and 0.43 $\log_{10} fO_2$ ΔNNO (Table 3.5).

Table 3.5. Geothermometry estimates for VT

Site	Sample	Temperature °C (Fe-Ti exchange)	$\log_{10} fO_2$ (ΔNNO)
Togiak Bay-1	UT1435	943	0.44
Togiak Bay-2	UT1409	931	0.39
Gold Hill I	UT822	941	0.44
Jackson Hill	UA1580	944	0.43

Trace-element geochemistry of VT tephra was determined for three sites spanning the geographic distribution of the tephra bed: TB-1 (UT 1435), Gold Hill (UT 822) and Jackson Hill (UT 1562). Chondrite normalized REE spider diagrams for the three samples are indistinguishable, have shallow slopes (La/Yb between 4.30 – 4.94), and well-developed negative Eu anomalies typical of Type I tephra (Fig. 3.6, Table 3.6). In addition, Cs, Sr, Sc and Hf contents are within the range reported by Preece et al. (1992) for Type I tephra beds (Table 3.6).

In summary, all of the samples considered in this paper have very similar morphological, mineralogical and geochemical characteristics and all can be classified as Type I distal tephra beds, likely from the eastern Aleutian arc, although the exact source is not presently known. The thickest, and most proximal sites, in the Togiak Bay area contain more pumice than the finer-grained sites in interior Alaska and Yukon. The dominant glass and Fe-Ti oxide populations in all samples are similar, although there exists some variation in the absolute geochemical range between samples. In addition, identical magmatic conditions are indicated at the TB-1, TB-2, Gold Hill I and Jackson Hill sites.

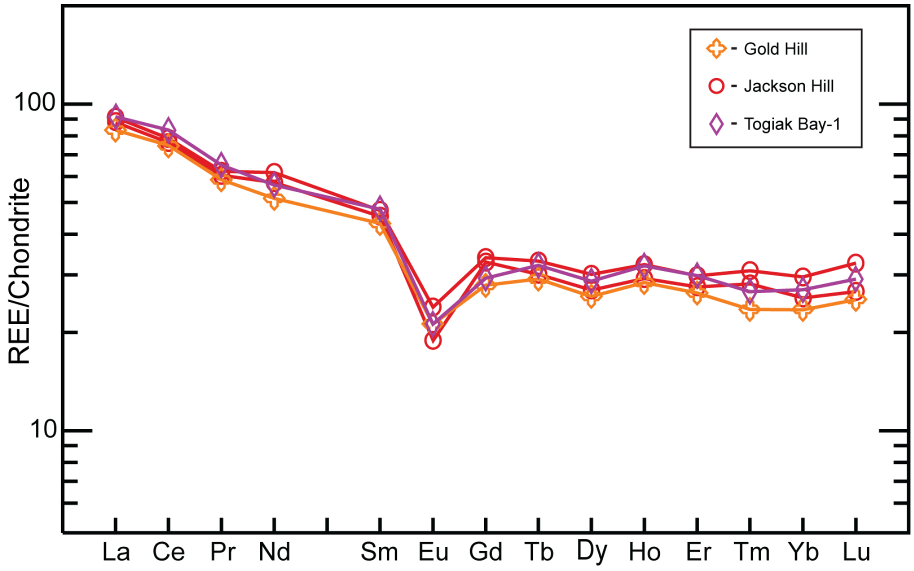

Figure 3.6. Trace-element data from Gold Hill I, TB-1 and Jackson Hill samples. REE abundance plot normalized to chondrite following Sun and McDonough (1989).

Previous age estimates

There are three published age estimates for the study samples, one direct and two indirect. The Jackson Hill tephra was dated by the diameter corrected glass fission-track method to 130 ± 30 ka (Sandhu et al., 2000). A recent, more precise age for the Moldavite tektite, the age monitor for glass fission-track age determinations, has reduced this age determination to 125 ± 30 ka (Preece et al., in press).

Table 3.6. Summary of trace element analyses

	ICP-MS 1999&2001			ICP-MS 2008		Accepted
	Jackson Hill	**QLO-1**	**Gold Hill**	**TB-1**	**QLO-1**	**QLO-1***
Sc	11.5 (1.5)	9.35 (0.34)	14.3	11.9	8.60 (0.65)	8.9
Co	5.07 (0.11)	7.56 (0.15)				7.2
Zn	63.5 (2.1)	65.0 (0.5)				61
Rb	70.4 (0.9)	73.9 (1.2)	66.4	68.4	71.3 (3.6)	74 (3)
Sr	205 (4)	348 (8)	191	181	345 (7)	336 (12)
Y	45 (1)	24.7 (1.0)	42.1	46.0	24.6 (0.0)	24 (3)
Zr	255 (6)	183 (5)	240	266	178 (0)	185
Nb	6.73 (0.44)	10.5 (0.3)	7.40	7.85	10.1 (0.6)	10.3
Cs	3.83 (0.16)	1.83 (0.05)	3.80	4.04	1.67 (0.05)	1.75
Ba	729 (1)	1430 (25)	788	775	1360 (1)	1370 (80)
La	21.3 (0.5)	28.3 (0.3)	19.7	21.7	27.0 (0.3)	27 (2)
Ce	47.5 (0.9)	54.4 (0.6)	45.8	51.0	52.1 (0.3)	54.6 (6.0)
Pr	5.85 (0.11)	5.77 (0.09)	5.58	6.18	5.56 (0.01)	6.01 (0.11)
Nd	27.9 (0.7)	24.7 (0.2)	24.0	26.4	22.0 (0.4)	26 (6)
Sm	7.11 (0.20)	4.96 (0.07)	6.60	7.30	4.90 (0.05)	4.88 (0.16)
Eu	1.31 (0.12)	1.45 (0.03)	1.23	1.23	1.32 (0.02)	1.43 (0.12)
Gd	6.88 (0.15)	4.66 (0.07)	5.74	6.02	4.30 (0.18)	4.7 (0.8)
Tb	1.19 (0.08)	0.74 (0.01)	1.09	1.20	0.70 (0.01)	0.71 (0.07)
Dy	7.27 (0.56)	4.16 (0.06)	6.54	7.29	3.98 (0.05)	3.8 (0.03)
Ho	1.74 (0.12)	0.94 (0.02)	1.61	1.81	0.92 (0.01)	0.86 (0.22)
Er	4.77 (0.26)	2.51 (0.05)	4.37	4.94	2.38 (0.01)	2.3 (0.1)
Tm	0.75 (0.05)	0.37 (0.02)	0.60	0.68	0.35 (0.01)	0.37
Yb	4.69 (0.32)	2.46 (0.11)	3.99	4.59	2.37 (0.01)	2.32 (0.24)
Lu	0.75 (0.10)	0.40 (0.02)	0.64	0.74	0.39 (0.01)	0.37 (0.04)
Hf	7.14 (0.60)	4.79 (0.16)	6.40	7.57	4.54 (0.04)	4.6
Ta	0.41 (0.11)	0.86 (0.06)	0.54	0.68	0.79 (0.03)	0.82
Th	6.18 (0.65)	4.64 (0.11)	6.18	7.90	4.52 (0.17)	4.5 (0.5)
U	2.90 (0.18)	1.93 (0.05)	2.97	3.36	1.83 (0.07)	1.94 (0.12)
n	2	2	1	1	2	

* Values provided by the United States Geological Survey, 2011
Values are averages based on "n" analyses, with 1 standard deviation in parentheses.

At Togiak Bay-2, Kaufman et al (2001) used luminescence dating to constrain the age of the exposure (Fig. 3.2). Near the top of the exposure, baked sediments directly underlying the basalt flow were dated by thermoluminescence (TL) to 70 ± 10 ka. Infrared stimulated luminescence (ISRL) ages provide age constraints on the lower half of the exposure; an age of 119 ± 10 ka was obtained approximately 1 m below UT1409, and the base of the section was dated to 151 ± 13 ka (Fig. 3.2). Pollen data from the exposure revealed two *Picea* peaks, a large peak over the lower ~1.5 m of the exposure, and another smaller one directly above UT 1409. Since *Picea* is not in the region today and modern surface samples contain less *Picea* pollen than the peaks, Kaufman et al. (2001) attribute the lower, larger, peak to MIS 5e, and place the Aeolis Mountain tephra at the transition from MIS 5d to 5c (Kaufman et al., 2001).

Berger (2003) used TL to date samples from both Halfway House and Gold Hill Ib (Fig. 3.1). He then calculated a weighted mean age of 77.8 ± 4.1 ka for VT tephra using a date from below VT tephra at Halfway House, one from above VT tephra at Gold Hill, and an additional TL date, reported by Oches et al. (1998), from above VT tephra at Halfway House (Fig. 3.2).

Infrared stimulated luminescence ages

To refine age estimates for VT tephra by utilizing advances in luminescence techniques, two samples were collected from loess bracketing VT tephra at Halfway House. Both samples have similar luminescence characteristics, with annual dose of 2.58 (4) and 2.69 (5) ± 0.1 Gy/ka. Sample 4, above VT, yielded a fading-corrected age of 104 ± 11 ka. Sample 5 below VT yielded a statistically equivalent age of 108 ± 12 ka. These provide a weighted mean age of 106 ± 10 ka, which is the final age adopted for discussion.

Determining accurate moisture values for "dry" loess exposures such as Halfway House is difficult. The saturation value was estimated at 15%, and the moisture content utilized to determine the age was calculated using the equation: WC = water in situ + (water saturation - water in situ)/2. The resultant values of 10.5 and 10.2 % were then used to calculate the IRSL ages. This is comparable to values reported by Demuro et al. (2008) from a frozen silt exposure in the Klondike of 13.9 and 10.8%, but lower than Berger (1996), who used assumed values of 21% for exposures similar to Halfway House around Fairbanks. To examine how a differing moisture value may alter the age determination, a sensitivity test was carried out; starting at 5.75%, the in situ moisture value, then at 15, 20 and 25%. The test shows that age increases by ~1 ka for every 1% increase in assumed moisture content. This is a relatively small effect, thus the age determinations remain fairly similar, particularly for the most likely moisture value range of 7-15%, placing VT tephra in MIS 5d (Fig. 3.7).

Discussion

Geochemistry and correlation

Glass major-element geochemistry of the study samples is indistinguishable, although glass shards with SiO_2 less than 69 wt% were not found in UT 1435 (TB-1) and UT 1409 (TB-2), and are less abundant in other western samples at Gold Hill (UA 1344, UT 822) and Halfway House (UA 1425)

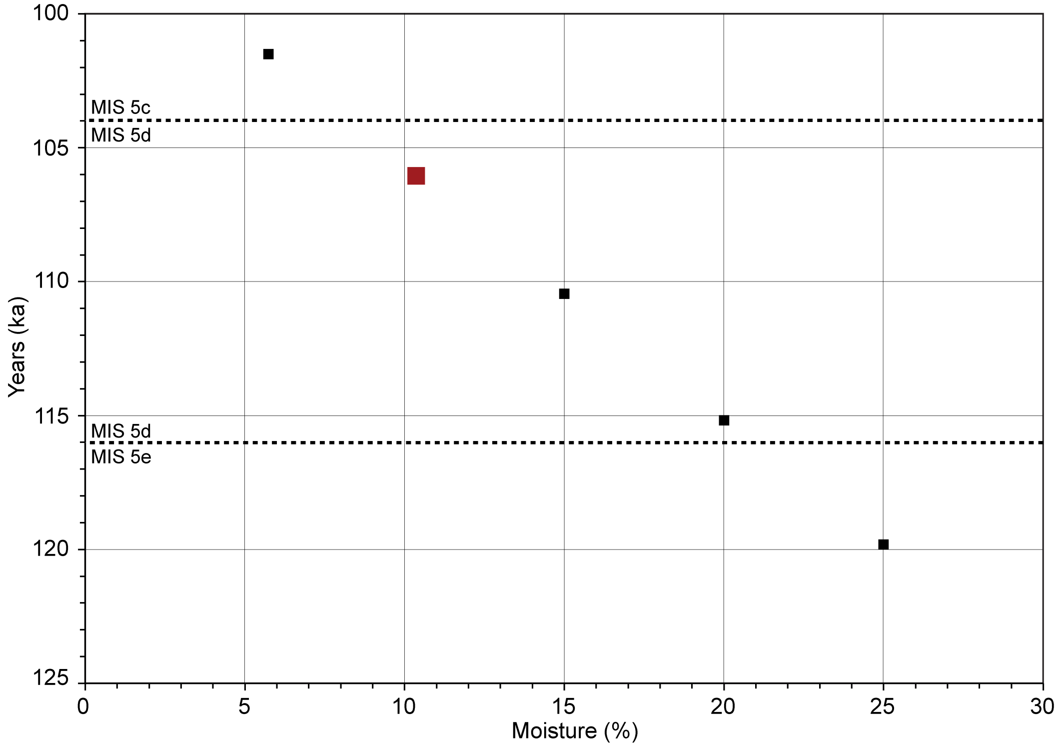

Figure 3.7. Calculated IRSL ages vs. estimates of water content. The youngest age is calculated from the in situ water content value (~5.75 %), 10.4% (large square) is our average estimate for the water content over burial time. Ages for higher water content estimates are shown, although the maximum water content for Halfway House has probably never attained values over 15%. Divisions of sub-stages are best estimates from data presented by Kukla et al. (1997), Lisiecki (2005), Lisiecki and Raymo (2005), and Thompson and Goldstein (2006). The MIS 5e/5d boundary is generally accepted at ~116 ka. The MIS 5d/5c boundary is poorly defined, Lisiecki (2005) places the peak of 5d at 109 ka and the peak of 5c at 96 ka, ~104 ka is a best estimate based on this data in combination with coral ages and SPECMAP boundaries.

(Fig. 3.4, Table 3.2). As with glass analyses, the Fe-Ti oxide mineral analyses for the Togiak Bay samples display less variability than the other samples (Fig. 3.5, Table 3.3, 3.4). Ilmenite is rare in the study samples and was difficult to isolate, although some data was successfully collected from TB-1, TB-2, Gold Hill I, and Jackson Hill. The same magmatic temperature and oxygen fugacity conditions occur at all four sites strongly suggesting that the tephra samples are from the same magma batch (Table 3.5).

Variations in geochemistry over the geographic distribution of tephra deposits have been reported previously, and most likely reflect changing wind directions during multi-modal eruptions (e.g. Shane et al., 2008). Eruptions from the Aleutian arc which produce tephra deposits that are geochemically bi-modal, or have a greater SiO_2 wt % range, are well documented (e.g. Preece et al., 1999; Dreher et al., 2005; Larsen et al., 1997; Finney et al., 2008). The lack of dacitic glass in the Togiak Bay samples may be a result of changing wind directions during the eruption, which would have carried the dacitic glass, probably erupted in the later part of the event, in a more easterly direction. It is possible that increasing the number of glass shard analyses of the Togiak Bay samples may reveal the minor dacite subpopulation found in all other samples of this study. For example, dacite glass was only identified in the Halfway House sample after ~50 analyses.

Therefore, although there is some variation in geochemistry, the strong similarity between the dominant glass and Fe-Ti oxide mineral populations support correlation between samples, which is further strengthened by the consistency of the stratigraphy, paleoenvironmental data, age estimates, trace-element geochemistry, and temperature and oxygen fugacity estimates.

Distribution and eruption volume estimates

With the correlation of these samples, only the Old Crow tephra has been identified at more locations throughout Yukon and Alaska (Preece et al., in press). The Dawson tephra, a prominent tephra deposit found commonly in the Klondike and sourced from Emmons Lake volcanic center in the eastern Aleutian arc, has an eruption volume estimated at >50 km^3, and may have a distribution equivalent or even greater than VT tephra (Froese et al., 2002; Mangan et al., 2003). However, this tephra bed has only been found at two additional sites outside of the Klondike (Begét, unpublished data).

For comparison with the Old Crow and Dawson tephra beds, we calculate a minimum bulk tephra volume eruption estimate for VT tephra. Due to a paucity of site localities, i.e. there are few sites between Togiak Bay and the other locations, we use the minimum volume estimate approach of Pyle et al. 2006. Facing a similar problem with few intermediate sites, they use a simple formula, $Vmin = 3.7A_iT_i$, where A_i is area of isopach of thickness Ti, that takes into account the exponential decay in thickness away from source, and only requires a single isopach to calculate minimum bulk tephra volume. In ArcGIS, we drew a 1 cm isopach, which encompasses an area of ~870 000 km^2. The shape and extent of the plume is based on: (1) geochemical, morphological and petrological evidence that suggests a source in the eastern Aleutian arc, (2) geochemical data, i.e. the relative lack of lower SiO_2 wt % glass present in the most westerly sites, that suggests the initial direction of the plume was in a more northerly direction, but shifted east as the eruption continued, and (3) constraints provided by thickness measurements (Fig. 3.8). Using the Pyle et al. (2006) formula and our area estimate, we calculate a minimum bulk tephra volume estimate of ~32 km^3.

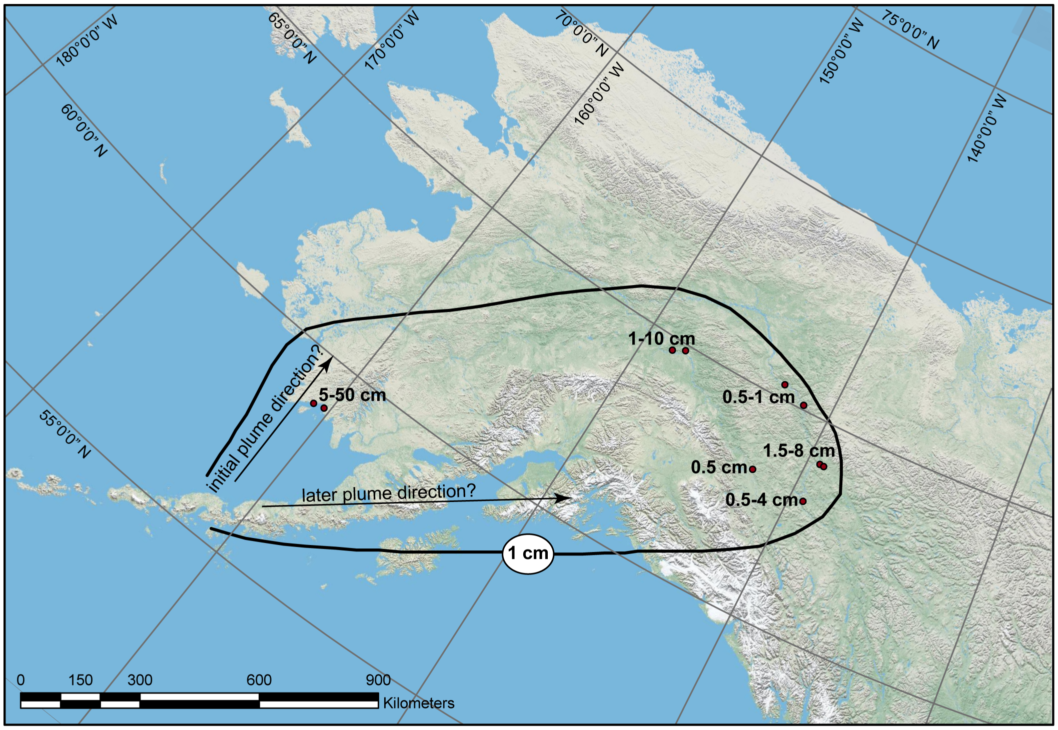

Figure 3.8: Plume extent for the VT tephra deposit used to calculate minimum bulk tephra volume estimate.

Age of VT

The various age determinations on VT tephra place the bed within marine isotope stage 5 *sensu lato* (MIS 5). Old Crow tephra (124 ± 10 ka) is a robust marker horizon for late MIS 6/MIS 5e, as this tephra bed was deposited immediately prior to the last interglacial (Hamilton and Brigham-Grette, 1991; Reyes et al., 2010a,b; Preece et al., in press). When present with VT tephra, Old Crow tephra is stratigraphically below. At Halfway House and Chester Bluff, a prominent paleosol is also present between Old Crow and VT tephras. At Togiak Bay the peak in *Picea* pollen below VT tephra is interpreted to represent warmer than present conditions and is assigned to MIS 5e (Kaufman et al., 2001). Collectively, these data suggest that VT tephra was deposited following MIS 5e.

The relatively consistent presence of a well-developed paleosol and/or organic rich material above VT tephra in conjunction with a smaller, but still significant, *Picea* peak at Togiak Bay, indicate that there was a warm interval soon after deposition of VT tephra. Kaufman et al. (2001) place this interval at the 5d-5c boundary, an age that is supported by the new IRSL dates from Halfway House of 106 ± 10 ka and the lack of additional paleosols between the Old Crow and VT tephras at sites where the two tephra beds are in a conformable sequence (e.g. Halfway House).

In the Yukon there are two well-documented sites, Ash Bend and Dominion Creek, where paleoenvironmental data in combination with optically stimulated luminescence (OSL) and glass-fission track ages reveal the MIS 5a-4 transition. A key tephra bed found at these sites, Sheep Creek tephra-K (SCt-K), has an OSL age of ~80 ka, a date supported by a glass fission-track age on the Dominion Creek tephra of 82 ± 9 ka, which is found directly above SCt-K. (Westgate et al., 2008). Although absence of a tephra bed should not be over interpreted, it should be noted that VT tephra has not been found at these two sites though it is known in the region. Additionally, SCt-K is also present at more than 15 additional sites throughout the Klondike area, but has never been found in association with VT tephra (Westgate et al., 2008).

The collected evidence suggests that the weighted mean age presented by Berger (2003) is too young, and the glass-fission track age too old, although it should be acknowledged that both fall within two standard deviations. The more probable age falls within this overlap, and the new IRSL age determination, near the 5d-5c transition at ca. 104 ka.

Conclusions

Stratigraphic, paleoenvironmental, petrographic, glass and Fe-Ti oxide compositional data and age estimates suggest that the Aeolis Mountain tephra at Togiak Bay, the Jackson Hill tephra from the Klondike and various other tephra samples from the Klondike and Alaska correlate to the VT tephra of the Fairbanks area. The areal distribution of this tephra bed, from southwestern Alaska to central Yukon, and a conservative estimate for bulk tephra volume at ~32 km^3, makes it the most extensive tephra bed in eastern Beringia after the Old Crow and Dawson tephras. The presence of a paleosol above VT tephra, pollen data from Togiak Bay, and multiple age determinations, place VT tephra firmly in MIS 5, sensu lato, most likely near the MIS 5d to 5c transition. Furthermore, we suggest that Halfway House be considered the reference section for the VT tephra. This was one of two sites from where the tephra was first described, is easily accessible, contains the salient features of the stratigraphy, and is the site of previous and new luminescence ages.

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CHAPTER 4: A CHRONOSTRATIGRAPHIC FRAMEWORK FOR HALFWAY HOUSE AND IMPLICATIONS FOR LOESS ACCUMULATION

A version of this chapter will be submitted to the Geological Society of America Bulletin as: Jensen, B.J.L., Evans, T., Froese, D.G., Kravshinsky, V.A., Tephrostratigraphic and paleomagnetic constraints on Marine Isotope Stage 6 to 1 loess accumulation in central Alaska.

Introduction

Large areas of Yukon and Alaska have remained non-glaciated during the Quaternary and preserve a loess record potentially spanning 3 Ma (e.g. Westgate et al., 1990). In interior Alaska and Yukon, the loess deposits can roughly be divided into two main types; valley-bottom and upland loess. In valley-bottom sites loess is commonly perennially frozen and may be interbedded with retransported loess and organic material related to past cycles of permafrost growth and degradation. Sediments are organic-rich, and alluvial and colluvial material is locally present. These valley-bottom deposits tend to preserve the rich floral and faunal records for which eastern Beringia is famous (e.g. Froese et al., 2006, 2009; Guthrie, 1968, 1990; Péwé, 1975a, 1997, 2009; Zazula et al., 2007). Upland loess is generally comprised of primary loess that was, or is, perennially frozen, but has been relatively ice-poor for most of its existence, and underwent periods where permafrost may have completely thawed (e.g. Péwé, 1975a,b, 1997). These primary deposits have experienced some reworking and erosion through thaw slumping and cryoturbation, but they are comparable to 'classic' loess deposits, such as the Chinese loess plateau, where dry, organic-poor loess is interbedded with numerous paleosols (e.g. Liu et al., 1986; Kukla, 1987; Begét and Hawkins, 1989; Begét, 2001; Muhs et al., 2003, 2008; Jensen et al., 2008).

Although these widely dispersed deposits, informally known as the "Yukon silts," have been mapped since the late 1800s (e.g. Russell, 1890; Spurr and Goodrich, 1898; Gilmore, 1908), it wasn't until the 1950s that their origin as eolian deposits was recognized (e.g. Péwé, 1955). Péwé (1975b) formalized the stratigraphic nonmenclature for these silts. Valley-bottom re-transported loess was thought to be primarily post-marine isotope stage (MIS) 5 in age and divided into the Goldstream (Wisconsinan; MIS 4-2) and Ready Bullion (Holocene; MIS 1) Formations. Primary loess deposits, which mantle mid-slope and upland portions of central Alaska, can also occur stratigraphically below or laterally to the Goldstream and Ready Bullion Formations, and were named the Engineering Loess (Holocene) and Gold Hill Loess (>MIS 5). Undifferentiated upland primary loess deposits were known simply as the Fairbanks Loess (e.g. Péwé, 1955, 1966, 1975b). Since Péwé's initial work, detailed geochronologic and paleomagnetic studies have helped differentiate units present in Fairbanks Loess locales (e.g. Westgate et al, 1990; Oches et al., 1998; Berger, 2003; Lagroix and Banerjee, 2004a; Péwé et al., 2009). Present usage of Péwé's nonmenclature finds the terminology generally limited to the Engineering (Holocene; MIS 1), Goldstream (Wisconsinan; MIS 4-2) and Gold Hill (> MIS 5) Formations, but application of the formal names is based on chronology rather than whether the loess is primary or secondary, or present in valley-bottoms or slopes, since the spatial distribution and age of deposits has proven to be more complex (e.g. Begét, 1990; Berger, 2003; Muhs et al., 2003; Lagroix and Banerjee, 2004a,b). The Eva Creek Formation is the formal name Péwé et al. (1997) designated to the forest bed/thaw unconformity that represents MIS 5e; sediments attributed to other stages of MIS 5 have not been clearly identified in Alaska (e.g. Reyes et al., 2010b). Terminology in this paper will follow recent applications of Péwé's formal stratigraphic nonmenclature, where divisions are based on the age of the loess rather than location or sedimentology.

The Halfway House site (64.708 N, 148.503 W) is a mid-slope loess deposit mapped as Fairbanks Loess by Péwé et al. (1966) (Fig. 4.1). Located ~47 km west of Fairbanks, this site was created during the construction of the George Parks Highway in the 1960s, and has been one of the most extensively studied loess sites in Alaska (e.g. Westgate et al., 1983, 1985; Begét and Hawkins, 1989; Begét, 1990; Begét et al, 1990; Oches et al., 1998; Preece et al., 1999; Vlag et al., 1999; Berger, 2003; Lagroix and Banerjee, 2002, 2004a,b; Muhs et al., 2003, 2008). Collectively, this research shows that Halfway House is mostly comprised of the Goldstream Formation, and contains a stratigraphic and paleomagnetic record that has regional paleoenvironmental significance. However, poor chronologic control has hindered the interpretation of the record, and made it difficult to compare it to other regional and global paleoenvironmental records.

Here we present a tephrostratigraphic framework for Halfway House that provides new chronologic control to this section by identifying several dated tephra beds from other locations in Yukon and Alaska. High-resolution paleomagnetic data provides additional age constraint that support the correlations and new age estimates. Magnetic susceptibility measurements and detailed stratigraphy allow direct correlation of our record to previous studies, placing that research into this new chronologic framework, and provide new insight into Alaskan loess accumulation models.

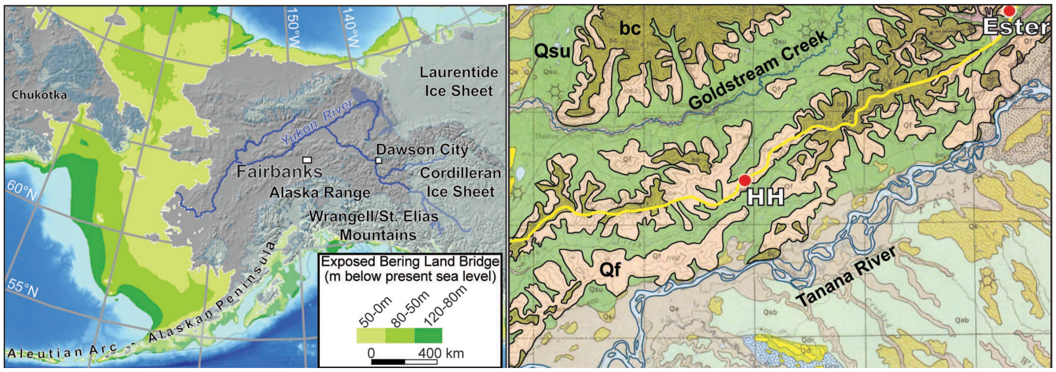

Figure 4.1. Location of Halfway House. ***Left**:* The square marking Fairbanks encompasses the location of Halfway House, and shows the site relative to the landscape during the last glacial maximum (modified from Froese et al., 2009). ***Right**:* Location of HH relative to Ester and geologic units of interest. Map is modified from Péwé et al. (1966) to highlight units of interest. Qf- Fairbanks Loess; Qsu- undifferentiated perennially frozen silts; and bc- Birch Creek Schist. Yellow line represents the George Parks Highway.

Previous Research

Tephrostratigraphy

Westgate et al. (1983, 1985) first described Halfway House and identified two paleosols and tephra beds across the section. The lowest tephra was correlated to the regionally extensive Old Crow tephra (Fig. 4.2; OCt; 124 ± 10 ka; Preece et al., 2011a). Preece et al. (1999) describe the second tephra, as well as two additional beds, all stratigraphically above OCt, naming them the Halfway House (HHt), VT and SD tephra beds. At the time, none of these beds had independent age estimates.

Magnetic Susceptibility

Unlike Chinese loess, magnetic susceptibility (χ) in Alaskan loess deposits is lower in paleosols and higher in inorganic loess (e.g. Begét and Hawkins, 1989; Vlag et al., 1999; Liu et al., 2001). Much of this variation has been attributed to changes in wind-intensity: ferromagnetic grains are more abundant and larger in loess during times of higher wind-intensity (i.e. glacials), than during times of lower wind-intensity (i.e. interglacials) (e.g. Begét and Hawkins, 1989; Begét et al., 1990; Vlag et al., 1999). Further examination of magnetic mineralogy also reveals little pedogenic enhancement of ferrimagnetic content and evidence for some destruction and alteration of magnetic grains, contributing to the lower susceptibility within paleosols (Vlag et al., 1999; Liu et al., 1999, 2001; Begét, 2001). This model of susceptibility variation is also seen in Siberian loess deposits (e.g. Chlachula et al., 1998; Evans et al., 2003)

Recognition that Chinese loess susceptibility appeared to be highly correlative to benthic foraminiferal δ^{18}O records (e.g. Heller and Lui, 1986; Kukla et al., 1988) led to a series of studies on Alaskan loess, including the

Halfway House section (e.g. Begét and Hawkins, 1989; Begét, 1990, 1996; Begét et al., 1990; Lagroix and Banerjee, 2004a). Results suggested that the site contained a continuous record of late- Middle Pleistocene to Holocene loess deposition, and variations in magnetic susceptibility could be correlated to oxygen isotope curves. Observations that susceptibility profiles were relatively consistent between similar-aged sites around the Fairbanks region (e.g. Begét, 1990; Vlag et al., 1999), and statistical tests suggesting significant correlation between isotope records and susceptibility (e.g. Begét and Hawkins, 1989), supported this hypothesis. However, new age determinations on OCt and VT, as well as new luminescence, ^{14}C and ^{10}Be ages, suggested unconformities were present and the record was shorter than previously considered (e.g. Berger, 2003; Muhs et al., 2003, 2008).

Lagroix and Banerjee (2002, 2004a,b) used anisotropy of magnetic susceptibility (AMS) to determine regional wind-directions during loess deposition and assess the amount of post-depositional deformation present at Halfway House; their continuous profiles were developed in trench 1 (Fig. 4.2). They found two zones of post-depositional deformation, 30-40 cm thick, directly above OCt, and associated with the paleosol at ~5-5.5 m (Fig. 4.3). Implications are that inclination and declination values obtained from samples in these intervals are not reliable. Using OCt as their age control, they correlated their magnetic susceptibility curve to SPECMAP. Low susceptibility values directly above OCt were interpreted to represent MIS 5e, while paleosols at ~5-5.5 m and

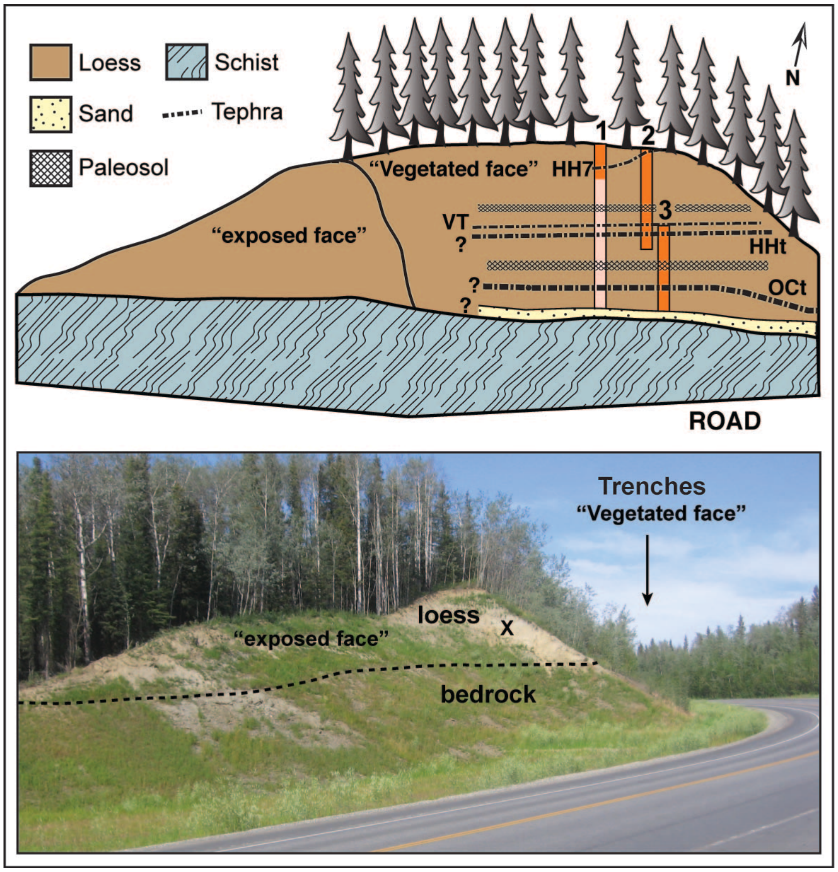

Figure 4.2. ***Top:*** A schematic drawing of Halfway House displaying the most prominent paleosols and continuous tephra beds at the site. Only three trenches were still clearly visible when the site was revisited in 2007. The dark orange highlights the trenches that were logged and sampled over the course of this study. ***Bottom*****:** A photo of the ~south facing slope of Halfway House, the trenches are on the south-east facing cut, which is heavily vegetated with birch, making it difficult to spot the trenches from the highway. **X** = where UA 1454 (DAB) was collected.

~7.5-8 m were correlated to MIS 5a and a mid-Wisconsinan warm period, respectively. With some modification, this supported Begét's original argument that the record was relatively complete. Results for wind-directions obtained from AMS measurements were placed in the SPECMAP correlated curve, and led them to conclude that wind-directions were predominantly in the N-S direction during interglacials and NW-SE during glacials.

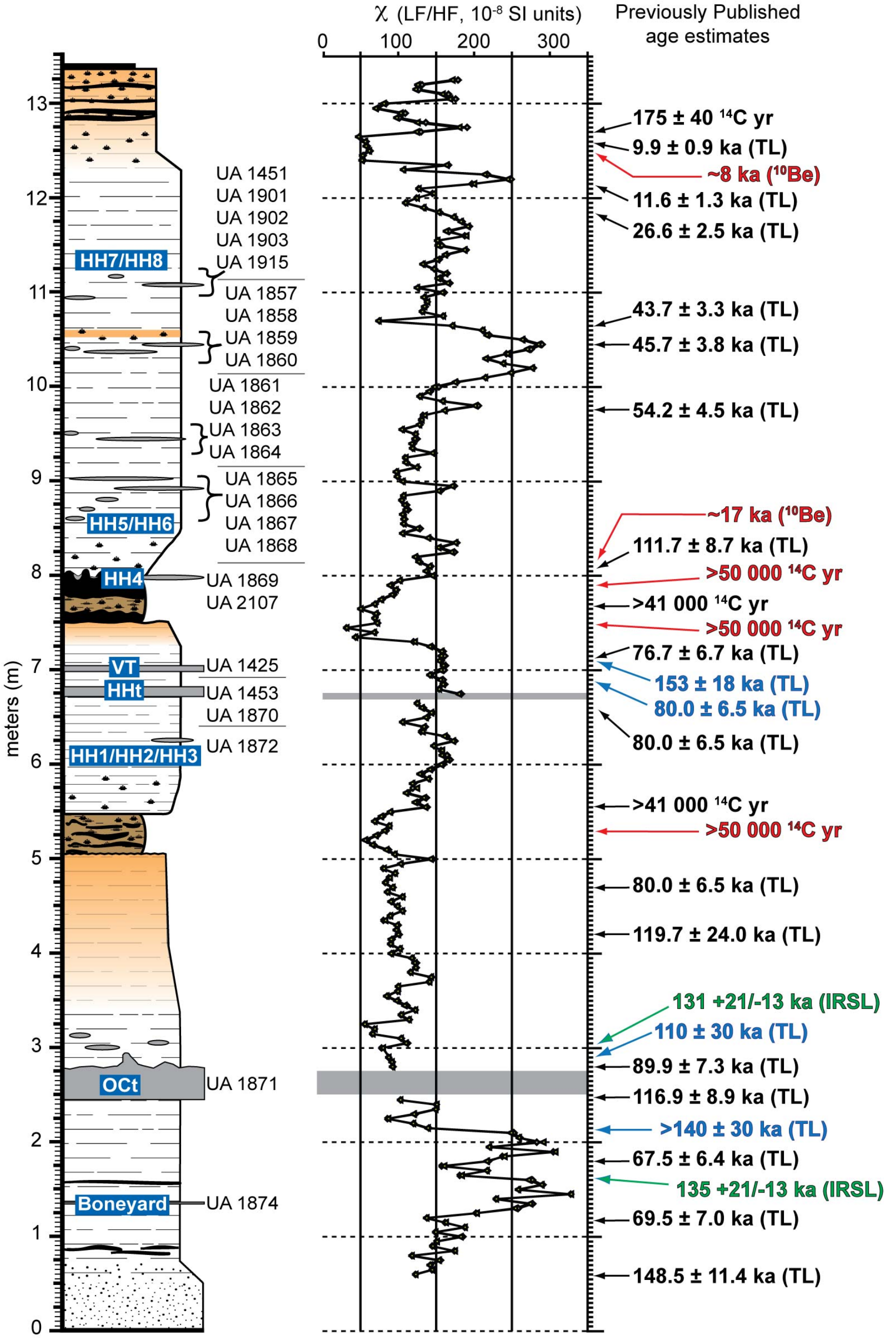

Figure 4.3. Stratigraphic log of Halfway House with magnetic susceptibility (χ) measurements (this study) and ages obtained from previous work. Stratigraphy and χ correlate well between studies, allowing accurate placement of ages. *Black* = Oches et al. (1998); *Blue* = Berger (2003); *Red* = Muhs et al. (2008); *Green* = Auclair et al. (2007). UA #'s are laboratory numbers assigned to field samples. Shards of HH5 and HH6 first appear in UA 1868, but are present in virtually all the samples collected from 8.5-10.5 m.

Previous chronology

Oches et al. (1998) were the first to attempt to date the site using thermoluminscence (TL). They made detailed magnetic measurements and obtained 19 TL dates through trench 1 (Fig. 4.2, 4.3; Oches et al., 1998; Vlag et al., 1999). The TL ages are stratigraphically consistent from the base of the Holocene soil to ~10 m, but below this point the ages become highly variable (Fig. 4.3). They argue, despite the age reversal that is present above the paleosol couplet at ~7.5-8 m, that their ages to ~80 ka, near HHt, are reliable. Berger (2003) reported a weighted mean TL age of 77.8 ± 4.1 ka for VT, calculated from one age from Halfway House and two from the Gold Hill section, placing VT in latest MIS 5a. This age is consistent with Oches et al. (1998) ages from this depth, but as with them, Berger also measured a much older sample above the paleosol couplet.

Muhs et al. (2003, 2008) carried out detailed geochemical analyses on the entire loess profile at Halfway House. Using a series of geochemical proxies developed to identify paleosols and assess the amount of weathering that is present within them (e.g. Muhs et al., 1998, 2003, 2008), they identified up to seven paleosols, but only two displayed an amount of development comparable to the modern soil, corresponding to the paleosol couplet at ~7.5-8.0 m and the paleosol at ~5.0-5.5 m (Fig. 4.4). Muhs et al. (2008) concluded, based on non-finite ages on charcoal from these paleosols, and the presence of OCt, that the paleosol at ~5.25 m mostly likely formed during the last interglacial, and the couplet likely formed during an early to mid-Wisconsinan interstadial, an assessment consistent with Berger (2003) and Oches et al. (1998) (Fig. 4.3).

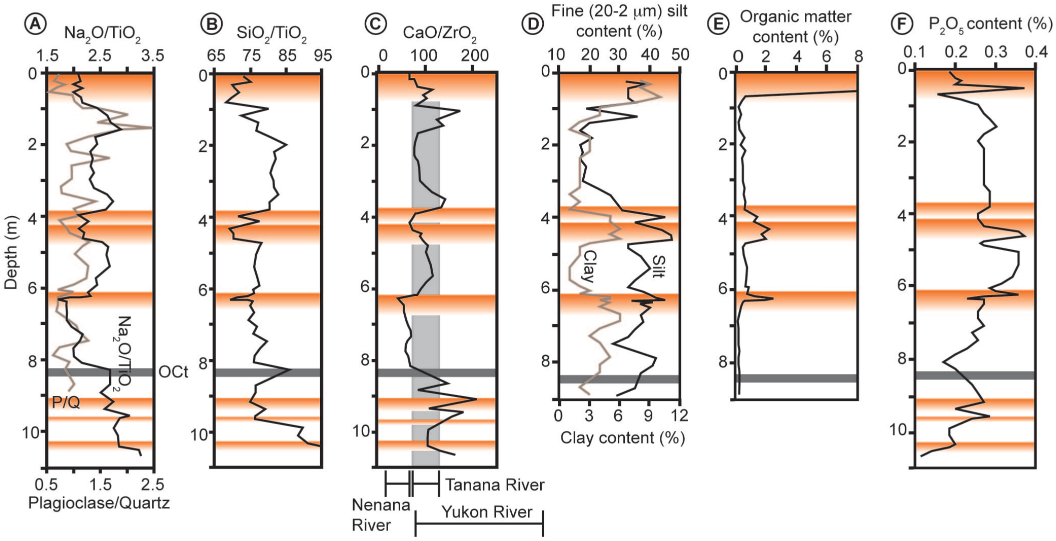

Figure 4.4. Selected geochemical profiles modified from Muhs et al. (2003, 2008). ***A,B***- Depletion of Na_2O and SiO_2 track the weathering of plagioclase, reflected in the plagioclase:quartz (P:Q) ratio, confirming a relatively significant degree of weathering associated with the modern soil, the paleosol couplet at ~4.5 m depth (~7.5 m height), and the paleosol at ~6 m depth (~5 m height). ***C***- Loess at Halfway House appears to be sourced mostly from Tanana river silt, but some input from Nenana and Yukon rivers is probable. ***D***- Since clay abundance tracks silt abundance, the variations are likely the results of direct deposition because silt is not a product of pedogenesis. Therefore, peaks of silt and clay within paleosols represent lower wind intensities resulting in deposition of finer material. ***E***- Only the most prominent paleosols at Halfway House show any notable amount of organic material. ***F***- Phosphorous accumulates in organic matter that is present in the A/O horizon of a soil, but is depleted in the B-horizon by plants. This "high-low" trend of phosphorous has not been documented in tundra soils.

Auclair et al. (2007) experimented with infrared stimulated luminescence (IRSL), an optical luminescence method, and tested their modifications to the method by dating sediments bracketing OCt. Their ages of 131 +21/-13 ka and 135 +21/-13 (Fig. 4.3) suggested that their approach was more reliable than TL with loess older than 80 ka (Auclair et al., 2007). Jensen et al. (2011) collected samples closely bracketing VT tephra to apply recent advances in the IRSL approach of Auclair et al. (2007). Evidence at other sites where VT is present indicated that the latest MIS 5a age assigned to the tephra was likely too young. Using single-aliquot regenerative-dose (SAR) IRSL, a new age of 106 ± 10 ka was determined for VT, which is consistent with paleoenvironmental and age data from correlative sites (Jensen et al., 2011). This new age suggests that the early mid-Wisconsinan age assigned to the paleosol couplet is also too young.

Methodology

Stratigraphy

Initial studies by Westgate et al., (1983, 1985) and Begét and Hawkins (1989) were completed while the original exposure was still well exposed. Later research required excavation of several trenches as the section became heavily re-vegetated (Fig. 4.2). In 2007, we re-excavated a 3 m section in trench 2 to collect bracketing luminescence samples around VT (c.f. Jensen et al., 2011). This trench was chosen as it had the best exposure of the tephra and was the location where Berger (2003) collected his samples. All of trenches 2 and 3 were re-excavated in 2010 for high-resolution paleomagnetic and tephra sampling. The upper section of trench 2 does not have a modern soil profile, thus to ensure a continuous sampling profile to the present, the upper ~3 meters of trench 1 was also re-excavated and sampled

Paleomagnetic sampling and analyses

Magnetic susceptibility and remanence samples were collected by pushing 2.5 cm diameter plastic cylinders horizontally into the vertically excavated trenches at 5 cm intervals. In 2011, the section from ~8.2-7.0 m was recollected at 2 cm intervals. Sample orientation was measured with a Brunton compass, set for local declination. A total of ~365 samples were collected. Remanence measurements were made at the University of Alberta by a horizontal 2G Enterprises DC-squid cryogenic magnetometer equipped with an alternating-field (AF) demagnetizer. Samples were progressively demagnetized using up to 16 steps and a maximum field of 100 mT. Results were interpreted with the aid of orthogonal vector component plots and principal component analyses. Magnetic susceptibility measurements were made on a Bartington MS-2 susceptibility meter at three orientations (x, y, z) and normalized by mass, both low and high frequency measurements were made.

Tephra analyses

Tephra samples were sieved into multiple size fractions; those with the most abundant glass were utilized for analysis. The majority of samples collected in this study, with the exception of OCt, VT and HHt, were small and fine, and the size fraction used was 45-75 μm. Major-element geochemistry was determined on a JEOL 8900 superprobe at the University of Alberta microprobe laboratory using a 15 KeV voltage, 10 μm beam diameter, and 6 nA current. A Lipari obsidian (ID 3506) and OCt were run concurrently with all samples to assure proper calibration and allow accurate comparison between samples run at different times.

Stratigraphy

The stratigraphic log is a composite from trenches 1, 2, and 3 (Fig. 4.3). Trench 3 was logged and sampled from the base of the section to HHt, and this tephra was used to correlate trench 3 to trench 2. The top of trench 2 corresponds to ~11 m in the composite stratigraphic log (Fig. 4.3). The remainder of the section was logged in the upper 2.5 m of trench 1.

The basal sands that drape the schist bedrock at Halfway House (e.g. Westgate et al., 1983) were exposed, but the bedrock was not. The first paleomagnetic sample was collect directly above the contact between the loess and sand, and from this sample to ~0.70 m, the loess contains small sand beds and concretions. Loess from the sands to ~1.6 m are tan-brown and appear laminated, with thin beds of organic-rich silts. From 1.6 m to 3.4 m the loess is massive, inorganic and heavily mottled, displaying colors more typical of unaltered loess, generally around 2.5Y 5/2 (e.g. Muhs et al., 2008). Similar to Muhs et al. (2003, 2008), no morphological evidence of paleosol formation was noted around OCt (~2.5 m), in contrast to the reports of Oches et al. (1998) and Lagroix and Banerjee (2002, 2004a) (Fig. 4.5B).

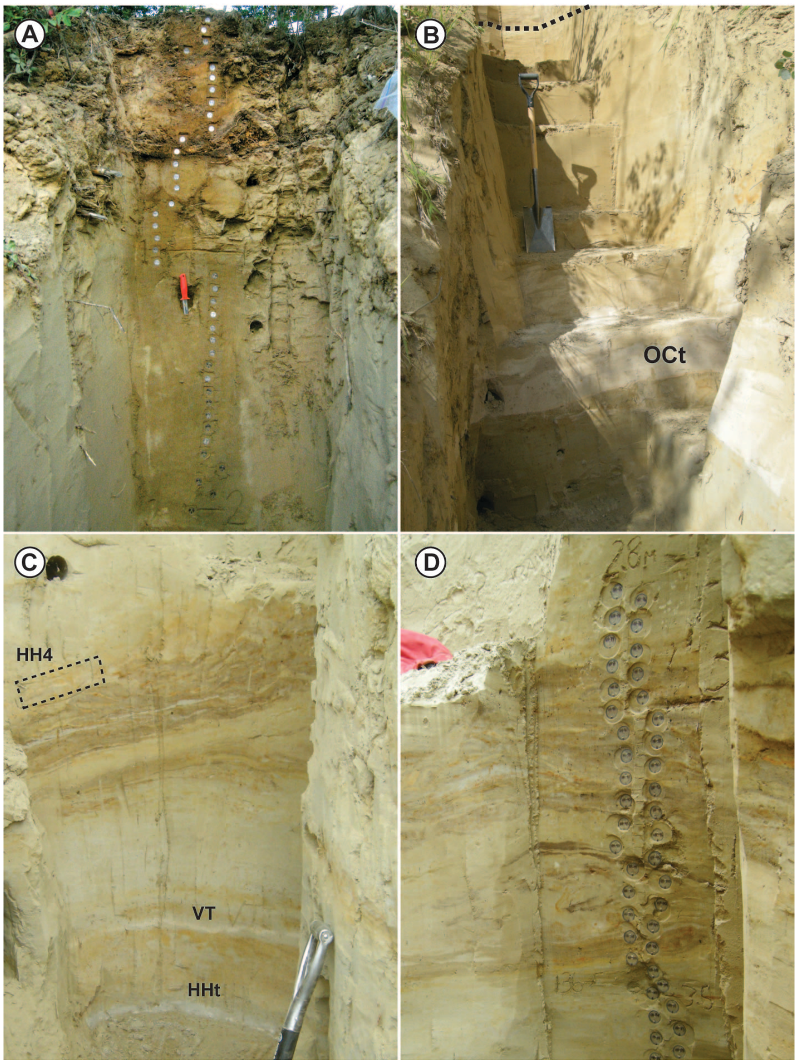

Figure 4.5. ***A***- Paleomagnetic samples in the upper ~2.5 m of trench 1 at Halfway House. The modern soil complex consists of several interbedded A and B- horizons. ***B***- OCt, up to 40 cm thick, is within grey-tan loess, while the loess above OCt to the paleosol (base at dashed line) is weathered. ***C***- The paleosol couplet above VT and HHt, the 5 cm paleomagnetic sampling profile was partially collected through the face with HH4. ***D***- A close up of the paleosol couplet and 2 cm paleomagnetic sampling profile, collected on the right face of the trench.

At ~3.4 m the loess becomes more weathered in appearance, taking on an orange tone that deepens moving towards the paleosol at 5 m. By 4.4 m, 0.25-1cm thick laminae of mm-scale silt/clay concretions are present through the loess, and the loess itself has become friable and carries a deep orange hue.

Munsell colours through this section tend to have hues of 7.5YR-10YR with high chromas and values. The paleosol (~5-5.4 m) is expressed as a cryoturbated organic-rich silt bed comprised of cryoturbated and weathered humic horizons and charcoal. The upper contact grades into less weathered loess, but occasional humic lenses are present. The loess becomes ‘speckled’ approaching HHt at ~6.7 m. The speckles appear to be < 1 mm diameter, weakly developed, Fe-oxide concretions. These are likely the remains of grass and shrub roots that oxidized following permafrost thaw. The loess is mottled and oxidized around HHt and VT, but remains massive and inorganic to the base of the paleosol couplet (Fig. 4.5C,D). The couplet is ~50 cm thick, with a relatively sharp basal contact and a poorly expressed B-horizon at its base. It is comprised of a lower, 10-20 cm thick, A-horizon intercalated with organic-rich silt, overlain by a ~10 cm thick less organic-rich B-horizon, and capped by another A-horizon/organic-rich silt bed that is 20-30 cm thick. Charcoal is abundant, the upper contact is highly undulatory, and the couplet rises and thickens slightly towards the right end of the trench (Fig 4.3, 4.5C). Except for two oxidized intervals, one ~50 cm above the paleosol couplet, the other at ~10.5 m, the loess is massive and inorganic for the remainder of trench 2.

Trench 1 was logged and sampled from the modern soil to ~2.5 m below the surface, the base approximately 10-20 cm below a series of small tephra samples that correlate to those found at the top of trench 2. Loess is massive and inorganic into the base of the modern soil, of which the B-horizon becomes visible ~1m below the surface. The soil is a complex of several interbedded O, A and B-horizons, rich in charcoal, with a prominent organic bed visible ~50-60 cm below the surface (Fig. 4.5A).

Revised Tephrostratigraphy

Muhs et al. (2003, 2008) label an “unidentified tephra” below OCt in their stratigraphic logs, this bed likely corresponds to a sample collected at ~1.5 m, a continuous, yellow-white bed up to 0.5 cm thick (Fig. 4.3; UA 1874). This tephra has been correlated to the Boneyard tephra, first identified at the Palisades site on the Yukon River, ~ 250 km west of Fairbanks, but also present at a new Gold Hill Loess exposure near Ester (Table 4.1, Fig. 4.6; Jensen et al., in review). It has distinctive major-element glass geochemistry and morphology, with relatively high Al_2O_3 weight percent (wt%) and low FeO_t wt% compared to other Yukon-Alaska tephra beds at this SiO_2 wt % range. Glass morphology of the bed consists almost entirely of blocky, thick-walled pumice that have small evenly distributed vesicles and abundant microcryts.

OCt (UA 1871), ~1 m above Boneyard tephra, is 20-40 cm thick, has a sharp lower contact, a heavily cryoturbated upper contact, and includes pods of tephra up to 20 cm above the main deposit (Fig. 4.3, 4.5). It is a rhyolitic tephra bed with few phenocrysts and a glass morphology predominantly consisting of platy glass and thick-walled pumice (Fig. 4.6; for a detailed review see Preece et al., 2011a).

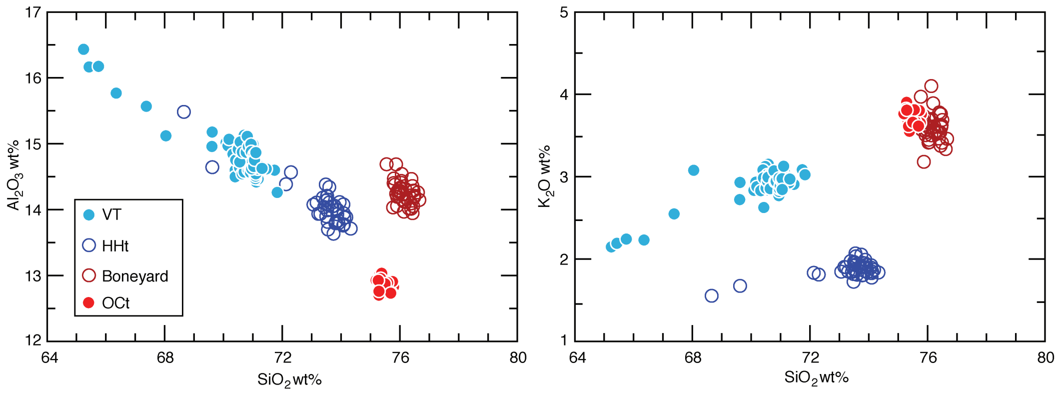

Figure 4.6. Selected bivariate plots of major-element glass geochemistry of the tephra beds previously identified at Halfway House.

HH1, HH2 and HH3 were identified from a single sample (UA 1872) collected on a face that was cleared between trenches 2 and 3 to track HHt. Approximately 50 cm below HHt, it was comprised of several white, diffuse pods, the largest 0.5 cm thick and 7 cm long. Glass morphology of the sample is predominantly thick-walled tricuspate and bubble-wall shards, although conspicuous shards of frothy pumice are present. Major-element geochemical analyses reveal that three separate populations are present. HH1 is the predominant population, comprised of tricuspate and bubble-walled shards, with a distinct geochemical trend that ranges from low SiO_2 wt% dacite to high SiO_2 wt% rhyolite. This tephra has been correlated to the Snag tephra, found in exposures along the White River, Yukon Territory (Table 4.1, Fig. 4.7; Turner et al., in review). Supporting this correlation is HH2, the second most abundant population, which is comprised of frothy pumice. HH2 is geochemically similar to, but can be distinguished from, the Sheep Creek-Canyon Creek tephra (Fig. 4.7; SC-CC; e.g. Westgate et al., 2008). HH2 has been correlated to a previously unreported tephra bed found in the same stratigraphic sequence as Snag at the White River exposure, although as a distinct bed (Turner, pers. comm.). For ease of discussion, we will name this tephra here White River-unknown 5 (WR-UN5), to remain consistent with nomenclature in Turner et al. (in review). The HH3 population is recognized from 5 shards in this sample, but is common as detrital material in virtually all samples collected stratigraphically above, but not below, this level. HH3 has been correlated to samples (UA 1624/1909) collected ~15-20 cm below VT at Gold Hill IV (for location details see Evans et al., 2011), where it is a mm-scale bed, semi-continuous, within heavily oxidized and laminated loess. It is a high SiO_2 wt% rhyolite with distinctly low K_2O wt% (Table 4.1; Fig. 4.7). Only three beds of similar composition are known: the Donjek, Kulukak Bay and Stampede tephras. The Donjek and Kulukak Bay tephras have higher K_2O wt%, and the Kulukak Bay tephra is above VT (Kaufman et al., 2001; Jensen et al., 2011; Turner et al., in review). However, glass major-element geochemistry of HH3 and averages of the Stampede tephra presented by Begét and Keskinen (1991) are notably similar (Table 4.1; Fig. 4.7). The Stampede tephra was first documented within a block of silt that is faulted and folded into a push moraine associated with the Lignite glaciation, and a site comprised of interbedded sand and silt on Richardson Highway by the Tanana river. The latter is thought to be correlative to the nearby Canyon Creek vertebrate locality (Weber et al., 1981; Begét and Keskinen, 1991). It has subsequently been correlated to Cook Inlet (Reger et al., 1996). Age estimates for the Stampede tephra, based on stratigraphy, $^{40}Ar/^{39}Ar$ and TL dating, range widely from >140

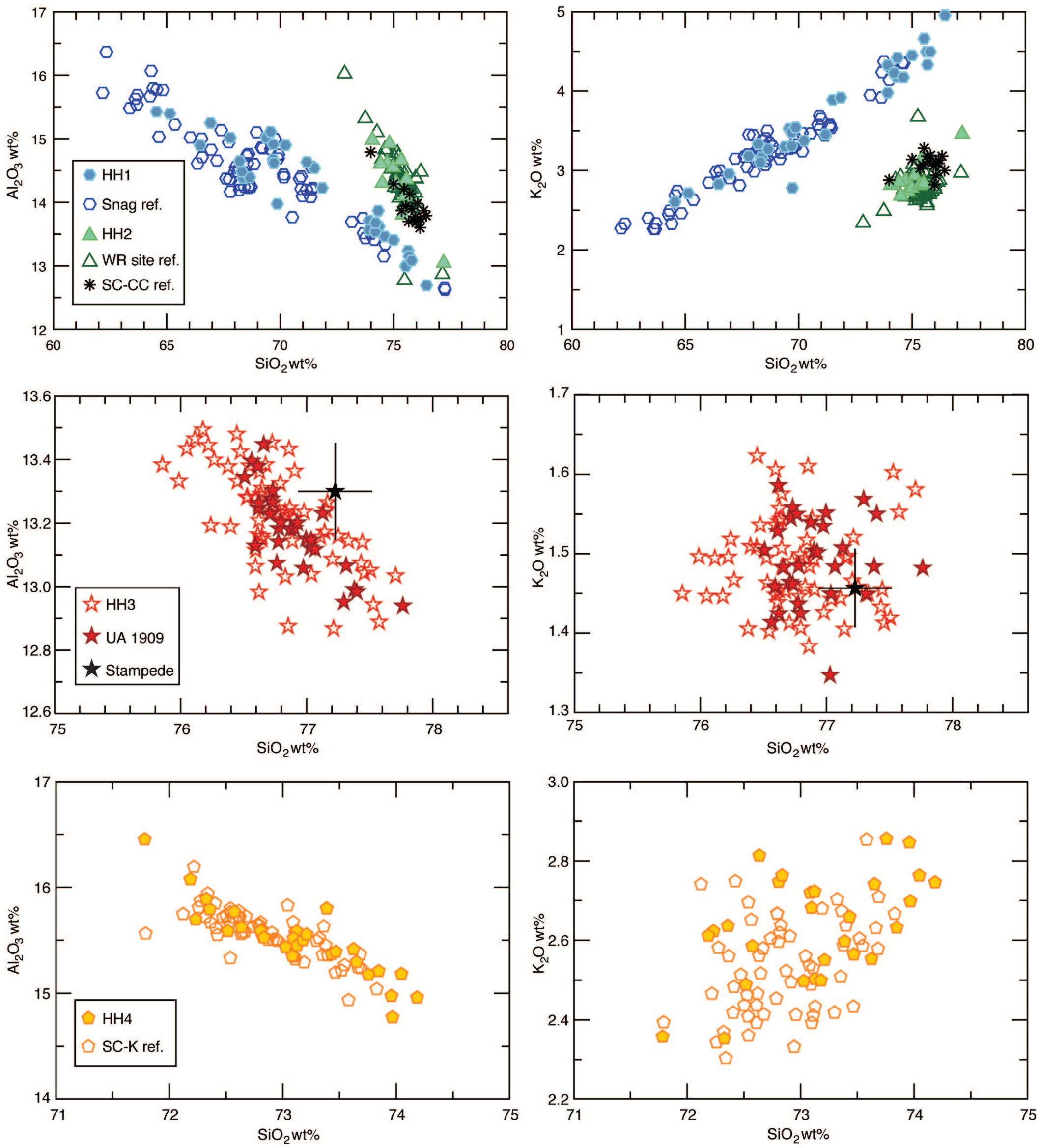

Figure 4.7. Selected bivariate plots of major-element glass geochemistry of HH1, HH2, HH3 and HH4 and their correlative beds. ***Top row*:** HH1, HH2 and reference material from Snag, WR-UN5, and SC-CC tephra beds. ***Middle row*:** HH3 plotted with UA 1909 from Gold Hill IV, and values reported for Stampede tephra from Begét and Keskinen (1991). ***Bottom row*:** HH4 plotted with a SC-K reference sample (UT 40).

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ka to ~380 ka (Begét and Keskinen, 1991; Reger et al., 1996; Begét, 2001). Recent cosmogenic dates (^{10}Be) reported by Dortch et al. (2010) suggest that the Lignite Glaciation may have had an advance in MIS 5d, and the presence of *Bison priscus* fossils at Canyon Creek suggest this site must be ≤ MIS 6

(Westgate et al., 2008). These latter dates support a younger age (i.e. ≤ MIS 6) for the Stampede tephra. Therefore, the uncertainty surrounding the age of this tephra indicates that the correlation could be valid, although analysis with reference material of the Stampede tephra is required to further test the potential correlation.

HHt (~6.7 m; UA 1453, 1870) and VT (~7 m; UA 1425) are discrete beds up to 10 and 3 cm thick, respectively. Both tephra beds have diffuse contacts, but similarly to OCt and Boneyard tephra, they can be followed continuously across the exposure, suggesting minimal post-depositional disturbance (Fig. 4.5D). Both tephra beds have a main rhyolitic population with some dacitic shards, although the latter are more abundant in VT (Fig. 4.6, Table 4.1.). Glass morphology of both tephra beds is comprised of bubble-walled and tricuspate shards with some pumice, although HHt glass is much thicker-walled. Detailed descriptions and geochemistry of HHt and VT are in Preece et al. (1999) and Jensen et al. (2011, in review).

HH4 (UA 1869, UA 2107) was collected at the contact between the paleosol couplet and overlying loess (Fig. 4.3, 4.5C). The samples consisted of diffuse blebs up to 1 cm thick that were semi-continuous for 70 cm across the trench. HH4 is very fine, most glass is < 75 μ, and consists of frothy pumice. Geochemical analyses show abundant detrital glass shards that have very low Na_2O and high SiO_2 concentrations. This suggests they are heavily weathered, which would make them particularly susceptible to Na-loss during analyses. The un-weathered shards form a coherent population that has distinct glass

Table 4.1. Major-element geochemistry of tephra beds from Halfway House and reference samples

Sample		**SiO_2**	**TiO_2**	**Al_2O_3**	**FeO_t**	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**Cl**	**H_2O_{diff}**	**n**
Boneyard	MEAN	76.15	0.04	14.21	0.60	0.14	0.10	1.04	3.94	3.69	0.10	7.40	45
	STDEV	0.28	0.04	0.30	0.22	0.03	0.03	0.08	0.47	0.50	0.05	0.81	
Old Crow	MEAN	75.47	0.31	12.85	1.76	0.08	0.30	1.51	3.72	3.71	0.28	3.34	18
	STDEV	0.18	0.04	0.10	0.06	0.03	0.03	0.06	0.16	0.09	0.02	1.29	
HH1	MEAN	71.27	0.64	14.20	3.02	0.05	0.68	2.18	4.14	3.71	0.10	4.29	32
(Snag)	STDEV	3.44	0.36	0.78	1.32	0.04	0.45	1.07	0.32	0.65	0.03	1.90	
HH2	MEAN	75.13	0.19	14.35	1.24	0.04	0.36	1.67	4.07	2.92	0.03	5.22	12
(WR-UN5)	STDEV	0.80	0.06	0.53	0.12	0.03	0.09	0.38	0.31	0.22	0.02	2.19	
HH3	MEAN	76.78	0.25	13.22	1.50	0.10	0.34	1.72	4.47	1.49	0.16	6.52	59
(Stampede?)	STDEV	0.42	0.04	0.16	0.06	0.04	0.03	0.08	0.28	0.06	0.03	1.79	
HHt	MEAN	73.04	0.48	14.16	2.49	0.14	0.54	1.99	5.17	1.86	0.14	2.31	84
	STDEV	1.47	0.09	0.44	0.56	0.03	0.16	0.50	0.27	0.11	0.02	1.40	
VT	MEAN	70.51	0.58	14.83	3.17	0.10	0.69	2.47	4.57	2.92	0.16	2.52	79
	STDEV	1.36	0.08	0.41	0.49	0.03	0.20	0.42	0.21	0.21	0.04	1.66	
HH4	MEAN	73.07	0.20	15.56	1.46	0.05	0.46	2.10	4.43	2.63	0.04	5.77	29
(SC-K)	STDEV	0.69	0.05	0.47	0.13	0.03	0.06	0.17	0.16	0.14	0.02	2.57	
HH5	MEAN	70.60	0.69	14.56	3.19	0.07	0.68	2.30	4.33	3.48	0.11	2.55	48
(DAB)	STDEV	1.43	0.17	0.33	0.55	0.03	0.20	0.51	0.30	0.30	0.06	1.59	
HH6	MEAN	75.88	0.27	13.04	1.34	0.05	0.19	0.88	3.73	4.53	0.11	6.04	73
(DCt)	STDEV	0.53	0.05	0.23	0.13	0.03	0.05	0.15	0.16	0.13	0.03	1.52	
HH7 pop.1	MEAN	78.71	0.13	12.33	0.87	0.06	0.19	1.03	3.23	3.26	0.20	6.32	52
	STDEV	0.38	0.04	0.27	0.09	0.03	0.05	0.10	0.23	0.32	0.04	1.17	
HH7 pop.2	MEAN	76.80	0.14	13.47	1.04	0.06	0.28	1.68	3.82	2.55	0.15	4.63	24
(Chatanika?)	STDEV	0.34	0.04	0.19	0.09	0.03	0.05	0.13	0.16	0.14	0.04	1.93	
HH7 all	MEAN	78.10	0.13	12.69	0.92	0.06	0.22	1.24	3.41	3.03	0.18	5.78	76
(EB?)	STDEV	0.96	0.04	0.59	0.12	0.03	0.07	0.32	0.35	0.43	0.05	1.64	
HH8	MEAN	74.19	0.27	13.60	2.15	0.08	0.22	1.23	4.49	3.55	0.22	4.84	8
(Dawson)	STDEV	0.25	0.05	0.08	0.12	0.02	0.04	0.06	0.36	0.09	0.04	2.21	
Snag	MEAN	68.17	0.99	14.63	4.30	0.07	1.13	3.12	4.38	3.15	0.08	1.55	39
reference	STDEV	2.88	0.25	0.66	1.09	0.02	0.54	0.99	0.23	0.52	0.02	2.17	
WR-UN5	MEAN	68.17	0.99	14.63	4.30	0.07	1.13	3.12	4.38	3.15	0.08	1.55	39
reference	STDEV	2.88	0.25	0.66	1.09	0.02	0.54	0.99	0.23	0.52	0.02	2.17	
*Stampede**	MEAN	77.23	0.23	13.30	1.34	NR	0.34	1.66	4.30	1.46	0.15	3.97	54
reference	STDEV	0.29	0.06	0.15	0.11		0.03	0.08	0.16	0.05	0.04	0.86	
SC-K	MEAN	72.87	0.21	15.56	1.46	0.04	0.50	2.21	4.58	2.53	0.04	4.09	59
reference	STDEV	0.46	0.04	0.22	0.11	0.03	0.06	0.15	0.23	0.12	0.02	1.98	
DAB	MEAN	71.43	0.55	14.46	2.67	0.05	0.50	1.86	4.61	3.76	0.10	3.24	20
reference	STDEV	0.53	0.07	0.19	0.19	0.03	0.06	0.16	0.12	0.10	0.02	1.76	
Dom.Crk.	MEAN	75.74	0.28	13.05	1.30	0.04	0.19	0.90	3.82	4.59	0.10	5.79	43
reference	STDEV	0.57	0.06	0.26	0.12	0.03	0.04	0.17	0.13	0.12	0.02	1.82	
*Chatanika***	MEAN	76.90	0.13	13.52	1.01	0.08	0.29	1.65	3.78	2.57	0.15	6.01	7
reference	STDEV	0.13	0.13	0.17	0.06	0.02	0.02	0.15	0.13	0.13	0.02	1.74	
*EB***	MEAN	77.62	0.12	13.06	0.83	0.08	0.17	1.26	3.63	3.01	0.22	6.25	12
reference	STDEV	0.86	0.08	0.58	0.12	0.04	0.07	0.22	0.22	0.23	0.07	2.10	
Dawson	MEAN	74.04	0.27	13.68	2.06	0.07	0.22	1.23	4.53	3.68	0.22	3.09	39
reference	STDEV	0.39	0.04	0.35	0.07	0.03	0.03	0.06	0.12	0.12	0.02	1.56	

Data normalized on a water-free basis. FeOt=total Fe as FeO; H_2Odiff=water by difference; n=number of analyses
Boneyard=UA 1874; Old Crow=UA 1871; HH1=UA 1872; HH2=UA 1872; HH3=UA 1872, 1857-69, 1873, 2107
HHt=UA 1870, 1453; VT=UA 1425; HH4=UA 1869, 2107; HH5/6=UA 1857-1868, 1873; HH7=UA 1901-3, 1915, 1451
HH8=UA 1901; Snag=UA 1589; WR-1=UA 1930, 1928; SC-K=UT 40; DAB=UT 745; Dom.Crk.=UT 1905;
Dawson=UA 1000. *Values from Begét and Keskinen (1991) **Values from Péwé et al. (2009)

geochemistry and morphology that places it in the Sheep Creek family (c.f. Westgate et al., 2008). Concurrent analyses with reference material show that HH4 correlates to Sheep Creek-Klondike (SCt-K, ca. 80 ka; Westgate et al., 2008) (Fig. 4.7). SCt-K is a widely distributed tephra bed in the Klondike region south of Dawson City, Yukon (Fig. 4.1), and is consistently found directly above a paleosol (Sanborn et al., 2006; Schweger 2003, Westgate et al., 2008).

Thirteen samples were collected above SCt-K; a series of discontinuous blebs and thin beds of tephra, rarely greater than 0.2 cm thick, were collected at intervals to the top of trench 2 (Fig. 4.3). Several small samples were also collected between 2.2-2.5 m below the surface in trench 1. Most samples only contained glass in the 45-75 μ fraction. Analyses revealed abundant detrital material, and in all samples but those collected around ~11 m (i.e. UA 1915 at the surface in trench 2, and most samples in trench 1), it was difficult to discern any predominant geochemical population in any one sample. However, taken collectively, we were able to isolate several distinct geochemical populations within the samples. HH5 and HH6 comprise two of the largest populations that were not correlated to older, known tephra beds, such as HH3 (potential Stampede tephra correlative), OCt and HHt. To test if contamination during laboratory processes may have mixed the samples, several from different stratigraphic levels were re-processed and analyzed, to the same result. Coincidentally, reference samples of the Dominion Creek tephra (DCt; Preece et al., 2000, 2011b) and Dome Ash Bed (DAB; e.g. Péwé, 1975b; Preece et al., 1999) were analyzed during the same runs, and their similarity to HH5 and HH6 was recognized. The major-element glass geochemistry permits correlation between HH5 and DAB, and HH6 and DCt (Table 4.1; Fig. 4.8). Additionally, UA 1454, a single sample collected from the exposed face at Halfway House (Fig. 4.2), 4 m below the surface, and 4 m above the bedrock contact, also

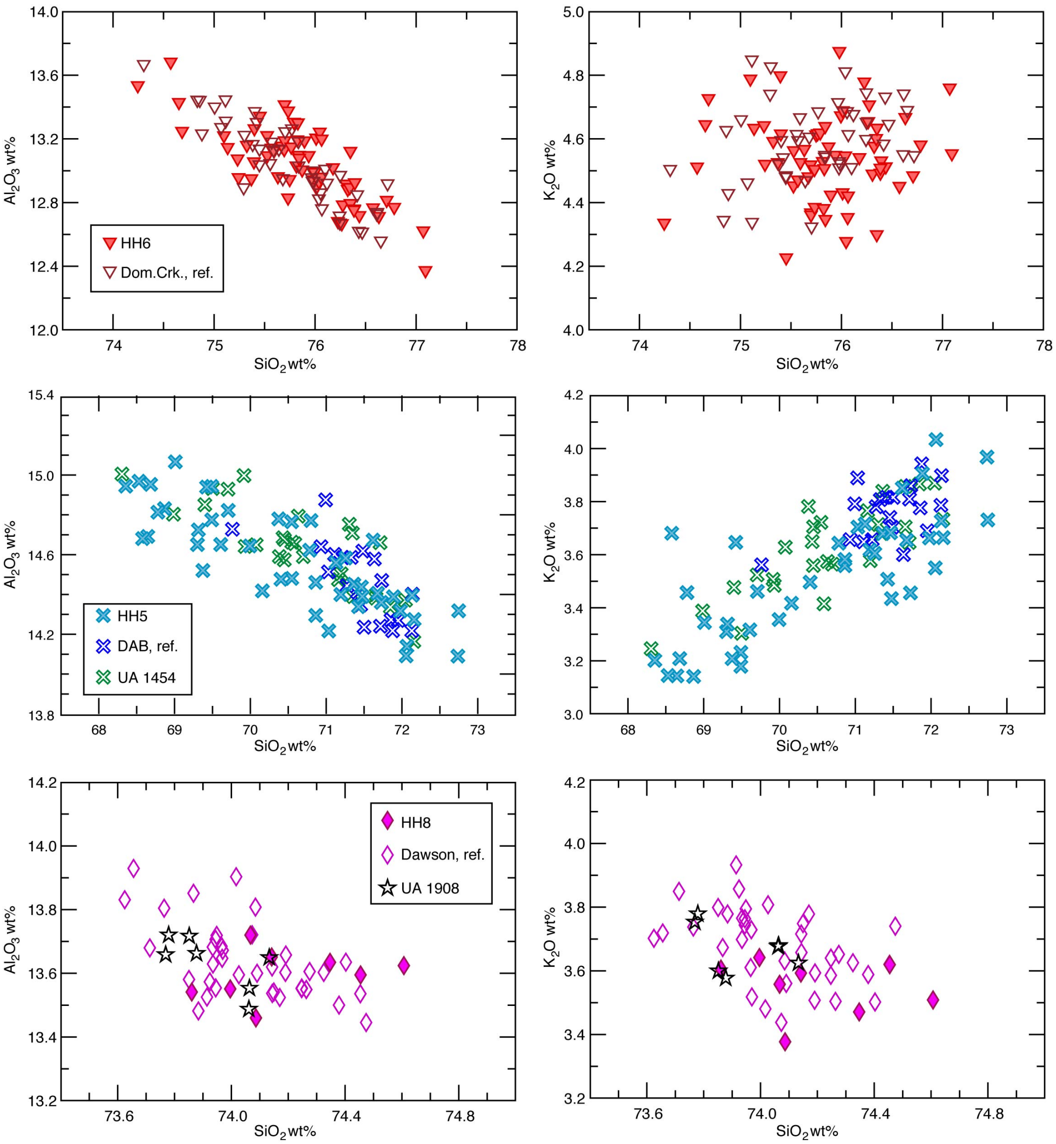

Figure 4.8. Selected bivariate plots of major-element glass geochemistry of HH5, HH6, and HH8 and their correlative beds ***Top row:*** HH6 and DCt reference material. ***Middle row:*** HH5, DAB reference material, and UA 1454. DAB reference contains fewer dacitic shards than HH5 and UA 1454. This may be the result fewer analyses and of processing of the reference material; during glass flotation (e.g. Jensen et al., 2008), it is possible to loose lower SiO_2 wt% shards if the density of the separation liquid is too low (e.g. Froese et al., 2003). ***Bottom row:*** HH8, Dawson reference material and UA 1908, a sample from Gold Hill III.

correlates to HH5 and DAB. This sample contains no other populations, and indicates that DAB is present at the site as a primary bed (Fig. 4.8). The correlation of DCt to HH6 is supported by stratigraphy, all locations were this tephra has previously been collected it is between 30 and 100 cm above SCt-K (e.g. Preece et al., 2000; Westgate et al., 2008). The stratigraphy of DAB is less certain; although originally placed within the Eva Creek Formation (e.g. Péwé et al., 1997), Muhs et al. (2008) show it likely post-dates MIS 5e, but is associated with non-finite radiocarbon ages, thus it remains uncertain if DAB is within later MIS 5 or early MIS 4 loess.

HH7 was collected 5-10 cm from the surface in trench 2 (UA 1915), a pink-grey bleb up to a 1 cm thick and 5cm long. This sample correlates to UA 1451, 1902 and 1903 in trench 1, pink wisps up to 0.5 cm thick and up to 10 cm long, linking the two trenches (Fig. 4.9). HH7 is a high SiO_2 wt% rhyolite consisting of two populations (Table 4.1; Fig. 4.9). HH7 has been correlated to three other sites around the Fairbanks area; Eva Creek, Gold Hill, and the remnants of the Engineer Creek/Dawson Cut exposures near the junction of the Steese Highway and Gold Mine Trail Road (for location details see Péwé et al., 2009). At all sites this tephra bed is a thin but semi-continuous wisp, within inorganic loess and generally 1-2.5 m beneath the local surface. Glass morphology is also consistent across all samples, predominantly comprised of chunky glass shards and pumice that is rich in phenocrysts and microcrysts, complicating analyses. Consistently finding two geochemical populations that are on trend with one another in samples from several sites suggest that HH7 is the product of one complex eruption. However, population 2 of HH7 bears a striking resemblance to the Chatanika tephra (Table 4.1; Fig. 4.9). Chatanika tephra was formally named by Péwé (1975b), and is described as a 1-10mm thick white

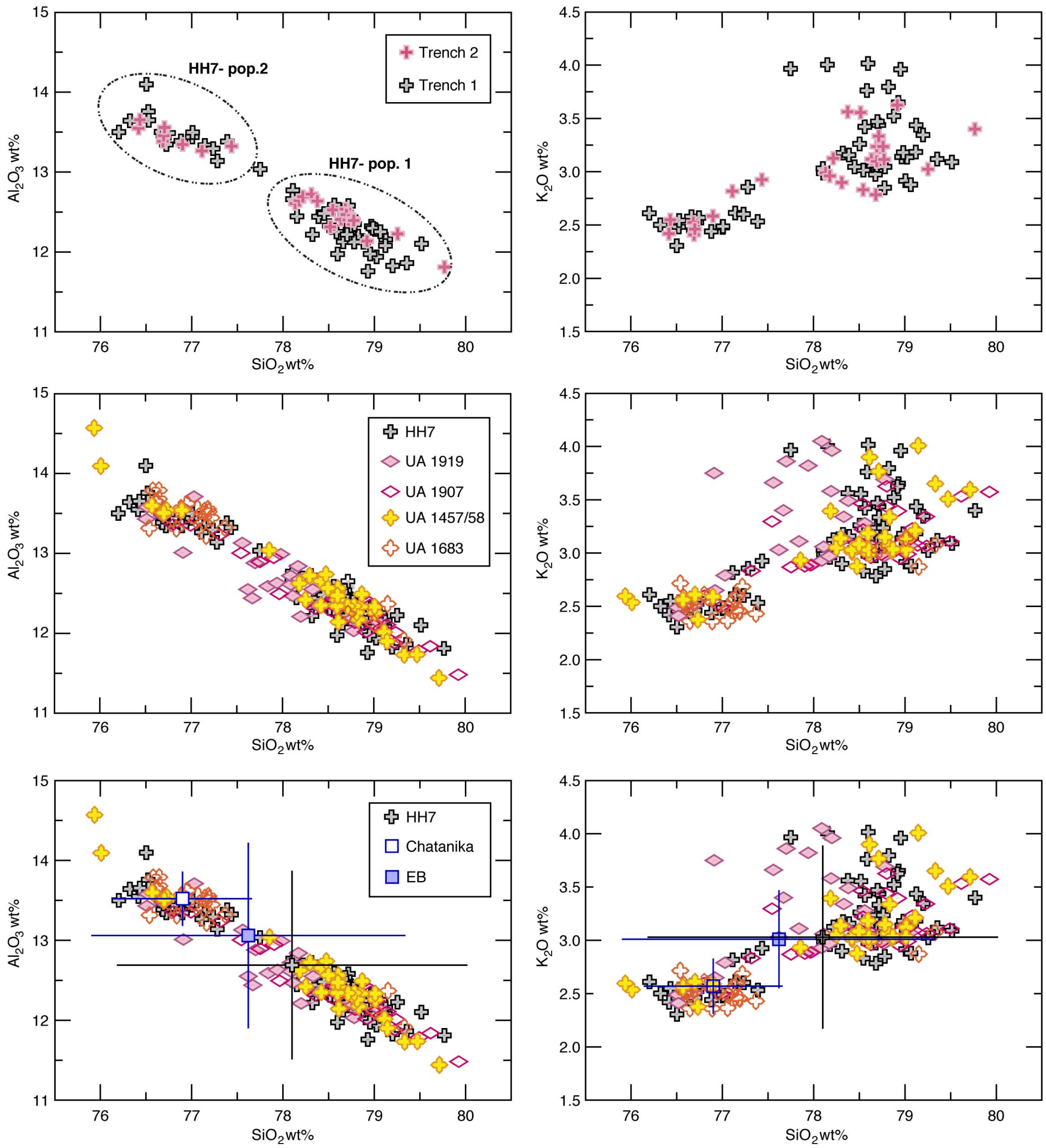

Figure 4.9. Selected bivariate plots of major-element glass geochemistry of HH7 and samples from other sites. ***Top row***: Correlation of the uppermost sample in trench 2 to trench 1 (HH7). ***Middle row***: HH7 correlates to samples around Fairbanks; UA 1919 (Gold Hill IV), UA 1907 (Gold Hill III), UA 1457/58 (Eva Creek), UA 1683 (Engineering Creek/Dawson Cut). ***Bottom row:*** Averages and 2σ uncertainties of Chatanika and EB tephra beds plotted with the average and uncertainty of both populations of HH7. Data reported from the University of Toronto are analyzed using the same standards and protocols as this study, resulting in highly comparable datasets.

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vitric ash, consistently found at sites in the upper portions of the Goldstream formation, with a type section designated at the Chatanika River, 40 km north of Fairbanks. However, averages of both populations of HH7 are similar to the Eva

Bench (EB) tephra (Fig. 4.9), a bed found near the base of what has been mapped as Engineer Loess at Eva Creek (Péwé et al., 2009). It is also possible that EB and Chatanika tephra beds are the same bed: Péwé et al. (2009) note their geochemical similarities, and with only seven analyzed points on Chatanika, the full geochemical range of that tephra may not be represented. Thus HH7, Chatanika and EB beds may all represent the same deposit. Regardless, reference material from both tephra beds is required to unravel these relations.

HH8 (UA 1901) was collected in trench 1 at the same level as HH7. HH8 was a < 0.2 mm thick white wisp. This tephra is also largely comprised of detrital glass, and some shards share affinities to older tephra beds at the site. However, the largest single population is a rhyolite that shares many geochemical and glass morphological characteristics to the Dawson tephra. Originally described in the Klondike, Yukon, this well characterized bed is part of a group of geochemically distinct tephra beds that includes OCt, Togiak Bay and DL tephras (e.g. Preece et al., 2011a), although Dawson is the only known bed of this group deposited after MIS 5, around 25,300 ^{14}C yr BP (Froese et al., 2006; Demuro et al., 2008). Re-analysis of HH8 with reference material of Dawson tephra, and it stratigraphic position within ~2.5 m of the surface of the exposure, support the correlation (Fig. 4.3, Fig. 4.8).

Loess Magnetism

A total of ~365 samples were collected for magnetic susceptibility and natural remanent magnetization (NRM) measurements, ~305 at 5-cm resolution scale for the entire profile, and an additional ~60 samples at 2-cm resolution through the paleosol couplet at ~7.75 m. A minimum of six AF steps, and an average of 11, were used for principal component analyses to obtain characteristic NRM values (ChNRM). For the 5-cm profile, maximum angular deviation (MAD) values ranged from 0.3 to 20, with a median of 1.0º (Fig. 4.10). MAD values for the 2-cm interval samples ranged from 0.8-5.8, with a median of 2.7º. Resulting inclination and declination measurements are plotted with magnetic susceptibility and the stratigraphic profile in Figure 4.11.

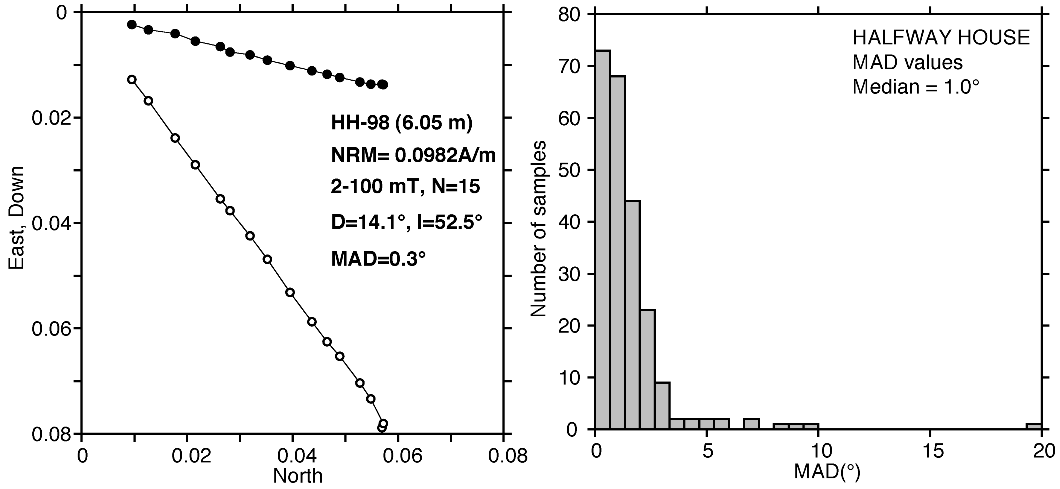

Figure 4.10. ***Left:*** An orthogonal vector diagram provides an example of sample's behavior during alternating-field (AF) demagnetization. ***Right**:* MAD angles (from 5-cm interval) obtained from principal component analyses of samples at Halfway House indicate that the loess is an excellent recorder of the geomagnetic field.

Inclination values recorded in the paleosol couplet at ~7.75 m show a systematic shallowing of inclination values and corresponding shifts in declination. Age control provided by bracketing tephra beds, VT (106 ± 10 ka) and SCt-K (~80 ka), indicate this excursion cannot be attributed to either the

Blake (ca. 120 ka; Singer and Hoffman, 2005) or Laschamp (ca. 41 ka; Singer et al., 2008). An extended period from ~100-80 ka of low paleointensity and increased productivity in ^{10}Be has been documented in multiple marine cores (e.g. Frank et al., 1997; Guyodo and Valet, 1999; Carcaillet et al., 2004; Channel

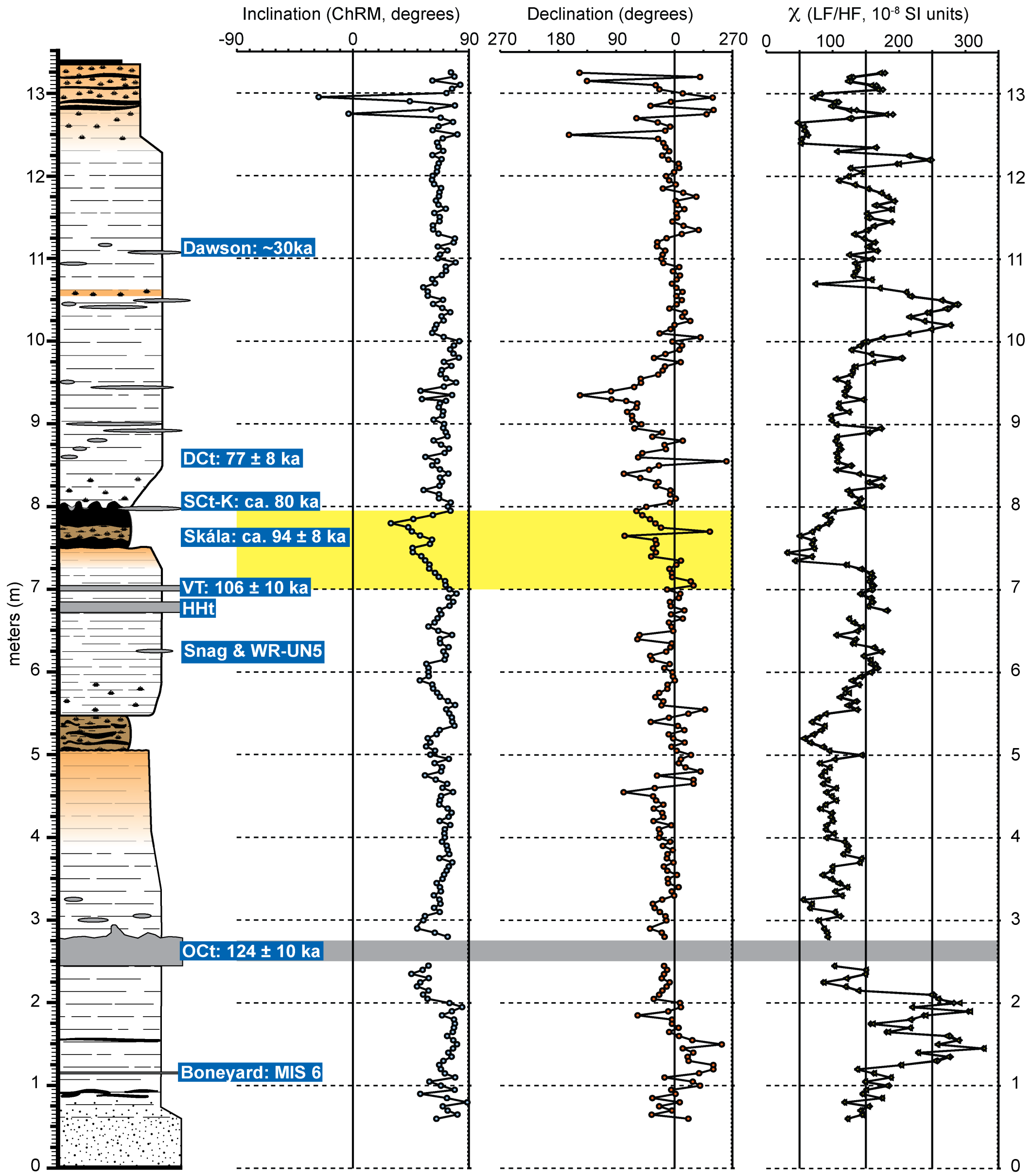

Figure 4.11. Stratigraphic log of Halfway House with the most significant tephra beds labeled, as well as inclination, declination and magnetic susceptibility profiles. Highlighted in yellow is the Skálamælifell excursion. Two reversed samples in the modern soil are not considered significant since they consist only of one sample each.

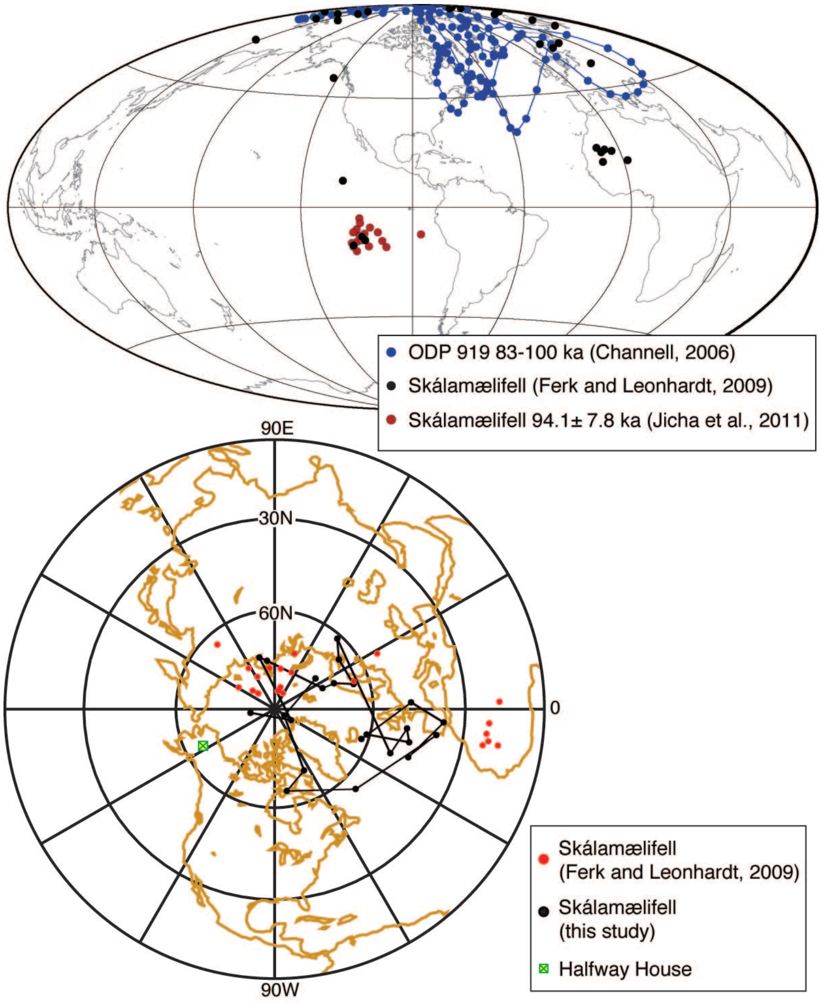

Figure 4.12. ***Top***: A series of VGPs paths from the interval containing the post-Blake compared to those from the Skálamælifell lava flows (modified from Jicha et al., 2011). ***Bottom***: Halfway House VPGs from 5-cm interval samples collected between 6.95-8.10 m describe a path towards the North African VGPs of Ferk and Leonhardt (2009). This path also shares some similarities to the path of the post-Blake interval from ODP 919- looping through Europe, across the Atlantic to northeastern North America.

et al., 2009). This interval has been coined the post-Blake, with an intensity minimum at ~95 ka (e.g. Thouveny et al., 2004). However, until recently, only one record of a directional excursion had been documented during this interval, from Lac du Bouchet in the French Massif Central (Thouveny et al., 1990). A series of transitionally magnetized flows on Iceland, previously ascribed to the Laschamp (e.g. Levi et al., 1990; Ferk and Leonhardt, 2009), were recently dated to 94 ± 8 ka (Jicha et al., 2011). Jicha et al. (2011) correlate this excursion to the post-Blake, but resurrect the name of Skálamælifell, the original name for the Icelandic excursion before it was erroneously correlated to the Laschamp (Kristjánsson and Gudmundsson, 1980). The age of this excursion agrees well with the constraints provided by the dated tephra beds that bracket it. Additionally, virtual geomagnetic poles (VGP) calculated from the Halfway House data reveal a path that moves similarly to that reported by Ferk and Leonhardt (2009), supporting a correlation to this event (Fig. 4.12).

Magnetic susceptibility was measured on the same samples used for determination of inclination and declination data, resulting in a high resolution profile that is virtually identical to that reported by Lagroix and Banerjee (2004a), Oches et al. (1998) and Vlag et al. (1999) from trench 1. This provides the opportunity to place previous research within the new chronologic framework (Fig. 4.13).

Dicussion

Interpreting detrital tephra

Loess at Halfway House contains a background of detrital glass shards that complicate analyses of small samples. Two small (~1 mm wisps) samples collected near Boneyard tephra were comprised of glass shards that do not form

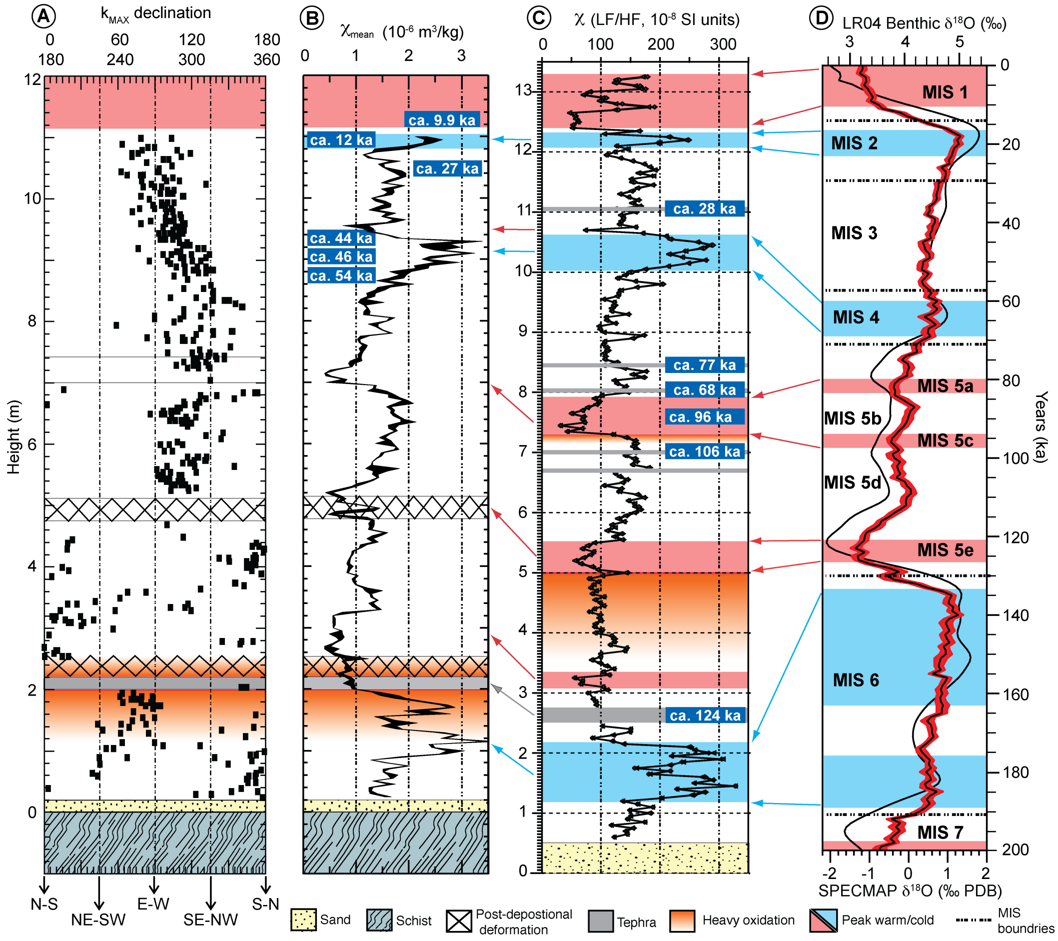

Figure 4.13. Correlation of Lagroix and Banerjee (2004a) wind-direction (*A*) and susceptibility (*B*) profiles to the susceptibility (*C*) profile from this study, and the LR04 oxygen isotope stack (*D*) from Liseski and Raymo (2005). SPECMAP profile (*D*; black curve) from Imbrie et al. (1984) is included for comparison, but MIS divisions are based on the LR05 record. k_{max} = maximum susceptibility axes; χ_{mean} of 5 samples collected at each 5-cm interval. Ages from dated tephra beds and the excursion are included on our profile, TL ages from Oches et al. (1998) that are considered the most reliable are on the Lagroix and Banerjee (2004a) profile.

any interpretable geochemical populations, and have no affinity to any of the tephra present at Halfway House. UA 1872, containing HH1 and HH2 as the most abundant populations, also contained 5 shards of HH3, which was later identified in virtually every sample collected above UA 1872. OCt and HHt are also frequently present as detrital shards in samples collected above their respective stratigraphic levels. Moving up the stratigraphic column, new populations appear, for example, DCt and DAB ~50 cm above SCt-K (Fig. 4.11). In the case of DCt in particular, its well-documented stratigraphic relationship with SCt-K from other locations adds confidence to the stratigraphy at Halfway House, despite the nature of the tephra samples that comprise it (Fig. 4.3). Therefore, it seems probable that the first appearance of shards in a sample correlating to a known tephra bed will provide an approximate maximum age for the loess at that point, and, at a minimum, all loess above this point must post-date the age of that tephra.

New chronologic framework for Halfway House

Prior to this research, only four tephra beds had been described at Halfway House; the Boneyard, Old Crow, Halfway House and VT tephra beds (Westgate et al., 1983, 1985; Preece et al., 1999; Jensen et al., in review). Revised age determinations for OCt and VT have been presented in recent years, and the Boneyard tephra has a regionally consistent stratigraphic context that provides insight into its time of deposition.

The Boneyard tephra is within ~1 m of OCt at all sites where it has been identified, although it has not been found in direct stratigraphic context with Sheep Creek-Fairbanks (SCt-F; 190 ± 20 ka; earliest MIS 6), another tephra commonly associated with OCt (Berger et al., 1996; Preece et al., 1999; Westgate et al., 2008; Jensen et al., in review). However, at the Palisades (reference site for the Boneyard tephra) and Eva Creek, two sites where SCt-F is in clear stratigraphic context with OCt, SCt-F is consistently found 3-6 m below OCt (Preece et al., 1999; Jensen et al., in review). This suggests that Boneyard tephra is bracketed by SCt-F and OCt, and was deposited during MIS 6.

The most recent recalculation of the age of OCt places it within error of MIS 5e (124 ± 10 ka; Preece et al., 2011a). However, Reyes et al. (2010a) describe a site at the Palisades where a primary bed of OCt buried a vegetated surface. The pollen, plant and insect fossils from this surface show tundra conditions still existed at the time of deposition. Further careful documentation of multiple sites around Alaska and the Yukon where the tephra occurs in association with MIS 5e deposits show that the tephra clearly predates MIS 5e (Reyes et al., 2010b). Thus, OCt was deposited in latest MIS 6.

Age control on HHt is provided by VT tephra, which lies directly above HHt at Halfway House and Gold Hill, and by an MIS 5e forest bed that underlies it at the Palisades (Preece et al., 1999; Berger, 2003; Jensen et al., in review). The new SAR-IRSL age for VT of 106 ± 10 ka is consistent with evidence at other sites where the tephra is found (Jensen et al., 2011). In particular, the correlation of the Aeolis Mountain tephra to VT, present in a coastal bluff with independent chronologic control and a high-resolution pollen profile, suggest VT was deposited during a stadial in MIS 5 that likely corresponds to MIS 5d (Kaufman et al., 2001; Jensen et al., 2011).

The correlation of the HH1 and HH2 to Snag tephra and WR-UN5 is supported by their close stratigraphic relationship to VT at Halfway House. Turner et al. (in review) report Snag tephra at a 5 km long bluff on the White

River, southwestern Yukon. This bluff exposes a sequence of till, non-glacial deposits, and abundant tephra beds, including OCt, DCt and Dawson tephra beds. Snag tephra is a newly described bed presented in this study, which is found stratigraphically above OCt and associated MIS 5e deposits, and below a woody peat unit representing MIS 5a that has DCt (77 ± 8 ka) overlying it. WR-UN5, although not reported in Turner et al. (in review), is present in close association with Snag at several exposures at this site (Turner, pers. comm.).

The identification of SCt-K, deposited directly on the surface of the paleosol couplet, and DCt shards first appearing in samples ~50 cm above SCt-K, unambiguously supports a late MIS 5 age for the couplet. SCt-K is widely distributed in the Klondike area of central Yukon. Stratigraphically, SCt-K is consistently found directly above a forest bed, and generally ≤ 1m below DCt, which has a glass fission-track age of 77 ± 8 ka (e.g. Sanborn et al., 2006; Westgate et al., 2008; Preece et al., 2011b; Zazula et al., 2011). Preliminary OSL ages reported by Westgate et al. (2008) of ~80 ka are in agreement with the age of DCt. Together, these tephra date the forest bed below SCt-K to MIS 5a. Schweger (2003) reports a detailed, 9 m long, pollen profile through the Ash Bend site on the Stewart River that shows the progression from boreal forest, to forest tundra, to birch tundra, to herb tundra. SCt-K is present ~1.5 m above the transition from boreal forest to forest tundra, and is firmly within the latter. This indicates that SCt-K was deposited relatively early in the transition from full interglacial conditions of MIS 5a (boreal forest) to full glacial conditions of MIS 4 (herb tundra). The reproduction of this well-documented stratigraphic relationship at Halfway House lends strength to the correlations and revises the age of the paleosol couplet below these tephra beds from the early to mid-Wisconsinan to late MIS 5.

Whether the paleosol couplet is entirely attributable to MIS 5a or is a complex that represents MIS 5c, 5b and 5a is not clear. The Skálamælifell excursion, dated to 94.1 ± 7.8 ka and most strongly expressed in marine paleointensity records during MIS 5c (~100-95 ka), is present through most of the couplet, supporting the latter interpretation (Thouveny et al., 2004, 2008; Jicha et al., 2011). There is little evidence for an unconformity in this interval, and Lagroix and Banerjee (2004b) did not find evidence of post-depositional deformation (Fig. 4.12). However, the excursion begins ~15 cm below the lower A-horizon, consistent with its age, but continues through the couplet, with inclination values not recovering until ~10 cm below SCt-K. Finding SCt-K on the surface of the paleosol suggests that it is MIS 5a in age, but it seems improbable, despite the relatively lengthy duration of the paleointensity low, that the excursion lasted for >10 ka. What seems more likely is that the upper portion of the paleosol may have been partially removed during MIS 5a, or there was hiatus in loess deposition during peak MIS 5a, causing the soil to form on older loess.

The inevitable question that arises from the presence of the post-Blake, is the absence of the Blake. Although records of the timing and duration of the Blake event are variable, most studies place it between ca. 125-116 ka, making it largely coincident with MIS 5e (e.g. Singer and Hoffman, 2005; Lund et al., 2006; Channell et al., 2012). Inclination measurements at Halfway House reported by Westgate et al. (1983, 1985) found a shallowing below OCt, an event that has been reported in the same stratigraphic position in cores from Imuruk Lake on the Seward Peninsula and Koyukuk Bluff (KY11) in central Alaska (e.g. Schweger and Matthews, 1985). We were not able to reproduce these results at Halfway House. Although originally interpreted as representing the Blake, because they are present below OCt (late MIS 6) this is unlikely. However, recent identification of an excursion above OCt, and directly below an MIS 5e forest bed at the Palisades, central Alaska, suggests the Blake is recorded in Alaskan loess of the appropriate age (Jensen et al., in review). At Halfway House, the paleosol from 5-5.5 m is interpreted to represent peak MIS 5e, and corresponds to one of two intervals where Lagroix and Banerjee (2004b) found evidence of post-depositional deformation (Fig. 4.12). Muhs et al (2008) also suggest that this paleosol may have experienced some erosion, truncating the pedogenic geochemical profile. Thus the absence of the Blake at Halfway House may be a result of the disturbance and/or absence of the loess that the event would have been recorded in.

The next dated point in the stratigraphic column is at ~11 m with the correlation of HH8 to the Dawson tephra. This tephra is found extensively throughout the Klondike goldfields (e.g. Westgate et al., 2000; Froese et al., 2002, 2006). Two grass leaves collected from an *in situ* surface buried by this tephra are dated to 25,410 ±160 and 25,210 ± 260 ^{14}C yr BP (Froese et al., 2006). Further Bayesian analysis of these ages and five additional radiocarbon dates estimate the time of deposition for Dawson between 30,433 and 30,032 cal yr BP (Demuro et al., 2003). Dawson tephra is found above organic-rich deposits that are MIS 3 in age, but plant macrofossil data suggests that the environment of MIS 2 (i.e. steppe-tundra) is largely present by this time (Zazula et al., 2005, 2007; Froese et al., 2006). Because the population of Dawson tephra in HH8 is likely detrital, and no samples were collected below this level in trench 1, it is not certain if HH8 represents the first occurrence of Dawson at Halfway House. Some insight into this problem is provided by the correlation of UA 1908 from Gold Hill III (for location detail see Evans et al., 2011) to Dawson tephra (Fig. 4.8). UA 1908 was collected ~1.3 m below the surface, laterally from, and ~75 cm below, UA 1907, which correlates to HH7 and is a discrete, mm-scale, continuous bed at this section. Therefore, it appears that Dawson tephra pre-dates HH7, which was collected at the same stratigraphic level at Halfway House.

HH7 has been correlated to Eva Creek, Gold Hill, and the Engineering Creek/Dawson Cut locales in this study, and potentially correlates to the Chatanika and/or EB tephra beds. At its reference locality along the Chatanika River, Péwé (1975b) reports radiocarbon ages bracketing the Chatanika tephra: a date of 14,760 ± 850 ^{14}C yr BP from a ground squirrel nest ~2 m below the tephra, and a second date of 14,510 ± 450 ^{14}C yr on coprolites extracted from another nest ~1.5 m above the tephra. EB tephra was collected at the Eva Bench cut, adjacent to the more widely studied Eva Creek exposure, in what was thought to be the base of the Holocene Engineer Loess, although there are no independent ages to confirm this assumption (Péwé et al., 2009).

Magnetic susceptibility, new chronology, new interpretations

There are several generally accepted assumptions that can guide interpretations of changes in magnetic susceptibility in Alaskan loess. First, the dominant fluctuations in susceptibility reflect changes in magnetic grain size; and these changes are driven by changes in wind intensity, with the highest wind intensities associated with cold stages or glaciations, while lower wind intensities are associated with interglacials (e.g. Begét, 1990, 1996, 2001; Vlag et al., 1999). These highest wind intensities are likely a result of katabatic winds from ice sheets (Muhs and Budahn, 2006), but may also reflect differences in synoptic climatology during the cold stages (e.g. Mock et al., 2001). These observations indicate that magnetic suscpetibility highs occur during cold stages, probably with extensive glaciation, while the lows are associated with intervals of decreased wind intensity during interglacials or interstadials (e.g. Begét et al., 1990). Second, loess in Alaska is largely glaciogenic, produced by comminution and transport via glacially-fed rivers such as the Tanana, Nenana and Yukon (e.g. Begét, 2001; Muhs et al., 2003; Muhs and Budahn, 2006). However, since high elevation areas of the Alaska Range through St. Elias Mountains host extensive modern glaciers, production of silt may span both glacial and interglacial intervals (Péwé, 1955; Begét, 2001; Muhs et al., 2003; Muhs et al., 2004). Thus, accumulation of loess can be continuous through interglacial-glacial cycles, and paleosols in loess may represent periods in which loess accumulation was sufficiently low that pedogenesis exceeded loess input (e.g. Muhs and Bettis, 2003; Muhs et al., 2004)

The lowest values in the magnetic susceptibility profile are present in the modern soil complex, the late MIS 5c-5a paleosol complex, and the MIS 5e paleosol. Additional short-lived susceptibility lows are present above OCt (~3.25 m) and at ~10.6 m; though both are better expressed in Lagroix and Banerjee's (2004a) profile of trench 1 (Fig. 4.13). The low at ~10.6 m is below the Dawson tephra (ca. 30 ka), and thus may be associated with a very poorly expressed paleosol of MIS 3 age; paleosols of this age have been documented at several sites around Fairbanks (e.g. Hamilton et al., 1988; Muhs et al., 2003, 2008).

The persistent, relatively low values below the MIS 5e paleosol to ~30 cm above OCt raises the possibility that MIS 5e is represented by that entire interval (Fig. 4.13). However, although Muhs et al. (2003, 2008) geochemically identify a truncated soil around the level corresponding to the lowest susceptibility values at ~3.25 m, there is no evidence, morphologically or geochemically, for other individual paleosols through this interval (unlike the Holocene soil which is a complex of four "soils"). This interval is also comprised of the heavily oxidized, friable loess with clay lamellae described in this study, and Muhs et al. (2008) show that measured ratios of mobile to immobile elements that indicate degree of weathering, although lowest in the paleosol at ~5 m, remain notably low throughout this section (Fig. 4.4). This raises the possibility that this interval may be a B-horizon related to the MIS 5e paleosol at ~5 m, and that weathering could have played a role in lowering susceptibility in this interval. Weathering, particularly when related to poorly drained conditions, can lead to some loss of magnetic grains within Alaskan loess (Lui et al., 1999, 2001; Begét, 2001). An alternative explanation is revealed by the wind-direction data reported by Lagroix and Banerjee (2004a); this interval is the only major interval that shows a change in wind direction (Fig. 4.13). If their interpretation is correct, the steady low in susceptibility could reflect a changing source, particularly if that source is more distal. In support of this interpretation, this is the only interval where Muhs et al. (2008) document a change in the geochemistry of the loess at Halfway House that they interpret as being driven by an influx of loess derived from the Nenana River, a more distant source than the Tanana River (Fig. 4).

The truncated paleosol identified by Muhs et al. (2003, 2008) appears to correspond to the susceptibility low at ~3.25 m, which was correlated to MIS 5e by Lagroix and Banerjee (2004a). This correlation does not appear likely, but it is a notable feature in the profile, and its presence in latest MIS 6 suggests it could be related to the Zeifen-Kattegat climate oscillation (Seidenkrantz et al., 1996). There is evidence of “two-step” deglaciation at the termination of MIS 6 that is considered analogous to the Younger Dryas, where warming at the termination of MIS 2 was interrupted by an abrupt return to glacial conditions before resuming the transition to interglacial conditions (e.g. Seidenkrantz et al., 1996). The Zeifen-Kattegat climate oscillation is documented in pollen records across Yukon and Alaska- at Imuruk Lake, Koyukuk Bluff, Chi’jees Bluff and Birch Creek, where spruce pollen appears for a short interval directly above OCt, but is then absent again until MIS 5e (e.g. Seidenkrantz et al., 1996, MacDowell and Edwards, 2001; Reyes et al., 2010a).

The highest susceptibility values are found below OCt (~1-2 m), below Dawson tephra (~10-10.5 m), and above Dawson tephra (~12.25 m) (Fig. 4.13). Age control provided by the tephra beds implies that these highs correspond to MIS 6, 4 and 2, respectively. MIS 6 and 4 are better expressed than MIS 2, and this pattern is also present in the susceptibility record for the upper ~8 m of Gold Hill IV. The chronology for this latter correlation is provided via the VT and HH7 tephra beds (Fig. 4.14). Although MIS 6 is absent at Gold Hill IV (a large unconformity underlies VT), the record indicates that MIS 4 is more strongly represented than MIS 2. This is consistent with Muhs et al. (2003, 2008) observations from several equivalent-aged loess localities around Fairbanks that there is an apparent lack of MIS 2 loess accumulation. The minimal amount of loess from MIS 2 is consistent with glacial records in Alaska that indicate MIS 4 and MIS 6 ice limits, from both the Alaska and Brooks Ranges, were more extensive than during MIS 2 (e.g. Briner and Kaufman, 2008; Dortch et al., 2010; Matmon et al., 2010).

The most striking feature of the overall magnetic susceptibility profile is how it is predominantly comprised of intermediate values. This suggests that the majority of accumulation at Halfway House corresponds to times of moderate wind intensity, which would likely correspond to stadials, interstadials or and transitions between MIS stages, an assumption supported by the chronology. These results differ somewhat from Muhs' et al. (2003) model for loess

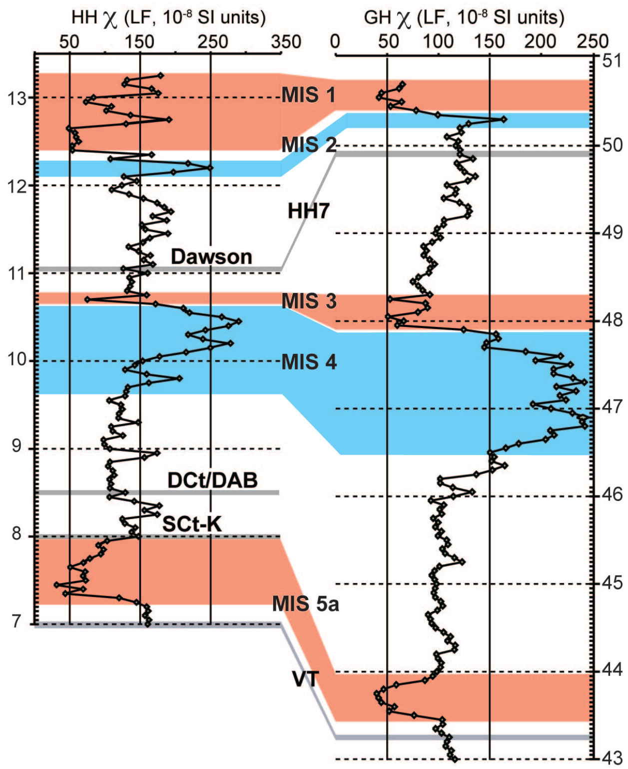

Figure 4.14. Correlation of the Halfway House and Gold Hill IV susceptibility profiles is supported by the presence of VT (106 ± 10 ka) and HH7 at both sites. Dawson tephra (ca. 30 cal yr BP) is not present at Gold Hill IV, but is ~50 cm below HH7 at Gold Hill III, approximately 150 m southwest from Gold Hill IV. Neither DCt (77 ± 8 ka) or SCt-K (ca. 80 ka) have been found at Gold Hill, but DAB is present at the Gold Hill Steps section, ~200 m east on the George Parks Highway.

accumulation in Alaska, which argues that while production is greatest during glacials, accumulation may be greatest during interglacials due to the effect of surface roughness. That is to say, while loess production during full glacial conditions is high, the landscape would be largely covered by herb and/or steppe-tundra, with low surface roughness. Thus, loess accumulation is relatively low due to the vegetation's low profile preventing effective trapping of loess. However, boreal forest has high surface roughness, thus, although production may be lower during these times, the forest is an excellent loess trap, and accumulation may be high. During interstadials, production is considered high, but accumulation only moderate (Fig. 4.15).

Our results agree with the full glacial scenario of this model, but find that there is no significant loess accumulation during peak warmth of MIS 5, and, in fact, a hiatus may even be present. Therefore, during peak interglacial warmth, loess production may be more critical than surface roughness as the dominant variable controlling accumulation rates, i.e. glaciers are at their minimum extent, resulting in low production of silt. However, at times during stadials, interstadials, and particularly transitions between isotope stages, production would have been greater, but so would surface roughness, since transitional environments would have consisted more of shrub tundra, potentially interspersed with stands of trees such as birch and aspen, and even sparse spruce (e.g. Anderson and Lozhkin, 2001; Brubaker et al., 2001; Schweger, 2003; Brubaker et al., 2005). Thus, these times represent optimal conditions for loess accumulation, where loess production and surface roughness are both relatively high. A caveat to this model, however, is its geographic limit: it is most

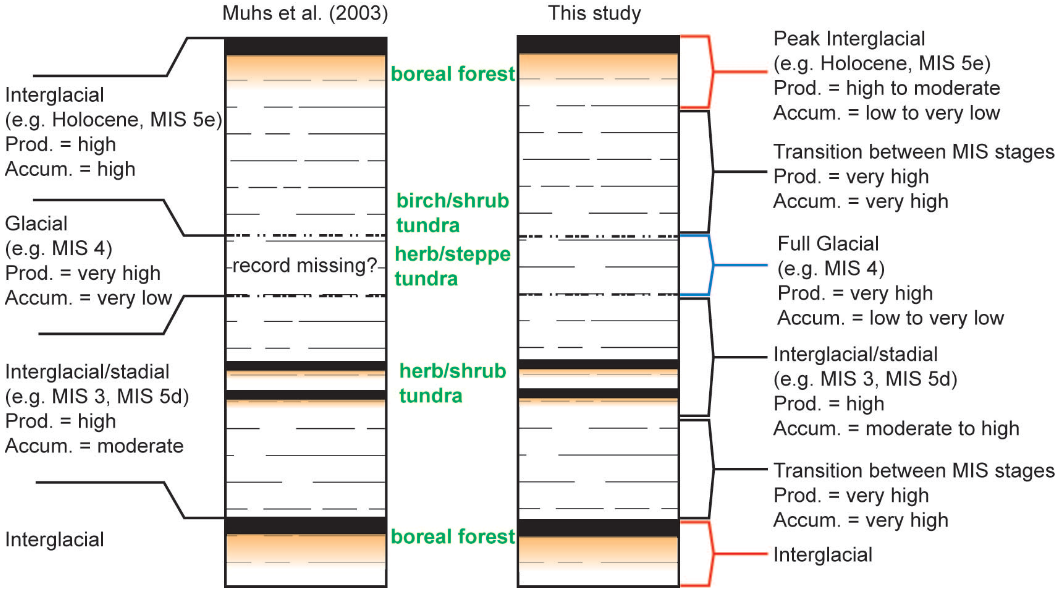

Figure 4.15. Comparison of Muhs et al. (2003) loess accumulation model to the one developed in the study using magnetic susceptibility and new age data as guides. The models are similar but peak susceptibility measurements indicate full glacial loess is present, and we find that more loess appears to accumulate during transitions between isotope stages than at any other time.

applicable to the thicker loess deposits that are found at more distal locations from their source. Loess deposits closer to source (e.g. in the Tanana, Delta or Nenana river valleys 10's of kms from the Alaska Range) tend to preserve shorter records and may, in fact, only preserve interglacial loess since the high wind intensity and low height of the vegetative surface during glacials can result in deflation (e.g. Thorson and Bender, 1985; Begét, 2001; Muhs et al., 2004).

The complexity of loess deposition in Alaska, with highly variable accumulation rates dependent on the interplay of wind intensity, loess production, surface roughness and location of the site, challenges the ability to correlate Alaskan magnetic susceptibility records to global δ^{18}O curves. What has not been considered thus far is the somewhat unusual nature of the Halfway House section, which is without any truly notable unconformities, which are often present, although not easily identifiable, at many loess sections (e.g. Jensen et al., 2008; Péwé et al., 2009). However, with the new chronology at Halfway House it is clear that the highest susceptibility values correlate to peak glacial times, and the lowest values are associated with well-developed paleosols that represent peak interglacial times (the one potential exception is the MIS 3 paleosol that is well expressed at Gold Hill; Fig. 4.14). Therefore, it is certain that meaningful information that can be gleaned from measuring magnetic susceptibility, but correlation to global δ^{18}O curves is hazardous if the data is not placed within a robust chronology.

The final important observation to take from Halfway House is that it contains a record of MIS 5e and 5d, but MIS 5c and 5b are poorly expressed, similar to records from the adjacent Yukon. In the Yukon there are multiple sites that preserve MIS 5a and 5e deposits, but only two sites are known with both in sequence (e.g. Westgate et al., 2008; Reyes et al., 2010b; Turner et al., in review; Froese, unpublished data). At these sites, if other MIS 5 sediments are present, it is usually a loess unit containing one or more of series of tephra beds, such as Snag, Woodchopper Creek or Donjek, that identify it as MIS 5d (e.g. Turner, in review). However, no evidence has ever been found of sediments that might have been deposited during MIS 5c or 5b.

Last interglacial deposits beyond MIS 5e are not clearly recognized in Alaska, but this could be the result of unreliable chronologies. For example, the Gold Hill Steps section, which has been examined along with Halfway House (e.g. Vlag et al., 1999; Muhs et al., 2003, 2008; Lagroix and Banerjee, 2004a,b), contains a similar susceptibility record and comparable stratigraphy in its upper ~8 m. Below a paleosol complex dated by Muhs et al. (2003, 2008) to the mid-Wisconsin (MIS 3), there is a peak in susceptibility that appears to correlate to the MIS 4 peak at Halfway House. Below this peak there is ~2.5 m of loess with intermediate susceptibility values to a well-developed paleosol, which is overlain by DAB. The correlation of Gold Hill Steps to Halfway House is supported by the correlation of Halfway House to the upper 8 m of the Gold Hill IV exposure (Fig. 4.14). The stratigraphic and magnetic susceptibility records between the upper 8 m of Gold Hill IV and Gold Hill Steps are virtually indistinguishable, except for the absence of DAB at the former, not unexpected since the sites are within ~200 m of one another (Fig. 4.14). Muhs et al. (2008) suggest the paleosol below DAB at Gold Hill Steps is representative of the last interglacial, however, in light of the evidence at Halfway House and Gold Hill IV, it seems more likely that it was formed during MIS 5a. Therefore, MIS 5 sediments, in addition to MIS 5e, may be more common in Alaska than has been previously considered.

Conclusions

Halfway House is one of the most studied loess sections in Alaska, but interpretations of those studies have been limited by poor chronological control. Systematic re-examination of the tephrostratigraphy has identified several dated tephra beds not previously recognized at the site: SCt-K (ca. 80 ka), DCt (77 ± 8 ka) and Dawson (~30 cal yr BP). The presence of the Skálamælifell/post-Blake excursion (94.1 ± 7.8 ka) provides an independent age at the site, and supports the chronology provided by SCt-K and VT (106 ± 10 ka), which bracket the excursion. These ages, and the well documented presence of OCt (124 ± 10 ka and VT (106 ± 10 ka), show that Halfway House has a relatively complete MIS 6 to Holocene record, and the two major paleosols present formed during MIS 5 (Fig. 4.13).

These new ages, when placed on the magnetic susceptibility profile, show that loess accumulation at Halfway House is highest during transitions between MIS stages, interstadials and stadials, with relatively low loess accumulation during peak cold and warm intervals. This is partially consistent with the loess accumulation model presented by Muhs et al. (2003), where loess production and accumulation are not positively correlated, and surface roughness is the leading variable controlling accumulation rates. We find that during full glacial conditions their model holds true, with relatively little accumulation during those times, but also find a lack of evidence for high accumulation rates during peak interglacial times. We modify the model to suggest that loess production is the most important variable controlling accumulation during times of extensive glacier retreat, and that the greatest amount of accumulation is actually during times when loess production, surface roughness, and wind intensity are all relatively moderate. This accumulation model is dependent on distance from the source, with sites proximal to source areas behaving differently (e.g. Muhs et al., 2004).

Constantly changing accumulation rates dependent on a variety of variables suggest that although fluctuations in magnetic susceptibility are largely driven by wind intensity linked to glacial/interglacial cycles, correlation of those records to global $\delta^{18}0$ records must be carried out with caution and a robust chronologic framework.

Finally, the identification of Snag, WR-UN5, SCt-K, and DCt is the first documentation of these tephra beds outside of the Yukon, and indicates that they are important regional markers for MIS 5d (Snag, WR-UN5) and MIS 5a (SCt-K, DCt). The appearance of DAB glass shards above the late MIS 5 paleosol at Halfway House, and the implication that the paleosol below DAB at the Gold Hill Steps site correlates to this paleosol, suggests that this tephra bed is of similar age to DCt (ca. 77 ka).

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CHAPTER 5: TRANSCONTINENTAL CORRELATION OF THE WHITE RIVER ASH

A version of this chapter will be submitted to Science as a Brevia:
Jensen, B.J.L., Pyne-O'Donnell, S.D.F., Plunkett, G., Froese, D.G., Hughes, P.M., Pilcher, J.R., Hall, V.A., van den Boogard, C., An American Ash in Europe.

Volcanic ash (tephra) beds are typically deposited in days to weeks, thus represent an isochronous surface across all depositional settings where they are preserved. This feature of tephra beds makes tephrostratigraphy the singular method for direct comparison of atmospheric, oceanographic, ecological, and archaeological changes. The most widely distributed tephra offer the potential to correlate these diverse records, and present an opportunity to investigate spatio-temporal leads and lags in earth-system and archaeological sciences that is not possible with the errors inherent in other dating methods (Lowe et al., 2012).

Mount Bona-Churchill, a volcano in the Wrangell volcanic field of southeastern Alaska (Fig. 5.1), has erupted several times over the last 10 000 years. The largest of these eruptions produced the White River Ash, which consists of two separate events: the "northern lobe" (WRn; AD 270-390; Livingston et al., 2009) and "eastern lobe" (WRe; ~830-855 AD; Froese et al., unpublished data). WRe has a conservative estimated eruptive volume of ~50 km^3 (Lerbekmo, 2008), which is an order of magnitude larger than the 1991 eruption of Pinatubo. WRe blankets much of northwestern Canada, with visible beds of WRe present up to ~1000 km from the source volcano (e.g. Lakeman et al., 2008).

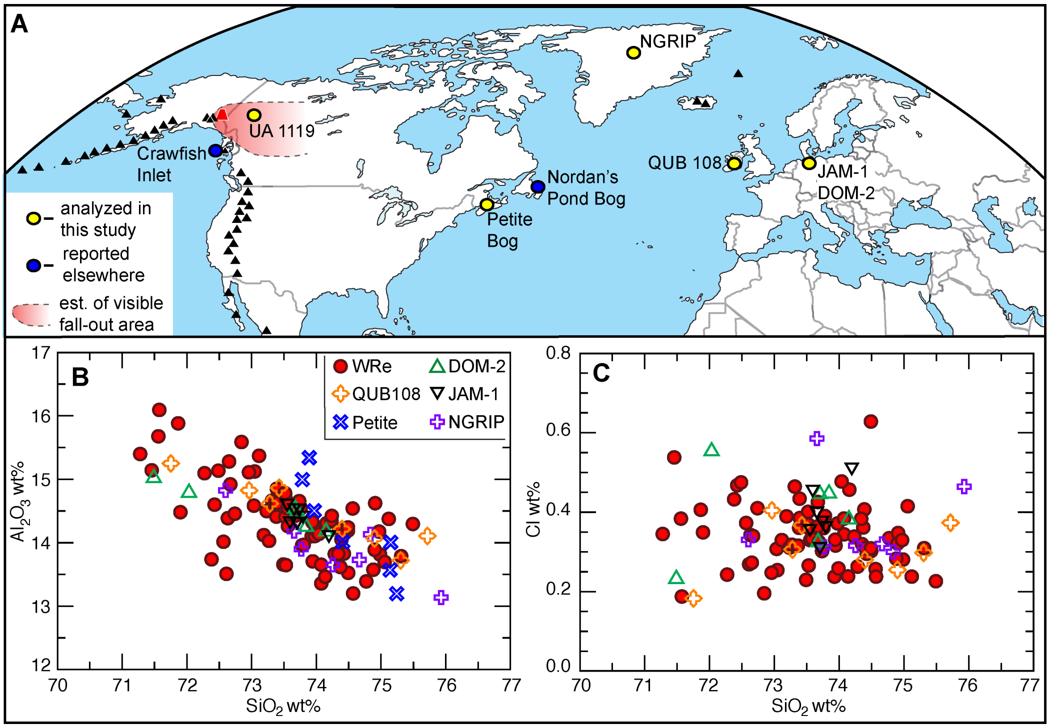

Figure 5.1: A- Location map. Crawfish Inlet (Addison et al., 2010); Nordan's Pond Bog (Pyne-O'Donnell et al., 2012). **B, C-** Major-element glass geochemistry bivariate plots, Cl is particularly distinct, being relatively high in concentration compared to many Icelandic and North American tephra beds.

A cryptotephra horizon (i.e. < ~125 µm grain size, not visible to the naked eye; Lowe, 2011) first identified in Ireland, known as the AD 860B tephra, has been correlated to sites across northern Europe in Scotland, Norway and Germany (e.g. Pilcher et al., 1995; Lawson et al., 2012). However, the origin of this tephra has remained enigmatic. Geochemically, AD 860B does not correlate to any known Icelandic rhyolitic tephra beds, a main source for Late Holocene European cryptotephra, and its geochemical fingerprint falls within the compositional field of Yukon and Alaska tephra. Indeed, published ages and geochemical data for WRe and AD 860B are strikingly similar.

The close agreement in age estimates and glass major-element geochemistry between WRe and the AD 860B tephra prompted us to re-analyze samples of the AD 860B tephra from Sluggan Bog, Northern Ireland, Jardelunde (JAM) and Dosenmoor (DOM) bogs from northern Germany (Bogaard et al., 2002), and the NGRIP ice core. These samples and one from the Petite Bog site in Nova Scotia were analyzed with a reference sample of WRe that was collected along the axis of the plume in Yukon (Fig. 5.1).

Our results show that AD 860B and WRe have indistinguishable glass major-element geochemistry (Fig 5.1B,C, Table 5.1). Their identical geochemical fingerprint, coincident age determinations, and distinctive similarity in glass-shard morphology, collectively demonstrate that they are the product of the same eruption that has a recently determined Greenland Ice Core Chronology 2005 (GICC05) age of ~AD 846-847 (Coulter et al., in review). This correlation, and the identification of WRe in the northeast Pacific Ocean (Addison et al., 2011) and eastern Newfoundland (Pyne-O'Donnell et al., 2012), indicates that WRe/AD 860B is present in the Pacific Ocean, across the North American continent and Greenland, and into northern Europe.

Although recurrence intervals are relatively low for eruptions similar to that which produced WRe/AD 860B, our results provide a compelling example of intercontinental distribution of airborne ash. Increased knowledge of tephra distribution from large prehistoric eruptions - combined with recent studies, such as those related to the 2010 eruption of Eyjafjoll that show how relatively small eruptions can produce widely distributed tephra - are essential for evaluating volcanic hazards, particularly with respect to aviation (Davies et al., 2010).

The intercontinental correlation of volcanic ash presented here, together with rapidly maturing capabilities for identifying and fingerprinting cryptotephra, also highlight the untapped potential to extend the North American tephra record. Several Holocene eruptions of similar magnitude, such as Aniakchak and Mazama, have been documented in Greenland ice cores (Zdanowicz et al., 1999; Pearce et al., 2004), and are also present in Nordan's Pond Bog (Pyne-O'Donnell et al., 2012) (Fig. 5.1A). The potential for cross-continental correlation extends into the Pleistocene, when eruptions of similar or much greater magnitude occurred (e.g. Preece et al., 2011).

Table 5.1. Major-element geochemistry of WRe (UA 1119) and AD 860B

Sample		**SiO_2**	**TiO_2**	**Al_2O_3**	**FeO_t**	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**Cl**	**H_2O_{diff}**	**n**	**source**
UA1119	MEAN	73.61	0.20	14.36	1.61	0.06	0.37	1.91	4.33	3.22	0.34	2.92	72	*this study*
reference	STDEV	0.99	0.12	0.62	0.36	0.17	0.20	0.30	0.30	0.34	0.08	1.64		
QUB108	MEAN	74.11	0.20	14.41	1.63	-0.11	0.44	1.80	4.14	3.09	0.29	4.22	7	*this study*
Ireland	STDEV	1.38	0.09	0.53	0.73	0.14	0.19	0.45	0.41	0.47	0.07	1.25		
JAM1	MEAN	73.75	0.21	14.42	1.54	0.06	0.40	1.92	4.22	3.08	0.40	3.03	7	*this study*
Germany	STDEV	0.21	0.01	0.17	0.08	0.02	0.04	0.05	0.20	0.05	0.07	1.75		
DOM2	MEAN	73.15	0.27	14.54	1.70	0.07	0.52	2.11	4.14	3.11	0.40	3.58	6	*this study*
Germany	STDEV	1.10	0.05	0.32	0.30	0.02	0.22	0.36	0.14	0.09	0.11	2.16		
NGRIP	MEAN	74.24	0.21	13.94	1.30	-0.02	0.28	1.92	4.47	3.29	0.38	3.57	7	*this study*
Greenland	STDEV	1.05	0.12	0.52	0.30	0.16	0.14	0.38	0.27	0.40	0.11	3.39		
Petite Bog*	MEAN	74.51	0.17	14.23	1.40	0.05	0.35	1.74	4.23	3.26	NA	2.75	7	*this study*
Canada	STDEV	0.65	0.02	0.76	0.13	0.01	0.06	0.13	0.22	0.18	-	0.65		
Ireland	MEAN	73.45	0.28	14.89	1.57	NA	0.45	1.93	4.26	3.17	NA	2.36	106	*1*
all	STDEV	0.62	0.03	0.52	0.08	-	0.04	0.13	0.21	0.15	-	1.35		
JAM1	MEAN	74.43	0.15	14.44	1.43	0.06	0.39	1.93	4.03	3.13	0.35	2.87	8	*2*
Germany	STDEV	0.31	0.16	0.17	0.21	0.06	0.06	0.18	0.12	0.22	0.05	0.64		
DOM2	MEAN	74.33	0.28	14.58	1.42	0.08	0.20	1.90	3.98	3.22	0.37	2.76	10	*2*
Germany	STDEV	0.50	0.16	0.20	0.15	0.05	0.09	0.14	0.11	0.10	0.08	0.61		
NGRIP	MEAN	75.11	0.18	13.64	1.43	0.07	0.30	1.53	4.08	3.67	NA	3.65	32	*3*
Greenland	STDEV	1.44	0.09	0.87	0.20	0.06	0.17	0.68	0.47	0.48	-	2.27		
NDN	MEAN	73.91	0.21	14.58	1.52	0.05	0.40	1.85	4.26	3.12	NA	2.59	24	*4*
Canada	STDEV	0.32	0.01	0.31	0.08	0.01	0.03	0.09	0.11	0.09	-	0.93		

All new analyses were carried out at the University of Alberta electron microprobe laboratory on a Cameca SX100 using a 5 μm beam and 3 nA current, and a JEOL 8900 superprobe using a 10 μm beam and 6 nA current. All samples were measured concurrently with UA 1119 and two secondary standards, the Old Crow tephra and ID 3506, to assess the quality of calibration and track any potential variation during analyses occurring over several days. *Analyzed at the University of Edinburgh tephrochronology lab (settings after Pyne-O'Donnell et al. 2012). *1*- Pilcher et al. (1995); *2* - Bogaard and Schmincke (2002); *3* - Coulter et al. (in review); *4* - Pyne-O'Donnell et al. (2012).

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CHAPTER 6: CONCLUSIONS

This dissertation has been guided by the three broad objectives outlined in the introductory chapter: (1) Build a tephrostratigraphic framework for the Middle to Late Pleistocene in eastern Beringia through the identification and characterization of regionally distributed tephra beds; (2) Date, by indirect and/or direct means, these regionally distributed beds; and, (3) Apply the tephrostratigraphic framework to place paleoenvironmental records into chronologic context.

I have shown through this dissertation how detailed stratigraphic, geochemical, and paleomagnetic investigations are required to disentangle the complex Middle to Late Pleistocene tephrostratigraphy of eastern Beringia. Chapters 2, 3 and 4 contribute to objective one by identifying multiple, regionally-dispersed tephra, correlating them between multiple sites, and using the collective stratigraphic, paleoenvironmental and/or chronologic data to supplement the initial information available from sites where the tephra were originally identified. Chapter 3 presents a new age for VT, making it a valuable marker for early marine isotope stage 5, and Chapters 2 and 4 revise the chronology of two paleoenvironmentally important sites through the application of a regionally- applicable tephrostratigraphic framework. Chapter 5, although focused on a Holocene bed, shows that tephra can travel exceptional distances and provide discrete, identifiable, stratigraphic markers over 1000's of kms. This has important implications for the distribution of Pleistocene tephra produced from other large eruptions

Chapter Summaries

Chapter 2 presents a detailed stratigraphic, tephrochronologic and paleomagnetic re-examination of the Palisades, a paleoenvironmentally significant exposure of perennially frozen sediments along the Yukon River in central Alaska. Our paleomagnetic data and tephrostratigraphy clearly show that the site is predominantly comprised of Middle Pleistocene sediments, contrary to previous suggestions. We also report the first known occurrence of the Blake geomagnetic event in Alaskan loess. Most importantly, a series of tephra beds at the site (Boneyard, Chester Bluff, Alyeska, Noyes, Taylor Highway and Valley Creek), are regionally-distributed, and are valuable additions for a new Middle Pleistocene tephrostratigraphic framework for eastern Beringia.

Chapters 3 introduces the Variegated tephra (VT), and establishes it as the most widely distributed tephra bed in eastern Beringia after the Old Crow tephra. The VT tephra was first recognized at Fairbanks, Alaska, but by re-examining previously published material and incorporating data from new sites, we show that this tephra bed is present from southwestern Alaska through to the central Yukon. A new infrared stimulated luminescence age of 106 ± 10 ka, stratigraphy and paleoenvironmental data, provide a more precise age estimate, establishing VT as a marker horizon for MIS 5, and most likely MIS 5d.

Chapter 4 revisits Halfway House, where a re-examination of the site has identified several dated tephra beds not previously recognized: Sheep Creek-Klondike (SC-K; ca. 80 ka), Dominion Creek (DCt; 77 ± 8 ka) and Dawson tephra (~30 cal yr BP). The Skálamælifell/post-Blake excursion (94.1 ± 7.8 ka) provides independent age control, and its presence in a paleosol bracketed by SCt-K and VT (106 ± 10 ka) provides additional confidence to the correlation of this excursion to this particular event. This new age control, the presence of OCt (124 ± 10 ka) and Boneyard tephra (MIS 6), detailed stratigraphy, and a high-resolution magnetic susceptibility profile, show that Halfway House has a relatively complete MIS 6 to Holocene record. Identification of Snag, WR-unknown5, SCt-K, DCt, and Dawson is the first clear documentation of these tephra outside of the Yukon, and indicates that they are important regional markers for MIS 5 (Table 6.1).

Chapter 5 presents the correlation of the White River Ash, eastern lobe (WRE), to the Irish AD 860B tephra, by major-element geochemistry and coincident age-determinations. WRE is ubiquitous across far northwestern North America, is present in northeast Pacific marine cores, and as cryptotephra in peat cores on the east coast of Canada. AD 860B has been correlated across northern Europe, from Ireland to Germany, and is present in the NGRIP ice core from Greenland. A source was never determined for AD 860B until now. The correlation of these tephra illustrates the viability of ultra-distal correlations, and comparison of the diverse archives in which the tephra are present. Additionally eruptions as large, or larger, than the one that produced WRE are known, suggesting other Alaskan tephra beds may be present at an intercontinental scale.

Combining the results and discussions in Chapter 2 (the characterization and distribution of VT tephra), Chapter 3 (a middle to late Pleistocene tephrostratigraphy at the Palisades) and Chapter 4 (chronologic framework for Halfway House) we can identify a series of tephra and place them in relative stratigraphic context (Table 6.1).

Table 6.1. Age estimates for tephra beds discussed in this study that are regionally-distributed, listed in stratigraphic order from youngest to oldest

Name	Radiometric age	Stratigraphic age	Source
White River Ash, eastern lobe	ca. 860 AD	MIS 1	This study
Dawson	ca. 30 cal yr BP	earliest MIS 2	Demuro et al. 2008
Dominion Creek	77 ± 8 ka	MIS 5/4 transition	Preece et al. 2011a
Sheep Creek-Klondike	ca. 80 ka	MIS 5/4 transition	Westgate et al. 2008
Dome Ash Bed	/	MIS 5/4 transition?	This study
VT	106 ± 10 ka	MIS 5 (d?)	This study
Halfway House	/	MIS 5 (d?)	This study
Snag/WR-unknown 5	/	MIS 5 (d?)	this study/Turner et al. in review
Donjek	/	MIS 5 (d?)	Turner et al. in review
Woodchopper Creek	/	MIS 5 (d?)	Jensen et al. 2008, Turner et al. in review
Old Crow	124 ± 10 ka	latest MIS 6	Preece et al. 2011b, Reyes et al. 2010
Boneyard	/	MIS 6	This study
Sheep Creek-Fairbanks	190 ± 20 ka	early MIS 6	Berger et al. 1996
Beiderman	/	MIS 7/6 transition	This study, Jensen et al. 2009
Chester Bluff	/	≥ MIS 9/8 transition	This study, Jensen et al. 2011
Preido Hill	/	≥ MIS 11, < ca. 600	Jensen et al. 2008
Tetlin Junction*	627.5 ± 47.7 ka	> MIS 11, < ca.700ka	Schaefer 2002, This study
Alyeska/VCt/Noyes/Taylor Highway	/	> MIS 11, < ca.700ka	This study
GI	500 ± 100 ka	≥ MIS 13, < ca. 700ka	Preece et al. 2011a
Hollis**	700 ± 40 ka	> MIS 13, < ca. 780ka	Westgate et al. 2011
Hollis 2**	630 ± 80 ka	> MIS 13, < ca. 780ka	Westgate et al. 2011
Gold Run**	690 ± 50 ka	> MIS 13, < ca.780ka	Westgate et al. 2011

* Only at the Tetlin Junction site, included for age control

** Only in Klondike, included for age control, relative stratigraphic order with GI unknown.

Ongoing and Future Research

Collectively, the work presented in this dissertation represents meaningful advances in the tephrostratigraphy of unglaciated Yukon and Alaska. These advances now permit a more extensive application of a tephrostratigraphic framework into the investigation of the sedimentary archives in this region. This research also presents new challenges and opportunities for future study. The following is a summary of ongoing and suggested future research:

1. This dissertation has provided a basic tephrostratigraphic framework that will continue to be built upon as more data from other sites are incorporated. Data collected over the past 5 years, from multiple sites across the Yukon and Alaska, have shown that Middle Pleistocene sediments are more common than previously thought. Work is presently in progress at multiple sites containing Middle Pleistocene sediments, some of which have already contributed to the research presented in this thesis: Hollis Mine and the Paradise "muck" site in the Klondike, Largent Mine in Ester, Alaska, Little Montauk on the Yukon River, east-central Alaska, and new collections from the Dawson Cut/Engineer Creek sections in Fairbanks. At the start of this dissertation, only three tephra beds were known to be present across the Yukon and Alaska (VT, Old Crow and Mosquito Gulch), and this work adds six more (Dawson, DCt, SCt-K, Snag, WR-UN5, and Valley Creek). It would be beneficial to

build upon this group to facilitate more correlations between sites with dated tephra beds. Additionally, further work at sites outside of the Klondike and Fairbanks regions would be beneficial, especially in consideration of the large contributions provided by the Palisades and Chester Bluff sites.

2. The most challenging facet of this dissertation was attempting to refine age estimates on several tephra beds. We present a new indirect age for the VT tephra in Chapter 2, but generally rely on the presence of previously dated tephra beds in section with newly identified tephra to place them into context. There are several challenges encountered when attempting to date Middle Pleistocene tephra beds: (1) they are often too old for indirect dating methods (luminescence, radiocarbon); (2) without high K_2O mineral phases, they are generally too young for classic methods such as $^{40}Ar/^{39}Ar$, and; (3) glass-fission track is limited to tephra that are comprised of thick-walled glass shards and pumice. However, improvements in $^{40}Ar/^{39}Ar$ dating methodology and technology, and development of new methods, such as (U-Th)/He on magnetite, prompted attempts to date several tephra beds using these methods, although this is not included in this dissertation. Hornblende and plagioclase separates from several tephra beds, including Chester Bluff (CB) and Beiderman tephra (BT), were analyzed by Alan Deino at the Berkley Geochronology Center. Laser fusion of mutli-grain aliquots has yielded initial results that suggest while plagioclase is burdened with excess Ar, resulting in exceptionally old ages; hornblende ages were promising, although precision was very poor. Future work is focusing on developing sample preparation methods that will help prevent contamination by other mineral grains, and fully remove glass attached to the phenocrysts. Similarly, results of (U-Th)/He dating on magnetite grains, carried out by Daniel Stockli at the University of Texas, yielded promising results on some samples, although precision was also very low. Fluid inclusions within the magnetite grains have been determined to be causing the inaccurate ages. Future work involves 'vetting' grains via CT scanning, a time-consuming proposition, but likely worthwhile since this method is single-grain, which removes the uncertainty introduced by contaminants in multiple grain aliquots.

3. High-resolution paleomagnetic and magnetic susceptibility measurements have been very beneficial in this study for both providing independent age control and insight into the processes producing the sedimentary record. This suggests that further work along these lines could be of use at other locales. Ongoing work at Gold Hill IV has identified additional excursions (e.g. Evans et al., 2011), and the magnetic susceptibility record that extends back ~1 Ma indicates that the large peaks seen at Gold Hill IV and/or Halfway House during MIS 2, 4, and 6 may be unusual. The implications of these results need to be further examined, and it would be

useful to supplement them with data from other sites with loess records older than MIS 6.

4. Finally, with improved age control, there is the potential that we have identified sediments that date from several Middle Pleistocene interglacials, such as MIS 7, 9 and 11 at Chester Bluff, and MIS 15, 17 and 19 at Gold Hill IV. Initial pollen and insect macrofossil data from the sediments at Chester Bluff do not indicate any unusual conditions, with an exception for the potential MIS 11 paleosol. This unit contains *Pinus* pollen, not previously documented in the Middle Pleistocene (e.g. Schweger et al., 2011), and an unusually high percentage of forest beetle fossils in comparison to other collections from middle Pleistocene interglacials (Appendix 1). These initial results suggest there is great potential for a more thorough examination of the paleoenvironmental proxy date (e.g. pollen, plant and insect macrofossils, biomarkers, etc.) at these sites.

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APPENDIX 1: CHAPTER 2

SINGLE GLASS SHARD ANALYSES FOR ALL TEPHRA IDENTIFIED AT THE PALISADES

EMPA detection limits based on average composition of ID 3506, lipari obsidian standard. Note, these values are the minimum detection values, theorectical detection limits increase with multiple analyses of a single sample

SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Cl	
0.01	**0.08**	**0.24**	**0.28**	**0.11**	**0.06**	**0.11**	**0.76**	**0.25**	**0.14**	(wt%)

Tephra ID	Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Cl	Total	H_2O_{diff}	n	Notes
Palisades-1: Alyeska Pipeline tephra															
	UA 2084-25	77.85	0.24	12.31	1.30	0.03	0.21	1.33	4.12	2.44	0.17	100	4.40		
	UA 2084-1	78.03	0.20	12.24	1.22	0.02	0.18	1.23	4.24	2.44	0.18	100	4.73		
	UA 2084-21	78.03	0.24	12.32	1.31	0.09	0.19	1.25	4.06	2.34	0.17	100	4.96		
	UA 2084-31	78.07	0.18	12.17	1.18	0.09	0.19	1.34	4.07	2.56	0.15	100	4.65		
	UA 2084-5	78.20	0.24	12.22	1.28	0.02	0.15	1.21	4.17	2.41	0.09	100	4.42		
	UA 2084-23	78.28	0.21	12.13	1.22	0.07	0.20	1.22	4.01	2.47	0.19	100	4.64		
	UA 2084-10	78.32	0.17	12.27	1.30	0.07	0.23	1.24	3.88	2.41	0.13	100	4.85		
	UA 2084-16	78.51	0.30	11.96	1.10	0.06	0.21	1.21	4.09	2.36	0.19	100	5.85		
	UA 1481-17	77.76	0.29	12.10	1.24	0.09	0.21	1.26	4.47	2.37	0.22	100	5.67		
	UA 1481-21	78.18	0.18	12.01	1.48	0.06	0.21	1.35	4.00	2.40	0.13	100	4.43		
	UA 1481-8	78.31	0.23	12.16	1.35	0.03	0.15	1.36	3.93	2.29	0.18	100	6.14		
	UA 1481-9	78.33	0.24	12.03	1.26	0.06	0.19	1.29	3.98	2.48	0.15	100	4.93		
	UA 1481-15	78.52	0.22	12.14	1.35	0.02	0.19	1.31	3.87	2.19	0.18	100	5.55		
	UA 1481-22	78.53	0.22	12.29	1.31	0.03	0.19	1.40	3.49	2.37	0.16	100	5.25		
	UA 2110-5	77.81	0.18	12.21	1.31	0.12	0.22	1.30	4.19	2.51	0.15	100	4.43		
	UA 2110-23	77.85	0.23	12.14	1.26	0.10	0.23	1.25	4.32	2.45	0.17	100	5.60		
	UA 2110-22	77.89	0.27	12.15	1.26	0.01	0.19	1.19	4.35	2.51	0.18	100	4.82		
	UA 2110-15	77.92	0.22	12.14	1.25	0.05	0.21	1.22	4.44	2.42	0.14	100	4.73		
	UA 2110-31	77.96	0.18	12.19	1.22	0.06	0.24	1.21	4.24	2.53	0.17	100	5.01		
	UA 2110-11	77.99	0.15	12.12	1.26	0.03	0.16	1.31	4.18	2.63	0.17	100	5.29		
	UA 2110-26	78.17	0.22	12.03	1.25	0.08	0.26	1.27	4.09	2.52	0.13	100	6.03		
	UA 2110-4	78.44	0.22	11.93	1.24	0.05	0.23	1.28	4.18	2.28	0.16	100	5.92		
	UA 2162-18	77.77	0.23	12.26	1.41	0.07	0.23	1.25	4.23	2.39	0.15	100	5.67		
	UA 2162-15	77.84	0.21	12.41	1.20	0.08	0.19	1.25	4.30	2.39	0.14	100	5.01		
	UA 2162-20	77.94	0.22	12.29	1.33	0.03	0.22	1.26	4.05	2.49	0.16	100	4.74		
	UA 2162-23	78.03	0.23	12.19	1.36	0.03	0.19	1.21	4.09	2.52	0.15	100	4.40		
	UA 2162-14	78.21	0.21	12.26	1.31	0.02	0.18	1.20	3.94	2.52	0.13	100	5.38		
	UA 2162-1	78.26	0.18	12.25	1.24	0.07	0.19	1.23	3.97	2.41	0.19	100	5.35		
	UA 2162-2	78.30	0.25	12.23	1.24	0.02	0.18	1.25	4.15	2.22	0.16	100	4.54		
	UA 2162-17	78.31	0.19	12.15	1.32	0.03	0.18	1.22	4.11	2.32	0.18	100	6.00		
	UA 2164-18	77.87	0.23	12.30	1.43	0.07	0.23	1.29	4.09	2.32	0.17	100	4.21		
	UA 2164-13	77.93	0.13	12.13	1.46	0.10	0.17	1.28	4.25	2.38	0.18	100	4.89		
	UA 2164-25	77.99	0.15	12.18	1.36	0.01	0.20	1.29	4.25	2.38	0.19	100	3.24		
	UA 2164-14	78.03	0.18	12.31	1.45	0.01	0.17	1.30	3.91	2.46	0.17	100	4.55		
	UA 2165-9	77.81	0.29	12.13	1.30	0.09	0.21	1.23	4.36	2.44	0.15	100	6.07		
	UA 2165-18	78.19	0.19	12.01	1.23	0.07	0.21	1.25	4.22	2.50	0.13	100	6.07		
	BV UA1314-	78.46	0.24	12.21	1.34	0.06	0.25	1.29	3.76	2.26	0.15	100	4.83		
	BV UA1314-	78.67	0.24	12.06	1.39	0.05	0.20	1.28	3.66	2.28	0.17	100	4.41		
	BV UA1314-	78.72	0.20	12.19	1.38	0.05	0.16	1.26	3.52	2.38	0.12	100	3.70		
	UA 2084-25	77.85	0.24	12.31	1.30	0.03	0.21	1.33	4.12	2.44	0.17	100	4.40		
	UA 2084-1	78.03	0.20	12.24	1.22	0.02	0.18	1.23	4.24	2.44	0.18	100	4.73		

UA 2084-21	78.03	0.24	12.32	1.31	0.09	0.19	1.25	4.06	2.34	0.17	100	4.96	
UA 2084-31	78.07	0.18	12.17	1.18	0.09	0.19	1.34	4.07	2.56	0.15	100	4.65	
UA 2084-5	78.20	0.24	12.22	1.28	0.02	0.15	1.21	4.17	2.41	0.09	100	4.42	
UA 2084-23	78.28	0.21	12.13	1.22	0.07	0.20	1.22	4.01	2.47	0.19	100	4.64	
UA 2084-10	78.32	0.17	12.27	1.30	0.07	0.23	1.24	3.88	2.41	0.13	100	4.85	
UA 2084-16	78.51	0.30	11.96	1.10	0.06	0.21	1.21	4.09	2.36	0.19	100	5.85	
UA 2084-37	77.51	0.24	12.26	1.30	0.06	0.25	1.27	4.36	2.60	0.19	100	5.70	
UA 2084-39	77.67	0.17	12.30	1.35	0.08	0.21	1.23	4.39	2.45	0.19	100	6.74	
UA 2084-21	77.80	0.22	12.23	1.15	0.11	0.22	1.33	4.39	2.46	0.13	100	5.80	
UA 2084-29	77.92	0.20	12.21	1.37	0.05	0.20	1.27	4.30	2.38	0.14	100	6.79	
UA 2084-24	77.98	0.25	12.03	1.22	0.06	0.22	1.26	4.44	2.40	0.18	100	5.85	
UA 2084-16	78.06	0.21	12.32	1.26	0.05	0.24	1.20	4.02	2.51	0.16	100	5.28	
UA 2084-5	78.11	0.18	12.02	1.26	0.03	0.19	1.21	4.33	2.52	0.18	100	6.48	
UA 2162-50	77.44	0.23	12.62	1.36	0.07	0.19	1.20	4.30	2.46	0.18	100	5.09	
UA 2162-39	77.54	0.24	12.58	1.35	0.04	0.19	1.15	4.23	2.54	0.18	100	5.43	
UA 2162-9	77.64	0.22	12.43	1.39	0.07	0.20	1.22	4.26	2.43	0.17	100	5.10	
UA 2162-25	77.75	0.28	12.27	1.41	0.07	0.17	1.26	4.18	2.50	0.14	100	3.92	
UA 2162-22	77.76	0.22	12.31	1.49	0.08	0.18	1.22	4.22	2.41	0.13	100	4.32	
UA 2162-23	78.08	0.22	12.08	1.33	0.09	0.18	1.20	4.20	2.42	0.24	100	10.00	
UA 2162-28	78.10	0.23	12.20	1.39	0.08	0.18	1.26	4.01	2.41	0.19	100	5.51	
UA 2162-6	79.13	0.25	12.30	1.25	0.04	0.17	1.23	3.42	2.09	0.17	100	5.57	
Mean	78.08	0.22	12.20	1.30	0.06	0.20	1.26	4.11	2.42	0.16	100	5.18	62
StDev	0.31	0.04	0.13	0.08	0.03	0.02	0.05	0.22	0.10	0.03	0	0.95	

Palisades-2a: Taylor Highway tephra

UA 2110-9	74.58	0.39	12.86	1.89	0.05	0.26	1.07	4.30	4.37	0.23	100	4.99
UA 2110-21	74.85	0.23	13.10	1.80	0.03	0.20	1.17	3.90	4.49	0.22	100	6.60
UA 2110-29	74.93	0.32	13.12	1.73	0.09	0.25	1.12	3.92	4.33	0.19	100	6.36
UA 2110-7	74.94	0.26	12.99	1.78	0.04	0.25	1.12	4.03	4.38	0.22	100	5.28
UA 1481-16	74.66	0.28	12.92	2.02	0.00	0.20	1.18	4.09	4.34	0.31	100	4.14
UA 1481-10	75.09	0.26	12.81	1.90	0.06	0.22	1.23	3.90	4.24	0.28	100	4.87
UA 2162-10	74.33	0.21	13.47	1.95	0.06	0.22	1.23	3.83	4.43	0.28	100	7.16
UA 2162-13	74.42	0.34	13.24	1.73	0.05	0.25	1.16	3.94	4.63	0.24	100	4.95
UA 2162-28	74.75	0.20	13.20	1.81	0.03	0.22	1.14	3.87	4.54	0.25	100	4.77
UA 2162-19	74.93	0.26	13.18	1.81	0.10	0.20	1.17	3.85	4.26	0.23	100	4.90
UA 2164-9	74.49	0.20	13.52	1.88	0.06	0.20	1.11	3.81	4.46	0.27	100	6.72
UA 2164-6	74.52	0.29	13.14	1.94	0.07	0.23	1.15	3.84	4.61	0.21	100	4.02
UA 2164-10	74.83	0.35	13.15	1.74	0.07	0.20	1.10	3.94	4.40	0.23	100	4.66
UA 2164-21	75.09	0.31	13.16	1.80	0.05	0.22	1.04	3.82	4.32	0.18	100	4.37
UA 2164-26	75.14	0.21	13.06	2.04	0.03	0.21	1.10	3.68	4.30	0.23	100	3.99
UA 2165-20	74.85	0.27	13.12	1.66	0.05	0.22	1.13	3.96	4.51	0.21	100	4.77
UA 2165-11	74.89	0.26	13.09	1.85	0.04	0.19	1.15	3.75	4.55	0.24	100	5.35
UA 2165-21	75.16	0.26	12.99	1.69	0.02	0.27	1.12	3.84	4.40	0.25	100	5.16
BV UA1314-	75.00	0.21	13.03	1.78	0.03	0.20	1.19	3.83	4.44	0.29	100	4.43
BV UA1314-	75.10	0.27	13.19	1.99	0.02	0.16	1.19	3.50	4.34	0.25	100	3.84
BV UA1314-	75.25	0.26	13.27	1.92	0.05	0.21	1.16	3.45	4.28	0.17	100	4.92
BV UA1314-	75.45	0.28	12.94	1.85	0.00	0.22	1.18	3.68	4.19	0.20	100	4.50
UA 2084-32	74.98	0.27	13.19	1.62	0.03	0.21	1.14	4.01	4.31	0.23	100	3.66
UA 2084-11	74.56	0.35	13.34	1.78	0.04	0.23	1.12	4.09	4.29	0.27	100	5.51
UA 2084-19	74.56	0.30	13.38	1.71	0.07	0.20	1.13	4.19	4.23	0.29	100	6.55
UA 2084-40	74.62	0.26	13.23	1.93	0.05	0.23	1.11	4.05	4.34	0.22	100	6.91
UA 2084-31	74.88	0.26	13.28	1.72	0.01	0.23	1.15	3.85	4.40	0.28	100	5.96
UA 2162-10	74.33	0.21	13.47	1.95	0.06	0.22	1.23	3.83	4.43	0.28	100	7.16

UA 2162-13	74.42	0.34	13.24	1.73	0.05	0.25	1.16	3.94	4.63	0.24	100	4.95	
UA 2162-28	74.75	0.20	13.20	1.81	0.03	0.22	1.14	3.87	4.54	0.25	100	4.77	
UA 2162-19	74.93	0.26	13.18	1.81	0.10	0.20	1.17	3.85	4.26	0.23	100	4.90	
UA 2162-46	74.56	0.39	13.12	1.88	0.05	0.15	1.11	3.97	4.58	0.26	100	5.12	
UA 2162-11	74.63	0.29	13.16	1.78	0.03	0.22	1.14	4.00	4.57	0.24	100	5.20	
Mean	74.80	0.27	13.16	1.83	0.05	0.22	1.15	3.89	4.41	0.24	100	5.20	33
StDev	0.28	0.05	0.16	0.10	0.02	0.03	0.04	0.17	0.13	0.03	0	0.97	

Palisades-3: Valley Creek tephra

UA 2164-30	75.70	0.25	13.32	1.46	0.02	0.30	1.67	4.02	3.05	0.20	100	3.59	
UA 2164-27	75.85	0.17	13.38	1.55	0.07	0.29	1.64	3.87	3.01	0.18	100	4.50	
UA 2110-14	75.56	0.17	13.41	1.53	0.01	0.30	1.49	4.29	3.03	0.20	100	4.36	
UA 2110-16	75.60	0.23	13.40	1.56	0.05	0.33	1.66	4.05	2.92	0.19	100	4.40	
UA 2162-25	75.55	0.18	13.51	1.44	0.06	0.29	1.62	4.02	3.16	0.18	100	4.88	
UA 2084-30	75.85	0.22	13.50	1.43	0.04	0.32	1.66	4.02	2.76	0.20	100	4.65	
UA 1481-19	75.96	0.17	13.30	1.55	0.00	0.33	1.62	3.92	2.89	0.26	100	4.89	
UA 2084-30	75.85	0.22	13.50	1.43	0.04	0.32	1.66	4.02	2.76	0.20	100	4.65	
UA 2084-22	76.26	0.16	13.66	1.35	0.08	0.32	1.69	3.92	2.36	0.19	100	3.84	
UA 2084-25	75.54	0.21	13.39	1.40	0.10	0.34	1.62	4.47	2.80	0.17	100	5.67	
UA 2084-8	75.74	0.21	13.43	1.42	0.09	0.35	1.59	4.17	2.84	0.20	100	6.60	
Mean	75.77	0.20	13.43	1.47	0.05	0.32	1.63	4.07	2.87	0.20	100	4.73	11
StDev	0.22	0.03	0.10	0.07	0.03	0.02	0.05	0.18	0.21	0.02	0	0.83	

Palisades-2b

UA 2162-11	65.21	0.87	15.51	5.30	0.14	1.37	3.74	4.69	3.00	0.16	100	1.00	
UA 2162-42	66.20	1.03	16.03	4.53	0.13	1.27	3.35	4.50	2.92	0.06	100	0.14	
UA 2162-4	66.94	1.19	15.39	4.44	0.07	1.33	3.48	3.84	3.27	0.04	100	0.89	
UA 2110-30	67.49	1.27	14.36	4.76	0.01	1.18	3.38	4.02	3.48	0.05	100	0.93	
UA 2110-2	67.87	1.11	14.85	4.43	0.06	1.00	2.88	4.42	3.33	0.06	100	1.55	
UA 2162-41	67.88	1.09	14.97	4.64	0.10	0.85	2.51	3.97	3.93	0.07	100	7.25	
UA 2164-2	67.97	1.14	14.77	4.21	0.09	1.07	3.22	4.28	3.18	0.06	100	1.03	
UA 2162-7	68.20	1.05	14.85	4.17	0.01	1.10	2.83	3.91	3.82	0.07	100	0.79	
UA 2162-6	68.52	1.18	14.11	4.26	0.08	1.06	2.89	4.07	3.76	0.08	100	1.85	
UA 2162-6	68.52	1.18	14.11	4.26	0.08	1.06	2.89	4.07	3.76	0.08	100	1.85	
UA 2110-19	68.53	1.15	14.13	4.50	0.06	1.04	2.80	3.89	3.83	0.07	100	1.73	
UA 2110-32	68.79	1.02	14.31	4.18	0.06	0.93	2.67	4.25	3.72	0.07	100	1.47	
UA 2162-16	69.66	1.14	14.06	4.09	0.04	0.98	2.64	3.75	3.56	0.11	100	7.09	
Mean	67.83	1.11	14.73	4.44	0.07	1.10	3.02	4.13	3.50	0.08	100	2.12	13
StDev	1.17	0.10	0.63	0.33	0.04	0.16	0.37	0.28	0.34	0.03	0	2.29	

Palisades-4: Noyes tephra

UA 2162-16	74.21	0.13	14.99	1.32	0.12	0.50	1.79	4.18	2.71	0.04	100	6.08	
UA 2162-31	74.49	0.20	14.69	1.37	0.07	0.42	1.77	4.30	2.67	0.02	100	6.13	
UA 2162-13	74.40	0.18	14.98	1.43	0.06	0.39	1.70	4.16	2.65	0.06	100	5.79	
UA 2162-24	74.63	0.20	14.70	1.42	0.04	0.47	1.76	4.21	2.50	0.08	100	5.29	
Mean	74.43	0.18	14.84	1.39	0.07	0.45	1.76	4.21	2.63	0.05	100	5.82	4
StDev	0.18	0.03	0.17	0.05	0.04	0.05	0.04	0.06	0.09	0.02	0	0.39	

Palisades-5: new tephra bed

UA 2084-17	74.30	0.40	13.53	1.96	0.06	0.35	1.48	4.85	2.99	0.09	100	4.73
UA 2084-2	74.50	0.35	13.63	2.10	0.06	0.37	1.43	4.63	2.78	0.16	100	3.37
UA 2084-7	74.55	0.45	13.53	2.12	0.05	0.39	1.52	4.51	2.71	0.17	100	5.42
UA 2084-33	74.56	0.41	13.47	1.92	0.08	0.38	1.46	4.74	2.81	0.18	100	4.20

UA 2084-12	74.58	0.45	13.47	1.98	0.10	0.34	1.49	4.73	2.72	0.13	100	4.74	
UA 2084-18	74.62	0.42	13.48	2.00	0.09	0.32	1.46	4.76	2.73	0.13	100	5.51	
UA 2084-15	74.64	0.38	13.60	1.93	0.14	0.36	1.46	4.59	2.77	0.14	100	5.33	
UA 2084-14	74.67	0.36	13.48	2.01	0.10	0.38	1.54	4.59	2.73	0.14	100	4.56	
UA 2084-24	74.69	0.38	13.68	1.91	0.07	0.33	1.46	4.63	2.62	0.21	100	4.42	
UA 2084-20	74.75	0.33	13.47	2.08	0.05	0.33	1.54	4.39	2.91	0.15	100	5.71	
UA 2084-4	74.84	0.39	13.63	1.93	0.05	0.34	1.40	4.41	2.86	0.15	100	5.45	
UA 2084-29	74.86	0.37	13.40	1.91	0.07	0.35	1.50	4.77	2.62	0.15	100	6.95	
UA 2084-8	74.94	0.44	13.52	1.95	0.05	0.36	1.43	4.34	2.83	0.14	100	5.98	
UA 2084-3	74.99	0.43	13.50	1.88	0.10	0.34	1.41	4.45	2.75	0.15	100	5.67	
UA 2084-6	75.00	0.35	13.42	2.02	0.12	0.34	1.39	4.61	2.60	0.16	100	5.13	
UA 2084-13	75.17	0.40	13.61	1.89	0.11	0.33	1.45	4.10	2.77	0.18	100	6.23	
UA 2164-12	73.48	0.41	13.98	2.14	0.18	0.39	1.57	4.75	2.94	0.15	100	5.05	
UA 2164-8	74.46	0.38	13.56	2.18	0.08	0.35	1.44	4.70	2.71	0.14	100	4.72	
UA 2164-20	74.61	0.41	13.40	2.02	0.07	0.31	1.44	4.86	2.74	0.14	100	4.22	
UA 2084-32	73.79	0.37	13.89	2.02	0.15	0.38	1.50	4.92	2.82	0.20	100	8.43	
UA 2084-26	74.10	0.47	13.72	2.09	0.11	0.39	1.43	4.74	2.82	0.18	100	5.19	
UA 2084-18	74.10	0.43	13.84	1.97	0.05	0.33	1.44	4.99	2.71	0.17	100	5.59	
UA 2084-23	74.13	0.35	13.52	2.00	0.08	0.42	1.50	5.08	2.78	0.17	100	8.61	
UA 2084-7	74.16	0.33	13.68	2.11	0.09	0.35	1.50	4.90	2.72	0.22	100	5.75	
UA 2084-12	74.21	0.45	13.81	2.09	0.05	0.35	1.50	4.74	2.71	0.13	100	5.85	
UA 2084-2	74.22	0.41	13.72	2.05	0.04	0.30	1.46	4.84	2.82	0.18	100	6.07	
UA 2084-20	74.26	0.36	13.76	2.05	0.02	0.35	1.47	4.91	2.70	0.15	100	5.68	
UA 2084-13	74.36	0.36	13.82	1.97	0.05	0.41	1.45	4.79	2.66	0.16	100	8.17	
UA 2084-30	74.38	0.39	13.50	2.08	0.11	0.41	1.50	4.70	2.81	0.15	100	5.98	
UA 2084-35	74.39	0.32	13.63	2.11	0.05	0.35	1.45	4.71	2.84	0.18	100	6.32	
UA 2084-14	74.40	0.40	13.50	2.03	0.10	0.36	1.49	4.75	2.82	0.19	100	6.15	
UA 2084-9	74.41	0.37	13.82	2.09	0.07	0.35	1.43	4.73	2.62	0.15	100	5.95	
UA 2084-36	74.42	0.38	13.66	2.10	0.05	0.32	1.47	4.69	2.81	0.13	100	5.95	
UA 2084-4	74.45	0.43	13.73	2.03	0.09	0.33	1.50	4.50	2.82	0.16	100	7.36	
UA 2084-38	74.51	0.44	13.50	2.00	0.06	0.37	1.48	4.71	2.80	0.18	100	5.92	
UA 2084-27	74.56	0.40	13.52	2.12	0.04	0.37	1.42	4.69	2.78	0.12	100	6.78	
UA 2084-6	74.60	0.37	13.33	2.18	0.04	0.33	1.45	4.86	2.72	0.16	100	6.82	
UA 2084-33	74.70	0.31	13.63	2.07	0.05	0.35	1.43	4.69	2.65	0.15	100	6.35	
Mean	74.48	0.39	13.60	2.03	0.08	0.35	1.47	4.69	2.76	0.16	100	5.80	38
StDev	0.33	0.04	0.15	0.08	0.04	0.03	0.04	0.19	0.09	0.03	0	1.13	

Palisades-6: new tephra bed

UA 2085-18	68.68	0.93	14.66	3.89	0.04	1.05	2.93	4.12	3.61	0.09	100	1.55
UA 2085-34	68.71	0.93	14.63	4.13	0.07	0.92	2.89	4.12	3.54	0.06	100	0.41
UA 2085-4	68.97	1.06	14.54	3.90	0.04	0.88	2.67	4.28	3.59	0.08	100	0.98
UA 2085-22	69.63	0.38	15.08	3.49	0.17	0.46	1.85	5.81	2.88	0.26	100	6.73
UA 2085-1	69.81	0.47	14.87	3.62	0.12	0.45	1.83	5.70	2.90	0.21	100	6.24
UA 2085-27	70.66	0.34	15.14	3.15	0.08	0.35	1.46	5.69	2.91	0.22	100	7.50
UA 2085-2	70.86	0.37	14.38	3.27	0.15	0.33	1.38	5.83	3.23	0.21	100	8.64
UA 2085-23	70.90	0.40	14.57	3.26	0.15	0.30	1.44	5.56	3.20	0.22	100	6.61
UA 2085-10	70.97	0.35	14.52	3.20	0.20	0.33	1.45	5.54	3.23	0.22	100	4.62
UA 2085-5	70.98	0.37	14.53	3.16	0.11	0.32	1.47	5.79	3.05	0.22	100	5.27
UA 2085-13	71.10	0.41	14.61	3.23	0.07	0.37	1.53	5.29	3.13	0.26	100	6.18
UA 2085-17	71.12	0.38	14.41	3.37	0.15	0.32	1.55	5.40	3.05	0.24	100	5.94
UA 2085-25	71.13	0.40	14.52	3.21	0.14	0.34	1.46	5.52	3.06	0.22	100	4.74
UA 2085-32	71.15	0.40	14.42	3.18	0.14	0.28	1.41	5.43	3.38	0.21	100	2.59
UA 2085-16	71.22	0.43	14.53	3.20	0.11	0.33	1.51	5.32	3.11	0.23	100	4.35

UA 2085-19	71.24	0.30	14.47	3.23	0.17	0.40	1.42	5.25	3.29	0.23	100	6.96	
UA 2085-9	71.29	0.41	14.40	3.23	0.11	0.34	1.43	5.33	3.22	0.23	100	6.16	
UA 2085-28	71.34	0.40	14.47	3.22	0.13	0.26	1.40	5.39	3.12	0.27	100	5.70	
UA 2085-31	71.34	0.39	14.39	3.30	0.08	0.33	1.50	5.31	3.17	0.18	100	5.04	
UA 2085-20	71.41	0.36	14.39	3.26	0.18	0.31	1.48	5.28	3.10	0.23	100	7.12	
UA 2085-35	71.42	0.37	14.51	3.19	0.16	0.31	1.39	5.26	3.16	0.24	100	5.70	
UA 2085-7	71.50	0.34	14.23	3.21	0.11	0.32	1.40	5.48	3.19	0.22	100	7.22	
UA 2085-21	71.53	0.37	14.45	3.13	0.10	0.29	1.38	5.32	3.17	0.26	100	7.78	
UA 2085-3	71.56	0.35	14.68	3.15	0.05	0.34	1.43	5.07	3.16	0.22	100	6.44	
UA 2085-14	71.59	0.43	14.25	3.43	0.14	0.29	1.50	4.92	3.19	0.26	100	7.71	
UA 2085-11	71.60	0.40	14.48	3.26	0.13	0.32	1.38	5.13	3.07	0.24	100	6.05	
UA 2085-8	71.76	0.36	14.41	2.96	0.05	0.28	1.37	5.37	3.21	0.24	100	6.18	
UA 2085-24	73.21	0.24	13.75	2.44	0.13	0.11	0.95	5.28	3.64	0.24	100	5.29	
UA 2085-30	73.62	0.24	13.82	2.48	0.09	0.22	0.95	4.84	3.49	0.24	100	6.24	
Mean	71.05	0.43	14.49	3.27	0.12	0.38	1.58	5.26	3.21	0.22	100	5.58	29
StDev	1.08	0.19	0.28	0.34	0.04	0.21	0.47	0.45	0.20	0.05	0	2.00	

Palisades-7: Chester Bluff tephra

UA1308-4	73.64	0.23	15.07	1.53	0.03	0.54	2.13	4.13	2.65	0.06	100	4.77
UA1308-1	73.74	0.24	14.97	1.54	0.05	0.51	2.11	3.99	2.81	0.04	100	4.74
UA1308-9	73.79	0.23	15.08	1.49	0.05	0.46	2.12	4.03	2.69	0.06	100	4.36
UA1308-16	73.81	0.32	14.80	1.61	0.09	0.56	1.98	4.07	2.72	0.04	100	4.35
UA1308-10	73.95	0.20	14.94	1.39	0.06	0.50	2.04	4.13	2.78	0.01	100	3.37
UA1308-7	74.05	0.21	15.01	1.44	0.00	0.48	2.09	4.10	2.62	0.00	100	5.01
UA1308-5	74.12	0.22	14.87	1.59	0.05	0.48	1.95	4.04	2.66	0.02	100	3.48
UA1308-12	74.22	0.20	14.70	1.49	0.00	0.48	2.05	4.08	2.71	0.07	100	3.80
UA1308-18	74.30	0.24	14.77	1.47	0.05	0.46	2.09	3.83	2.71	0.08	100	5.60
UA1308-15	74.49	0.23	14.51	1.51	0.08	0.39	1.80	4.13	2.81	0.04	100	3.96
UA1308-2	74.62	0.21	14.71	1.32	0.00	0.40	1.80	4.20	2.71	0.03	100	3.49
UA1308-14	75.00	0.20	14.44	1.42	0.05	0.32	1.90	3.79	2.85	0.04	100	4.53
UA1308-3	75.01	0.26	14.35	1.36	0.04	0.43	1.80	3.87	2.89	0.00	100	4.61
UA1308-6	75.40	0.30	14.03	1.41	0.01	0.39	1.76	3.72	2.92	0.06	100	4.10
UA 1308-25	73.16	0.26	15.15	1.64	0.04	0.55	2.03	4.30	2.78	0.08	100	9.87
UA 1308-3	73.53	0.24	15.16	1.46	0.07	0.53	1.98	4.22	2.75	0.06	100	6.46
UA 1308-28	73.66	0.22	15.14	1.52	0.06	0.52	1.95	4.16	2.74	0.04	100	4.31
UA 1308-33	73.66	0.24	15.02	1.54	0.07	0.52	1.97	4.09	2.86	0.01	100	3.78
UA 1308-6	73.70	0.22	15.01	1.47	0.11	0.42	1.89	4.21	2.93	0.04	100	4.68
UA 1308-9	73.77	0.25	14.93	1.58	0.04	0.50	1.87	4.17	2.81	0.08	100	9.47
UA 1308-20	73.81	0.16	15.05	1.53	0.04	0.50	1.99	4.06	2.82	0.03	100	5.32
UA 1308-23	73.81	0.20	14.89	1.48	0.04	0.52	2.01	4.20	2.82	0.04	100	4.76
UA 1308-32	73.82	0.21	14.91	1.50	0.08	0.48	1.86	4.21	2.89	0.03	100	5.48
UA 1308-17	73.84	0.24	15.09	1.51	0.00	0.58	1.94	4.06	2.69	0.04	100	5.72
UA 1308-22	73.85	0.25	14.97	1.50	0.05	0.47	1.92	4.14	2.81	0.04	100	7.19
UA 1308-21	73.89	0.23	14.95	1.50	0.07	0.44	1.84	4.09	2.93	0.06	100	6.87
UA 1308-19	73.94	0.25	14.93	1.55	0.04	0.44	1.91	4.08	2.77	0.08	100	9.88
UA 1308-2	74.08	0.19	14.77	1.44	0.07	0.40	1.85	4.23	2.93	0.03	100	6.74
UA 1308-34	74.16	0.23	14.87	1.41	0.04	0.44	1.80	4.29	2.74	0.02	100	3.99
UA 1308-8	74.40	0.22	14.60	1.48	0.06	0.45	1.88	4.11	2.76	0.05	100	7.06
UA 1308-7	74.56	0.26	14.60	1.34	0.03	0.43	1.73	3.99	2.98	0.07	100	9.94
UA 1308-15	74.60	0.26	14.55	1.40	0.03	0.44	1.73	4.04	2.94	0.02	100	4.31
UA 1308-24	74.71	0.23	14.45	1.48	0.00	0.39	1.77	4.10	2.83	0.04	100	5.98
UA 1308-27	74.78	0.24	14.42	1.45	0.04	0.40	1.65	4.10	2.86	0.06	100	8.64
UA 1308-16	74.84	0.20	14.50	1.38	0.03	0.37	1.75	4.19	2.70	0.05	100	3.52

UA 1308-11	73.40	0.30	15.06	1.60	0.04	0.53	2.03	4.21	2.79	0.06	100	7.36		
UA 1308-7	73.53	0.28	15.16	1.44	0.07	0.47	2.00	4.27	2.76	0.03	100	5.48		
UA 1308-40	73.58	0.31	15.03	1.50	0.07	0.44	1.88	4.24	2.92	0.04	100	4.54		
UA 1308-39	73.61	0.27	15.18	1.45	0.04	0.47	1.88	4.34	2.75	0.01	100	5.89		
UA 1308-26	73.63	0.26	15.13	1.48	0.09	0.51	1.94	4.28	2.65	0.03	100	4.90		
UA 1308-15	73.65	0.23	15.17	1.47	0.08	0.52	1.93	4.24	2.65	0.07	100	7.21		
UA 1308-12	73.69	0.14	15.03	1.50	0.03	0.52	1.91	4.40	2.75	0.04	100	6.98		
UA 1308-27	73.75	0.18	15.24	1.49	0.05	0.52	1.93	4.01	2.78	0.07	100	5.85		
UA 1308-3	73.90	0.16	15.01	1.36	0.00	0.43	1.90	4.44	2.76	0.05	100	5.30		
UA 1308-33	74.00	0.24	14.84	1.46	0.05	0.45	1.83	4.32	2.78	0.04	100	5.09		
UA 1308-1	74.01	0.22	14.99	1.76	0.03	0.54	1.75	3.81	2.84	0.05	100	5.25		
UA 1308-9	74.01	0.44	14.09	1.78	0.06	0.43	1.86	4.07	3.24	0.03	100	5.93		
UA 1308-38	74.11	0.26	14.61	1.34	0.07	0.48	1.86	4.34	2.90	0.04	100	4.80		
UA 1308-8	74.20	0.23	14.60	1.37	0.00	0.47	1.83	4.37	2.90	0.04	100	6.06		
UA 1308-30	74.28	0.23	14.94	1.27	0.04	0.44	1.79	4.28	2.69	0.06	100	6.11		
UA 1308-25	74.31	0.22	14.78	1.28	0.02	0.40	1.74	4.34	2.87	0.04	100	4.74		
UA 1308-20	74.35	0.21	14.50	1.39	0.01	0.47	1.85	4.29	2.92	0.02	100	5.04		
UA 1308-36	74.36	0.25	14.54	1.41	0.02	0.43	1.80	4.24	2.93	0.03	100	5.38		
UA 1308-13	74.51	0.27	14.70	1.32	0.01	0.41	1.71	4.24	2.79	0.05	100	5.76		
UA 1308-10	74.53	0.26	14.76	1.31	0.07	0.40	1.59	4.26	2.78	0.05	100	5.66		
UA 1308-22	74.59	0.26	14.38	1.43	0.03	0.51	1.79	4.09	2.90	0.03	100	7.03		
UA 1308-17	75.10	0.22	14.59	0.94	0.03	0.16	1.56	4.44	2.96	0.01	100	4.00		
UA 1308-4	75.20	0.24	14.15	1.35	0.04	0.38	1.62	4.12	2.86	0.06	100	6.12		
UA 1308-37	75.52	0.19	14.27	0.76	0.00	0.11	1.74	4.32	3.08	0.02	100	4.68		
AVERAGE	74.14	0.24	14.80	1.44	0.04	0.45	1.88	4.15	2.82	0.04	100	5.58	59	population
STDEV	0.52	0.04	0.30	0.15	0.03	0.08	0.13	0.16	0.11	0.02	0	1.61		
UA1308-11	76.16	0.38	13.43	1.48	0.06	0.32	1.47	3.36	3.29	0.05	100	3.82		
UA 1308-5	77.50	0.41	12.34	1.37	0.00	0.14	0.27	3.09	4.85	0.02	100	3.99		
UA 1308-10	77.83	0.23	12.70	0.84	0.02	0.19	0.83	3.71	3.60	0.06	100	4.12		
UA 1308-32	76.64	0.15	13.78	0.78	0.10	0.23	0.85	4.24	3.23	0.00	100	4.56		
UA 1308-19	78.14	0.57	11.81	1.33	0.00	0.17	0.67	3.45	3.85	0.00	100	6.08		
UA 1308-18	78.23	0.26	12.89	1.04	0.06	0.32	0.92	2.66	3.59	0.03	100	6.26		
UA 1308-16	80.00	0.26	11.18	1.04	0.02	0.38	0.49	2.71	3.90	0.03	100	6.63		
Mean	77.79	0.32	12.59	1.13	0.04	0.25	0.78	3.32	3.76	0.03	100	5.07	7	"CBt-2" Population
StDev	1.24	0.14	0.90	0.27	0.04	0.09	0.38	0.56	0.54	0.02	0	1.21		
Mean	74.53	0.25	14.56	1.41	0.04	0.43	1.76	4.07	2.92	0.04	100	5.53	66	populations
StDev	1.29	0.06	0.79	0.19	0.03	0.10	0.38	0.34	0.35	0.02	0	1.57		

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UA1199-1	73.02	0.38	13.48	2.34	0.01	0.36	1.58	3.74	4.42	0.66	100	5.43
UA1199-2	73.07	0.31	13.67	2.03	0.00	0.34	1.52	4.03	4.36	0.68	100	5.70
UA1199-3	73.19	0.39	13.77	2.21	0.07	0.33	1.55	3.72	4.22	0.55	100	5.02
UA1199-4	73.10	0.30	13.56	2.11	0.05	0.35	1.69	3.83	4.34	0.66	100	6.03
UA1199-5	72.60	0.41	13.66	2.26	0.03	0.36	1.73	4.24	4.04	0.65	100	5.40
UA1199-12	72.77	0.33	13.64	2.20	0.13	0.34	1.63	4.12	4.25	0.59	100	5.18
UA1199-13	72.71	0.37	13.59	2.29	0.07	0.37	1.54	4.13	4.30	0.61	100	3.32
UA1199-15	73.55	0.26	13.70	1.98	0.00	0.31	1.41	3.96	4.18	0.64	100	4.51
UA1199-16	72.87	0.37	13.63	2.37	0.04	0.37	1.72	3.82	4.23	0.57	100	5.78
UA1199-18	73.15	0.38	13.49	2.20	0.02	0.29	1.52	3.86	4.44	0.65	100	3.58
UA1200-4	73.64	0.32	13.43	2.00	0.01	0.29	1.48	4.05	4.20	0.58	100	5.10
UA1200-8	73.35	0.29	13.56	2.11	0.04	0.29	1.56	3.95	4.21	0.64	100	4.83
UA1200-11	73.79	0.26	13.47	2.03	0.03	0.24	1.32	3.88	4.41	0.56	100	5.18

UA1200-13	72.70	0.34	13.89	2.27	0.00	0.41	1.69	3.93	4.15	0.63	100	5.03
UA1200-14	72.51	0.45	13.86	2.36	0.07	0.40	1.75	3.88	4.18	0.54	100	4.53
UA1200-15	73.52	0.29	13.30	2.11	0.05	0.29	1.48	4.00	4.44	0.53	100	5.47
UA1200-16	73.60	0.39	13.41	2.28	0.00	0.35	1.57	3.65	4.13	0.61	100	6.23
UA1200-19	74.00	0.37	13.32	1.90	0.01	0.27	1.43	3.78	4.29	0.61	100	5.22
UA1200-20	72.68	0.42	13.46	2.26	0.11	0.40	1.71	4.06	4.30	0.60	100	3.65
BT UA1201 (	72.25	0.47	13.91	2.46	0.04	0.42	1.89	4.04	4.03	0.51	100	4.73
UA 1201-2	72.37	0.43	13.85	2.55	0.10	0.35	1.76	3.79	4.19	0.62	100	4.89
UA 1201-14	72.51	0.47	13.68	2.45	0.10	0.38	1.84	3.79	4.24	0.53	100	6.15
BT UA1201 (	72.58	0.36	13.90	2.48	0.07	0.35	1.75	3.92	4.09	0.51	100	4.82
UA1201-15	72.72	0.45	13.69	2.48	0.04	0.34	1.65	3.85	4.28	0.49	100	4.57
UA1201-10	72.73	0.38	13.78	2.24	0.07	0.38	1.72	3.89	4.19	0.60	100	4.69
BT UA1201 (	72.75	0.42	13.52	2.53	0.04	0.43	1.86	3.76	4.15	0.54	100	5.50
UA1201-2	72.82	0.38	13.83	2.15	0.00	0.34	1.58	3.92	4.37	0.61	100	5.63
BT UA1201 (	73.04	0.40	13.59	2.36	0.03	0.37	1.69	3.94	4.01	0.57	100	2.12
UA 1201-3	73.10	0.34	13.60	2.13	0.06	0.37	1.64	4.11	4.15	0.51	100	2.28
BT UA1201 (	73.19	0.33	13.53	2.27	0.09	0.37	1.75	3.89	4.08	0.51	100	2.53
UA1201-3	73.21	0.36	13.60	2.20	0.08	0.37	1.58	3.95	4.11	0.53	100	2.65
UA1201-6	73.26	0.36	13.37	2.23	0.08	0.34	1.55	3.93	4.29	0.60	100	4.76
UA 1201-12	73.37	0.30	13.47	2.21	0.00	0.35	1.49	3.94	4.21	0.66	100	4.00
BT UA1201 (	73.42	0.35	13.63	2.27	0.03	0.38	1.66	3.48	4.25	0.55	100	4.11
BT UA1201 (	73.43	0.34	13.33	2.40	0.01	0.36	1.64	3.70	4.28	0.51	100	4.22
BT UA1201 (	73.44	0.31	13.51	2.17	0.06	0.31	1.59	3.89	4.19	0.51	100	2.47
UA1201-7	73.52	0.33	13.36	2.20	0.08	0.31	1.52	3.89	4.18	0.60	100	5.01
UA1201-14	73.55	0.32	13.57	1.99	0.06	0.30	1.37	3.93	4.33	0.58	100	4.87
UA 1201-1	73.62	0.37	13.44	2.13	0.03	0.25	1.49	3.78	4.30	0.60	100	4.30
BT UA1201 (	73.63	0.34	13.49	2.35	0.03	0.24	1.50	3.58	4.33	0.52	100	5.75
BT UA1201 (	73.83	0.30	13.38	2.03	0.06	0.25	1.54	3.75	4.31	0.56	100	4.20
BT UA1201 (	73.86	0.29	13.28	2.05	0.01	0.29	1.62	3.74	4.26	0.61	100	4.59
BT UA1201 (	73.91	0.28	13.35	2.12	0.04	0.32	1.49	3.87	4.11	0.52	100	4.98
BT UA1201 (	73.93	0.30	13.21	2.06	0.05	0.24	1.42	3.55	4.61	0.63	100	4.57
BT UA1201 (	73.93	0.26	13.40	1.94	0.06	0.23	1.45	3.64	4.58	0.51	100	6.17
UA1201-8	73.96	0.33	13.37	1.93	0.07	0.31	1.36	3.70	4.42	0.56	100	6.87
UA1201-5	74.01	0.22	13.47	2.02	0.05	0.27	1.45	3.78	4.14	0.58	100	5.05
UA1201-16	74.01	0.26	13.50	1.85	0.06	0.25	1.42	4.04	3.98	0.62	100	5.12
UA 1201-4	74.04	0.29	13.50	1.97	0.05	0.34	1.46	3.75	4.04	0.58	100	1.69
UA 1201-13	74.09	0.26	13.04	1.98	0.03	0.26	1.39	3.98	4.35	0.62	100	3.68
UA 1201-11	74.15	0.32	13.47	2.02	0.01	0.33	1.51	3.42	4.28	0.49	100	6.49

UA1201-8	73.96	0.33	13.37	1.93	0.07	0.31	1.36	3.70	4.42	0.56	100	6.87
UA1201-5	74.01	0.22	13.47	2.02	0.05	0.27	1.45	3.78	4.14	0.58	100	5.05
UA1201-16	74.01	0.26	13.50	1.85	0.06	0.25	1.42	4.04	3.98	0.62	100	5.12
UA 1201-4	74.04	0.29	13.50	1.97	0.05	0.34	1.46	3.75	4.04	0.58	100	1.69
UA 1201-13	74.09	0.26	13.04	1.98	0.03	0.26	1.39	3.98	4.35	0.62	100	3.68
UA 1201-11	74.15	0.32	13.47	2.02	0.01	0.33	1.51	3.42	4.28	0.49	100	6.49

UA 1201-8	72.29	0.27	13.99	2.41	0.01	0.42	1.82	4.14	4.10	0.54	100	4.69
UA 1201-21	72.69	0.29	13.58	2.47	0.08	0.37	1.61	4.03	4.44	0.43	100	5.09
UA 1201-16	72.82	0.31	13.64	2.36	0.07	0.34	1.62	3.94	4.33	0.57	100	3.84
UA 1201-10	72.88	0.30	13.54	2.33	0.05	0.33	1.54	4.25	4.22	0.56	100	3.99
UA 1201-22	72.90	0.30	13.63	2.14	0.09	0.37	1.58	4.14	4.41	0.44	100	4.82
UA 1201-23	72.93	0.36	13.63	2.08	0.09	0.35	1.54	4.16	4.35	0.51	100	4.90
UA 1201-1	72.95	0.37	13.51	2.45	0.07	0.35	1.62	3.91	4.29	0.50	100	5.59
UA 1201-3	73.02	0.27	13.55	2.14	0.02	0.28	1.52	4.23	4.41	0.55	100	3.20
UA 1201-24	73.28	0.32	13.48	2.16	0.05	0.31	1.46	4.10	4.31	0.54	100	5.01

UA 1201-13	73.32	0.29	13.67	2.01	0.05	0.28	1.37	4.18	4.32	0.51	100	5.38	
UA 1201-2	73.39	0.34	13.43	2.08	0.04	0.30	1.54	4.02	4.31	0.55	100	6.30	
UA 1201-4	73.59	0.32	13.45	2.07	0.07	0.29	1.58	3.92	4.22	0.50	100	7.71	
BT UA1305-	72.45	0.35	13.80	2.60	0.09	0.39	1.91	4.04	3.90	0.48	100	4.21	
BT UA1305-	72.90	0.37	13.64	2.41	0.05	0.39	1.73	4.08	3.94	0.50	100	3.51	
BT UA1305-	73.23	0.34	13.65	2.30	0.06	0.34	1.79	3.93	3.89	0.48	100	3.33	
BT UA1305-	73.29	0.33	13.65	2.21	0.05	0.30	1.54	3.83	4.29	0.51	100	4.51	
BT UA1305-	73.34	0.30	13.47	2.16	0.06	0.35	1.63	3.96	4.15	0.58	100	3.72	
BT UA1305-	73.54	0.39	13.60	2.16	0.05	0.30	1.67	3.59	4.11	0.58	100	4.33	
BT UA1305-	73.72	0.29	13.38	2.08	0.10	0.34	1.43	3.86	4.26	0.53	100	3.86	
BT UA1305-	73.78	0.37	13.52	2.22	0.06	0.30	1.54	3.59	4.05	0.56	100	3.75	
BT UA1305-	73.94	0.29	13.26	2.16	0.08	0.29	1.46	3.58	4.36	0.58	100	4.31	
BT UA1305-	73.96	0.34	13.38	2.02	0.05	0.27	1.55	3.62	4.36	0.46	100	4.76	
BT UA1305-	74.16	0.39	12.76	2.49	0.05	0.31	1.40	3.64	4.24	0.55	100	4.70	
BT UA1305-	74.39	0.22	13.27	1.96	0.05	0.24	1.38	3.79	4.18	0.54	100	4.69	
BT UA1305-	74.51	0.29	13.24	2.09	0.03	0.26	1.51	3.17	4.27	0.64	100	5.05	
BT UA1306-	72.55	0.39	13.76	2.55	0.13	0.09	1.87	4.21	3.93	0.52	100	2.80	
BT UA1306-	73.03	0.40	13.59	2.30	0.03	0.33	1.69	3.77	4.33	0.54	100	4.27	
BT UA1306-	73.19	0.39	13.59	2.32	0.08	0.34	1.74	3.74	4.09	0.52	100	3.93	
BT UA1306-	73.20	0.40	13.59	2.38	0.01	0.36	1.74	3.77	3.99	0.55	100	4.17	
BT UA1306-	73.62	0.35	13.42	2.23	0.08	0.32	1.50	3.70	4.29	0.51	100	4.36	
BT UA1306-	73.86	0.32	13.32	1.99	0.07	0.32	1.49	3.92	4.12	0.57	100	4.11	
BT UA1306-	73.95	0.21	13.48	2.14	0.03	0.28	1.49	3.86	4.13	0.43	100	5.22	
BT UA1306-	74.33	0.24	13.09	2.03	0.08	0.22	1.46	3.67	4.28	0.61	100	4.65	
BT UA1306-	74.44	0.22	12.97	2.12	0.11	0.29	1.47	3.73	4.12	0.53	100	3.49	
BT UA1306-	74.45	0.23	13.18	1.88	0.04	0.18	1.42	3.83	4.19	0.59	100	3.52	
BT UA1306-	74.46	0.31	13.31	1.92	0.06	0.30	1.45	3.41	4.20	0.60	100	4.88	
BT UA1306-	74.48	0.26	13.21	1.86	0.07	0.26	1.47	3.62	4.15	0.61	100	5.37	
BT UA1306-	74.48	0.28	13.14	1.94	0.06	0.22	1.41	3.74	4.21	0.51	100	4.53	
BT UA1306-	74.57	0.28	13.13	1.89	0.03	0.25	1.41	3.67	4.27	0.49	100	4.65	
BU UA1307-	73.17	0.42	13.59	2.40	0.00	0.36	1.79	3.87	3.96	0.45	100	3.83	
BU UA1307-	73.34	0.32	13.57	2.18	0.03	0.35	1.63	3.94	4.09	0.55	100	2.86	
BU UA1307-	73.48	0.42	13.43	2.15	0.03	0.48	1.66	3.86	4.05	0.46	100	3.96	
BU UA1307-	73.56	0.34	13.33	2.37	0.04	0.27	1.61	3.63	4.33	0.52	100	4.29	
BU UA1307-	73.65	0.30	13.58	2.05	0.05	0.30	1.46	3.80	4.23	0.56	100	3.81	
BU UA1307-	73.71	0.29	13.40	2.16	0.04	0.36	1.59	3.86	4.04	0.55	100	3.97	
BU UA1307-	73.79	0.28	13.67	2.10	0.07	0.33	1.55	3.75	3.95	0.52	100	3.70	
BU UA1307-	73.83	0.33	13.30	2.13	0.04	0.30	1.48	3.90	4.15	0.53	100	3.73	
BU UA1307-	73.97	0.28	13.56	1.84	0.07	0.26	1.48	3.98	4.01	0.55	100	3.71	
BU UA1307-	74.05	0.40	13.18	2.16	0.10	0.31	1.57	3.68	3.98	0.57	100	3.32	
BU UA1307-	74.07	0.33	13.49	2.09	0.05	0.32	1.47	3.65	4.02	0.51	100	2.72	
AVERAGE	73.47	0.33	13.49	2.17	0.05	0.32	1.56	3.85	4.21	0.56	100	4.51	##
STDEV	0.58	0.06	0.21	0.18	0.03	0.06	0.13	0.20	0.15	0.05	0	1.10	
UA1199-7	71.26	0.45	14.27	2.71	0.00	0.54	2.03	4.55	3.74	0.45	100	3.06	
UA1199-9	71.71	0.43	14.49	2.55	0.08	0.51	2.00	3.96	3.86	0.42	100	5.88	
UA1199-11	70.62	0.51	14.49	2.86	0.03	0.58	2.34	4.30	3.75	0.51	100	1.55	
UA1199-17	71.64	0.37	14.12	2.62	0.04	0.52	2.01	3.97	4.19	0.51	100	4.84	
UA1199-20	71.25	0.45	14.42	2.59	0.10	0.47	2.03	4.11	4.06	0.50	100	3.87	
UA1200-1	70.49	0.46	14.47	2.88	0.01	0.58	2.22	4.40	3.94	0.56	100	4.86	
UA1200-2	71.24	0.40	14.32	2.80	0.07	0.54	2.23	4.13	3.79	0.48	100	1.88	
UA1200-3	70.90	0.44	14.43	2.96	0.03	0.54	2.20	4.21	3.87	0.42	100	2.26	
UA1200-10	70.75	0.48	14.43	2.65	0.04	0.59	2.20	4.47	3.85	0.53	100	1.69	
UA1200-5	69.81	0.53	14.77	3.06	0.10	0.65	2.46	4.41	3.68	0.54	100	1.34	

UA1200-6	69.91	0.53	14.70	3.03	0.07	0.70	2.45	4.38	3.72	0.51	100	1.63	
UA1200-7	69.72	0.67	14.81	3.01	0.09	0.68	2.35	4.42	3.74	0.51	100	2.69	
UA1199-6	69.96	0.53	14.74	3.00	0.07	0.62	2.44	4.52	3.50	0.61	100	3.75	
UA1201-13	69.72	0.56	14.67	3.13	0.08	0.65	2.43	4.44	3.82	0.49	100	2.10	
UA1201-12	69.84	0.56	14.69	3.18	0.15	0.73	2.54	4.21	3.59	0.50	100	1.79	
BT UA1201 (	70.52	0.46	14.45	3.05	0.07	0.62	2.40	4.37	3.62	0.44	100	2.10	
BT UA1201 (	70.56	0.56	14.66	2.84	0.05	0.56	2.54	4.00	3.81	0.42	100	5.25	
BT UA1201 (	70.57	0.56	14.65	2.97	0.11	0.56	2.55	4.11	3.54	0.38	100	3.81	
UA1201-20	70.72	0.56	14.53	2.77	0.11	0.58	2.26	4.41	3.66	0.41	100	1.45	
BT UA1201 (	70.87	0.54	14.46	2.98	0.11	0.54	2.39	3.86	3.79	0.47	100	4.46	
BT UA1201 (	70.95	0.52	14.54	2.90	0.04	0.56	2.45	3.83	3.76	0.46	100	5.35	
UA1201-17	70.98	0.48	14.20	2.88	0.05	0.60	2.26	4.19	3.73	0.64	100	1.88	
BT UA1201 (	71.08	0.44	14.52	2.98	0.06	0.58	2.34	3.95	3.61	0.43	100	0.90	
UA1201-18	71.38	0.51	14.10	2.81	0.10	0.52	2.11	3.86	4.03	0.58	100	4.71	
UA1201-19	71.55	0.54	14.18	2.79	0.00	0.48	2.07	3.80	4.04	0.55	100	4.34	
UA 1201-17	69.81	0.50	14.65	3.00	0.06	0.65	2.41	4.57	3.94	0.42	100	4.97	
UA 1201-18	69.87	0.60	14.92	2.95	0.08	0.69	2.38	4.26	3.81	0.44	100	0.78	
UA 1201-6	69.89	0.50	14.71	3.03	0.09	0.64	2.35	4.47	3.85	0.47	100	1.23	
UA 1201-7	69.99	0.49	14.62	3.08	0.11	0.65	2.43	4.27	3.88	0.48	100	3.98	
UA 1201-11	70.23	0.56	14.70	2.97	0.02	0.60	2.35	4.37	3.78	0.41	100	5.36	
UA 1201-25	70.41	0.54	14.57	3.09	0.07	0.60	2.30	4.21	3.80	0.41	100	2.08	
UA 1201-12	70.52	0.52	14.63	2.88	0.02	0.56	2.19	4.44	3.72	0.52	100	2.87	
UA 1201-5	70.57	0.50	14.37	2.88	0.09	0.57	2.26	4.40	3.85	0.51	100	6.22	
UA 1201-9	70.57	0.57	14.58	2.75	0.08	0.58	2.28	4.40	3.84	0.36	100	1.61	
UA 1201-14	70.77	0.47	14.28	2.97	0.10	0.57	2.31	4.16	3.89	0.48	100	1.46	
UA 1201-20	71.75	0.38	14.16	2.48	0.06	0.42	1.81	4.37	4.05	0.52	100	5.35	
BT UA1305-	70.53	0.55	14.61	3.00	0.06	0.57	2.57	4.02	3.53	0.57	100	0.59	
BT UA1305-	71.20	0.43	14.32	2.93	0.06	0.41	2.25	4.27	3.68	0.45	100	2.79	
BT UA1305-	71.72	0.41	14.04	2.75	0.04	0.49	2.07	4.11	3.90	0.46	100	0.81	
BT UA1305-	71.85	0.43	14.12	2.58	0.09	0.38	2.10	3.85	4.13	0.46	100	4.28	
BT UA1305-	72.02	0.39	14.24	2.56	0.09	0.36	1.85	4.09	3.90	0.50	100	2.14	
BT UA1306-	71.90	0.42	14.01	2.69	0.05	0.50	2.14	3.81	3.98	0.51	100	5.05	
BT UA1306-	70.29	0.55	14.51	2.93	0.07	0.62	2.48	4.20	3.88	0.46	100	3.35	
BT UA1306-	70.76	0.61	14.56	2.98	0.08	0.54	2.34	3.86	3.81	0.45	100	4.33	
BT UA1306-	70.79	0.47	14.62	2.92	0.12	0.30	2.40	4.00	3.97	0.40	100	4.03	
BU UA1307-	69.77	0.60	14.72	3.27	0.08	0.63	2.57	4.08	3.84	0.43	100	2.10	
BU UA1307-	69.84	0.56	14.60	3.18	0.09	0.60	2.46	4.50	3.67	0.51	100	0.58	
BU UA1307-	69.92	0.63	14.62	3.19	0.09	0.73	2.52	4.06	3.84	0.40	100	2.99	
BU UA1307-	70.20	0.52	14.56	3.21	0.11	0.64	2.55	4.10	3.67	0.44	100	1.92	
BU UA1307-	70.61	0.53	14.43	2.96	0.09	0.59	2.46	3.98	3.84	0.50	100	3.67	
BU UA1307-	70.66	0.56	14.35	2.92	0.07	0.56	2.29	4.39	3.73	0.48	100	3.66	
BU UA1307-	71.49	0.35	14.05	2.92	0.09	0.54	2.20	4.06	3.79	0.50	100	2.60	
AVERAGE	70.69	0.50	14.48	2.91	0.07	0.57	2.30	4.20	3.81	0.48	100	3.04	52
STDEV	0.66	0.07	0.22	0.18	0.03	0.09	0.18	0.22	0.15	0.06	0	1.56	
UA1200-18	75.41	0.24	12.84	1.61	0.03	0.27	1.24	3.57	4.31	0.48	100	4.77	utlier
AVERAGE	72.56	0.39	13.81	2.41	0.06	0.40	1.80	3.96	4.08	0.53	100	4.03	##
STDEV	1.44	0.10	0.51	0.39	0.03	0.14	0.38	0.26	0.24	0.07	0	1.44	

PAU

UA1263-12	72.51	0.34	13.58	2.39	0.08	0.38	1.70	3.90	4.53	0.59	100	8.15
UA1263-8	72.52	0.36	13.59	2.33	0.03	0.38	1.74	4.09	4.37	0.58	100	9.43

UA1263-3	72.54	0.46	13.43	2.43	0.06	0.39	1.64	3.98	4.48	0.58	100	8.72		
UA1263-11	72.59	0.38	13.67	2.35	0.09	0.35	1.71	3.93	4.48	0.45	100	9.05		
UA1263-5	72.76	0.35	13.57	2.28	0.07	0.36	1.65	4.28	4.17	0.49	100	7.66		
UA1263-1	72.77	0.36	13.78	2.12	0.08	0.34	1.56	3.99	4.48	0.52	100	8.87		
UA1263-1	72.86	0.38	13.63	2.15	0.05	0.32	1.57	4.07	4.32	0.64	100	6.69		
UA1263-4	72.86	0.39	13.50	2.26	0.04	0.34	1.64	4.02	4.38	0.56	100	7.74		
UA1263-23	72.94	0.41	13.55	2.23	0.01	0.31	1.61	4.22	4.22	0.50	100	4.80		
UA1263-6	72.98	0.34	13.59	2.33	0.05	0.34	1.65	4.06	4.08	0.57	100	6.87		
UA1263-26	73.01	0.36	13.42	2.29	0.10	0.31	1.54	4.05	4.38	0.54	100	4.97		
UA1263-18	73.07	0.41	13.50	2.31	0.03	0.37	1.60	3.68	4.51	0.52	100	7.00		
UA1263-12	73.10	0.32	13.63	2.01	0.02	0.34	1.65	4.02	4.29	0.62	100	7.48		
UA1263-10	73.20	0.37	13.44	2.30	0.12	0.41	1.64	3.69	4.25	0.58	100	6.80		
UA1263-2	73.25	0.31	13.53	2.21	0.11	0.31	1.53	3.83	4.38	0.53	100	7.54		
UA1263-17	73.36	0.37	13.26	2.23	0.05	0.32	1.50	3.81	4.52	0.58	100	5.08		
UA1263-18	73.38	0.31	13.54	2.04	0.10	0.30	1.56	3.93	4.29	0.56	100	5.02		
UA1263-16	73.40	0.34	13.48	2.14	0.02	0.27	1.52	3.72	4.49	0.62	100	5.22		
UA1263-25	73.45	0.32	13.33	2.10	0.03	0.33	1.60	3.76	4.52	0.57	100	5.30		
UA1263-6	73.48	0.40	13.44	2.10	0.05	0.33	1.47	3.96	4.27	0.51	100	5.65		
UA1263-13	73.49	0.26	13.47	2.10	0.06	0.32	1.52	3.82	4.38	0.57	100	8.40		
UA1263-9	73.57	0.40	13.47	1.98	0.06	0.30	1.44	3.77	4.55	0.46	100	8.33		
UA1263-24	73.64	0.47	13.31	2.22	0.12	0.29	1.59	3.79	4.08	0.50	100	5.27		
UA1263-9	73.69	0.25	13.54	1.92	0.10	0.31	1.43	3.91	4.31	0.55	100	6.70		
UA 1263-16	72.31	0.40	13.76	2.49	0.09	0.37	1.72	4.03	4.31	0.52	100	4.18		
UA 1263-1	72.32	0.37	13.86	2.40	0.03	0.39	1.70	4.03	4.38	0.53	100	5.23		
UA 1263-7	72.75	0.33	13.68	2.27	0.15	0.39	1.65	4.06	4.16	0.55	100	4.42		
UA 1263-6	72.75	0.37	13.55	2.20	0.02	0.35	1.71	4.05	4.40	0.60	100	4.69		
UA 1263-24	72.80	0.33	13.69	2.27	0.04	0.33	1.64	4.04	4.30	0.55	100	4.14		
UA 1263-25	72.90	0.31	13.35	2.34	0.07	0.33	1.61	4.24	4.32	0.54	100	5.10		
UA 1263-21	73.06	0.32	13.55	2.36	0.08	0.39	1.61	4.02	4.17	0.44	100	4.14		
UA 1263-10	73.12	0.29	13.43	2.13	0.04	0.33	1.59	4.06	4.39	0.62	100	5.43		
UA 1263-13	73.46	0.42	13.19	2.06	0.07	0.28	1.42	4.02	4.52	0.56	100	5.61		
UA 1263-8	73.70	0.30	13.28	2.05	0.07	0.29	1.48	4.10	4.23	0.52	100	6.16		
AVERAGE	73.05	0.36	13.52	2.22	0.07	0.34	1.59	3.97	4.35	0.55	100	6.35	34	Pop 1
STDEV	0.40	0.05	0.15	0.14	0.03	0.04	0.09	0.15	0.13	0.05	0	1.60		
UA1263-15	69.94	0.58	14.83	3.13	0.15	0.76	2.45	4.14	3.64	0.37	100	7.62		
UA1263-4	70.02	0.60	14.49	3.12	0.08	0.68	2.52	4.20	3.76	0.54	100	3.61		
UA1263-5	70.06	0.62	14.66	3.09	0.10	0.69	2.44	4.12	3.77	0.44	100	6.21		
UA1263-3	70.08	0.61	14.58	3.39	0.08	0.67	2.37	4.19	3.55	0.49	100	4.50		
UA1263-21	70.18	0.55	14.59	3.01	0.04	0.64	2.50	4.46	3.57	0.47	100	3.27		
UA1263-23	70.19	0.56	14.40	3.03	0.07	0.69	2.50	4.50	3.62	0.44	100	5.63		
UA1263-21	70.29	0.55	14.57	3.09	0.07	0.63	2.42	4.07	3.89	0.42	100	4.46		
UA1263-7	70.38	0.59	14.55	2.93	0.09	0.69	2.39	4.37	3.61	0.39	100	5.42		
UA1263-24	70.38	0.52	14.75	2.99	0.09	0.64	2.32	4.24	3.67	0.40	100	4.64		
UA1263-22	70.39	0.52	14.51	3.05	0.06	0.60	2.31	4.11	3.95	0.50	100	1.75		
UA1263-22	70.61	0.56	14.51	2.88	0.09	0.67	2.48	4.24	3.55	0.40	100	4.65		
UA1263-16	70.80	0.52	14.55	2.64	0.06	0.54	2.13	4.33	3.99	0.44	100	5.15		
UA1263-17	71.06	0.47	14.65	2.66	0.06	0.58	2.09	4.29	3.71	0.44	100	2.77		
UA1263-10	71.24	0.52	14.12	2.73	0.01	0.55	2.20	4.14	4.07	0.41	100	8.58		
UA1263-15	71.78	0.36	14.10	2.59	0.07	0.46	2.03	4.37	3.82	0.41	100	6.51		
UA 1263-2	68.13	0.62	14.97	3.62	0.10	0.91	3.00	4.46	3.80	0.39	100	3.44		
UA 1263-17	69.52	0.54	14.95	3.16	0.12	0.64	2.36	4.57	3.72	0.43	100	5.79		
UA 1263-11	69.59	0.54	14.95	3.12	0.10	0.66	2.57	4.41	3.61	0.45	100	5.68		
UA 1263-23	69.62	0.57	14.92	3.28	0.06	0.67	2.61	4.31	3.54	0.41	100	1.45		

UA 1263-5	69.64	0.54	14.67	3.20	0.14	0.65	2.60	4.51	3.59	0.47	100	1.73	
UA 1263-20	69.85	0.50	14.76	3.03	0.05	0.64	2.42	4.58	3.70	0.48	100	7.05	
UA 1263-22	69.99	0.54	14.65	3.12	0.04	0.63	2.52	4.34	3.71	0.47	100	1.93	
UA 1263-12	70.40	0.56	14.47	2.81	0.11	0.61	2.35	4.50	3.80	0.39	100	4.85	
UA 1263-9	70.63	0.49	14.52	2.82	0.06	0.53	2.26	4.37	3.86	0.46	100	4.39	
UA 1263-14	71.02	0.42	14.52	2.75	0.10	0.49	2.16	4.24	3.84	0.47	100	4.68	
AVERAGE	70.23	0.54	14.61	3.01	0.08	0.64	2.40	4.32	3.73	0.44	100	4.63	25 Pop 2
STDEV	0.70	0.06	0.22	0.24	0.03	0.09	0.20	0.15	0.14	0.04	0	1.86	
AVERAGE	71.85	0.43	13.98	2.55	0.07	0.46	1.94	4.12	4.09	0.50	100	5.62	59 both
STDEV	1.50	0.11	0.57	0.44	0.03	0.16	0.43	0.23	0.34	0.07	0	1.90	

Palisades-8: new tephra bed

BU UA1309-	77.27	0.26	11.95	1.61	0.05	0.31	1.39	3.79	3.16	0.22	100	5.82	
BU UA1309-	77.40	0.36	12.08	1.66	0.02	0.24	1.42	3.38	3.20	0.26	100	3.96	
BU UA1309-	77.45	0.22	12.03	1.55	0.06	0.26	1.25	3.93	3.05	0.20	100	3.78	
BU UA1309-	77.58	0.33	11.89	1.62	0.00	0.24	1.40	3.56	3.12	0.25	100	3.87	
BU UA1309-	77.70	0.39	12.00	1.47	0.04	0.34	1.26	3.59	3.01	0.20	100	3.70	
BU UA1309-	77.74	0.32	11.99	1.59	0.05	0.21	1.31	3.51	3.07	0.21	100	4.35	
BU UA1309-	77.76	0.33	11.96	1.60	0.02	0.23	1.31	3.45	3.08	0.25	100	4.37	
BU UA1309-	77.78	0.34	11.81	1.60	0.07	0.25	1.33	3.42	3.12	0.28	100	4.32	
BU UA1309-	77.78	0.33	11.84	1.54	0.02	0.28	1.37	3.51	3.07	0.26	100	5.41	
BU UA1309-	77.82	0.31	11.90	1.49	0.05	0.23	1.49	3.46	2.98	0.26	100	4.04	
BU UA1309-	77.90	0.34	11.80	1.62	0.06	0.24	1.32	3.43	3.04	0.25	100	5.13	
BU UA1309-	77.91	0.31	11.81	1.64	0.01	0.32	1.29	3.41	3.09	0.22	100	4.71	
BU UA1309-	77.98	0.34	11.88	1.42	0.08	0.28	1.35	3.37	3.11	0.20	100	4.24	
UA 1309-14	75.99	0.39	12.34	1.99	0.08	0.32	1.73	3.89	3.06	0.22	100	4.52	
UA 1309-19	76.84	0.38	11.73	1.60	0.03	0.31	1.31	4.14	3.24	0.42	100	4.82	
UA 1309-1	77.07	0.27	11.80	1.55	0.06	0.24	1.34	3.96	3.33	0.37	100	5.91	
UA 1309-17	77.34	0.32	11.84	1.57	0.00	0.32	1.35	3.75	3.09	0.42	100	4.97	
UA 1309-16	77.42	0.28	11.84	1.63	0.03	0.28	1.31	3.78	3.14	0.29	100	5.56	
UA 1309-9	77.43	0.27	11.89	1.62	0.05	0.31	1.35	3.65	3.17	0.26	100	6.11	
UA 1309-22	77.48	0.38	11.74	1.67	0.03	0.28	1.22	3.77	3.18	0.27	100	4.76	
UA 1309-5	77.49	0.35	11.96	1.51	0.02	0.25	1.28	3.82	3.06	0.24	100	5.95	
UA 1309-11	77.51	0.32	11.96	1.62	0.03	0.22	1.30	3.67	3.13	0.24	100	5.08	
UA 1309-4	77.60	0.36	11.79	1.54	0.03	0.25	1.26	3.77	3.15	0.25	100	5.32	
UA 1309-12	77.62	0.33	11.84	1.53	0.06	0.26	1.31	3.74	3.06	0.23	100	5.07	
UA 1309-7	77.65	0.38	11.66	1.49	0.05	0.23	1.29	3.81	3.21	0.23	100	6.29	
UA 1309-10	77.65	0.35	11.72	1.50	0.00	0.24	1.24	3.81	3.24	0.25	100	6.49	
UA 1309-6	77.68	0.34	11.96	1.57	0.04	0.27	1.28	3.52	3.11	0.23	100	5.14	
UA 1309-3	77.74	0.34	11.73	1.57	0.05	0.21	1.26	3.75	3.14	0.20	100	5.09	
AVERAGE	77.52	0.33	11.88	1.59	0.04	0.26	1.33	3.67	3.12	0.26	100	4.96	28
STDEV	0.39	0.04	0.14	0.10	0.02	0.04	0.10	0.20	0.08	0.06	0	0.79	

Palisades-9: new tephra bed

UA1468-6	65.13	0.50	16.78	4.66	0.21	1.59	4.91	4.42	1.55	0.23	100	0.56
UA1467-4	65.27	0.48	17.03	4.58	0.12	1.51	4.85	4.36	1.58	0.23	100	0.09
UA1467-5	65.51	0.52	16.95	4.29	0.14	1.51	5.00	4.59	1.31	0.18	100	1.13
UA1467-2	65.59	0.44	16.71	4.48	0.12	1.43	4.90	4.87	1.26	0.20	100	0.65
UA1468-16	65.70	0.49	17.00	4.46	0.13	1.39	4.86	4.26	1.54	0.17	100	0.91
UA1467-3	65.79	0.46	16.50	4.67	0.10	1.44	4.77	4.59	1.47	0.20	100	3.78
UA1468-1	65.85	0.55	16.60	4.23	0.16	1.51	4.74	4.74	1.43	0.20	100	4.33

UA1468-12	66.56	0.40	16.61	4.07	0.16	1.46	4.60	4.40	1.53	0.20	100	0.98	
UA1467-16	66.58	0.44	16.16	4.43	0.15	1.50	4.32	4.57	1.65	0.21	100	6.94	
UA1468-7	66.60	0.42	16.91	3.38	0.13	1.09	4.87	5.18	1.28	0.14	100	2.60	
UA1468-8	66.90	0.44	16.99	3.66	0.13	1.22	4.44	4.55	1.55	0.11	100	2.88	
UA1468-3	68.07	0.40	16.21	3.74	0.09	1.19	4.02	4.49	1.58	0.21	100	2.52	
UA1468-4	68.07	0.44	16.31	3.62	0.15	1.29	4.02	4.43	1.48	0.18	100	2.06	
UA1467-6	68.49	0.42	16.33	3.22	0.12	1.16	3.91	4.67	1.56	0.12	100	1.04	
UA 1467-5	64.78	0.41	17.76	4.14	0.08	1.28	5.32	4.85	1.17	0.20	100	5.75	
UA 1467-4	65.03	0.39	16.94	4.68	0.17	1.48	5.25	4.50	1.39	0.18	100	1.88	
UA 1467-12	65.71	0.48	16.72	4.52	0.16	1.55	4.78	4.42	1.47	0.20	100	1.43	
UA 1467-6	65.77	0.52	16.38	4.37	0.13	1.46	4.83	4.79	1.50	0.24	100	1.90	
UA 1467-9	65.91	0.47	16.77	3.92	0.15	1.32	5.02	4.99	1.24	0.20	100	1.55	
UA 1467-14	66.19	0.38	16.62	4.15	0.12	1.39	4.83	4.71	1.38	0.22	100	1.29	
UA 1467-8	66.38	0.42	16.89	4.10	0.12	1.34	4.64	4.43	1.46	0.21	100	1.58	
UA 1467-2	66.96	0.47	16.39	4.34	0.13	1.36	4.23	4.47	1.46	0.18	100	1.09	
UA 1467-15	67.70	0.42	16.70	3.38	0.13	0.99	4.43	4.75	1.35	0.17	100	3.71	
UA 1467-13	67.86	0.46	16.10	3.81	0.11	1.27	4.04	4.56	1.59	0.19	100	4.10	
UA 1468-11	64.91	0.53	16.99	4.53	0.12	1.52	5.37	4.33	1.48	0.23	100	4.89	
UA 1468-9	64.91	0.42	16.88	4.77	0.20	1.45	5.09	4.42	1.66	0.20	100	2.18	
UA 1468-4	65.26	0.43	16.82	4.68	0.16	1.45	5.21	4.42	1.38	0.19	100	1.55	
UA 1468-14	65.41	0.43	16.61	4.69	0.14	1.49	5.13	4.46	1.40	0.23	100	2.16	
UA 1468-7	65.54	0.46	16.96	4.18	0.12	1.41	5.17	4.74	1.25	0.17	100	0.93	
UA 1468-2	65.60	0.46	16.73	4.63	0.16	1.43	4.98	4.32	1.51	0.19	100	0.47	
UA 1468-5	65.90	0.44	16.81	4.69	0.17	1.50	4.73	4.17	1.38	0.20	100	1.22	
UA 1468-13	65.97	0.38	17.06	4.43	0.19	1.44	5.18	3.79	1.40	0.17	100	2.03	
UA 1468-10	66.31	0.48	16.75	4.25	0.12	1.30	4.89	4.18	1.54	0.18	100	4.55	
UA 1468-15	66.62	0.43	16.20	4.23	0.13	1.42	4.70	4.56	1.49	0.22	100	2.44	
UA 1468-12	67.14	0.45	16.49	3.92	0.11	1.27	4.63	4.37	1.49	0.14	100	2.40	
UA 1468-16	68.68	0.50	15.75	3.51	0.11	1.10	3.86	4.52	1.69	0.28	100	5.46	
UA 1468-1	69.67	0.41	15.68	3.29	0.13	0.88	3.52	4.51	1.74	0.18	100	3.15	
AVERAGE	66.33	0.45	16.65	4.18	0.14	1.36	4.70	4.52	1.47	0.19	100	2.38	37 Pop 1
STDEV	1.18	0.04	0.39	0.45	0.03	0.16	0.45	0.25	0.13	0.03	0	1.64	
UA1467-11	77.17	0.11	13.07	1.42	0.07	0.24	1.46	3.38	2.81	0.29	100	5.46	
UA1467-12	77.52	0.26	12.81	1.34	0.12	0.24	1.41	3.26	2.74	0.28	100	3.46	
UA1467-15	78.01	0.16	12.37	1.09	0.08	0.18	0.98	3.32	3.53	0.27	100	6.25	
UA 1467-11	77.20	0.21	12.67	1.18	0.08	0.21	1.23	3.81	3.22	0.19	100	6.10	
UA 1467-10	77.26	0.26	12.66	1.12	0.09	0.20	1.21	3.88	3.07	0.23	100	5.63	
AVERAGE	77.43	0.20	12.72	1.23	0.09	0.21	1.26	3.53	3.08	0.25	100	5.38	5 Pop 2
STDEV	0.35	0.07	0.25	0.14	0.02	0.03	0.19	0.29	0.32	0.04	0	1.12	

Palisades-10: new tephra bed

UA1469-8	68.73	0.68	15.38	3.92	0.22	1.06	3.16	4.70	1.99	0.17	100	1.06
UA1469-5	69.40	0.66	15.25	3.60	0.16	0.92	3.17	4.66	1.98	0.20	100	0.84
UA1469-11	69.62	0.71	15.05	3.80	0.19	0.89	3.02	4.52	1.99	0.22	100	2.43
UA1469-21	70.06	0.69	14.89	3.67	0.17	0.82	2.66	4.79	1.98	0.26	100	3.79
UA1469-12	70.21	0.71	14.82	3.73	0.19	0.81	2.72	4.51	2.10	0.20	100	3.70
UA1469-3	70.37	0.79	14.73	3.74	0.13	0.75	2.50	4.62	2.17	0.19	100	3.77
UA1469-14	70.56	0.64	14.81	3.58	0.10	0.79	2.66	4.72	1.97	0.17	100	1.46
UA1469-20	71.60	0.51	14.73	3.05	0.11	0.70	2.64	4.31	2.15	0.19	100	1.23
UA 1469-1	65.63	0.45	16.98	4.00	0.12	1.23	5.05	4.81	1.60	0.15	100	2.21
UA 1469-5	68.93	0.68	15.42	3.89	0.07	0.94	3.12	4.85	1.90	0.19	100	1.92
UA 1469-3	68.94	0.67	15.34	3.74	0.22	0.91	3.15	4.77	2.08	0.19	100	1.81
UA 1469-20	69.02	0.67	15.27	3.90	0.15	0.93	3.14	4.76	1.94	0.23	100	8.36

UA 1469-9	69.10	0.52	15.31	3.72	0.14	1.13	3.66	4.35	1.83	0.24	100	2.59	
UA 1469-2	69.12	0.66	15.46	3.61	0.16	0.85	3.07	4.83	2.08	0.17	100	2.59	
UA 1469-4	69.48	0.72	15.16	3.62	0.15	0.82	2.95	4.81	2.08	0.20	100	2.67	
AVERAGE	69.38	0.65	15.24	3.70	0.15	0.90	3.11	4.67	1.99	0.20	100	2.70	15
STDEV	1.30	0.09	0.55	0.22	0.04	0.14	0.61	0.17	0.14	0.03	0	1.83	

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UA1297-4	70.84	0.23	16.37	2.30	0.06	0.79	3.01	4.48	1.92	0.01	100	0.85
UA1297-25	71.12	0.27	16.27	2.24	0.05	0.65	3.25	4.36	1.75	0.03	100	2.44
UA1297-17	71.13	0.29	15.92	2.37	0.11	0.74	3.00	4.56	1.84	0.04	100	1.54
UA1297-2	71.18	0.29	15.94	2.21	0.01	0.83	2.95	4.73	1.85	0.02	100	5.41
UA1297-24	71.23	0.35	15.81	2.26	0.05	0.84	2.90	4.69	1.82	0.05	100	1.86
UA1297-13	71.35	0.25	15.94	2.32	0.04	0.80	2.80	4.63	1.85	0.03	100	1.26
UA1297-10	71.45	0.19	15.94	2.24	0.06	0.82	3.01	4.49	1.76	0.04	100	4.63
UA1297-23	71.59	0.29	15.80	2.05	0.05	0.86	2.80	4.51	2.00	0.05	100	2.06
UA1297-8	71.82	0.25	15.96	2.05	0.05	0.66	2.82	4.51	1.85	0.02	100	5.95
UA1297-15	71.83	0.28	15.69	1.90	0.06	0.71	2.80	4.79	1.92	0.01	100	3.08
UA1297-7	71.87	0.19	15.83	2.14	0.01	0.68	2.74	4.59	1.92	0.02	100	4.87
UA1297-14	71.88	0.26	15.94	2.03	0.04	0.67	2.72	4.52	1.93	0.02	100	2.01
UA1297-1	71.94	0.31	15.94	2.08	0.03	0.63	2.68	4.45	1.93	0.01	100	3.80
UA1297-22	72.07	0.33	15.79	1.96	0.05	0.64	2.74	4.50	1.91	0.01	100	4.88
UA1297-21	72.27	0.29	15.80	1.89	0.08	0.61	2.57	4.49	2.00	0.01	100	1.81
UA1297-16	72.32	0.27	15.67	1.90	0.04	0.65	2.77	4.48	1.90	0.00	100	3.93
UA1297-20	72.48	0.27	15.83	1.71	0.07	0.60	2.56	4.41	2.04	0.03	100	4.14
UA1297-11	72.66	0.24	15.40	1.86	0.04	0.63	2.56	4.59	2.00	0.01	100	5.43
UA1297-18	73.18	0.29	15.30	1.56	0.09	0.54	2.28	4.47	2.25	0.04	100	2.58
UA1297-6	73.27	0.27	15.32	1.82	0.02	0.40	2.57	4.23	2.06	0.04	100	6.18
UA1297-5	73.27	0.14	15.40	1.62	0.10	0.60	2.42	4.43	1.99	0.04	100	1.03
UA1297-19	73.63	0.16	15.28	1.50	0.09	0.54	2.26	4.45	2.06	0.04	100	4.01
UA1301-16	73.93	0.20	15.11	1.42	0.10	0.48	2.14	4.39	2.20	0.02	100	4.38
UA1301-17	73.53	0.25	15.02	1.50	0.06	0.43	2.19	4.89	2.09	0.05	100	2.15
UA1301-21	73.09	0.29	15.53	1.60	0.04	0.62	2.43	4.32	2.06	0.02	100	5.10
UA1301-20	72.95	0.24	15.58	1.72	0.04	0.58	2.45	4.36	2.07	0.00	100	3.96
UA1301-6	75.39	0.24	13.17	1.76	0.02	0.29	1.55	3.66	3.69	0.23	100	4.22
UA1301-14	72.56	0.19	15.59	1.76	0.01	0.64	2.55	4.61	2.07	0.02	100	1.93
UA1301-13	72.56	0.31	15.56	1.79	0.06	0.62	2.55	4.45	2.04	0.05	100	2.90
UA1301-10	75.62	0.36	12.93	1.80	0.05	0.29	1.46	3.46	3.74	0.30	100	4.73
UA1301-12	72.31	0.22	15.87	1.83	0.00	0.59	2.56	4.68	1.93	0.02	100	2.89
UA1301-8	71.99	0.17	15.83	1.87	0.02	0.65	2.80	4.67	1.97	0.03	100	5.36
UA1301-23	71.68	0.30	16.09	1.88	0.04	0.61	2.92	4.62	1.80	0.06	100	5.79
UA1301-1	72.22	0.28	15.80	1.89	0.02	0.65	2.60	4.61	1.91	0.04	100	3.68
UA1301-7	72.91	0.22	15.79	1.90	0.04	0.57	2.51	3.95	2.05	0.06	100	6.92
UA1301-18	72.19	0.19	15.66	2.01	0.03	0.63	2.68	4.61	1.95	0.05	100	1.32
UA1301-15	71.16	0.22	16.04	2.05	0.07	0.83	3.11	4.76	1.74	0.02	100	1.92
UA1301-24	72.02	0.30	15.93	2.06	0.03	0.65	2.75	4.34	1.88	0.04	100	7.90
UA1301-11	72.04	0.23	15.79	2.09	0.04	0.63	2.64	4.57	1.92	0.05	100	3.55
UA1301-2	71.32	0.30	16.02	2.09	0.07	0.70	2.97	4.69	1.82	0.02	100	1.97
UA1301-19	71.68	0.26	15.76	2.10	0.08	0.74	2.85	4.59	1.91	0.03	100	4.11
UA1301-3	71.85	0.21	15.68	2.16	0.08	0.68	2.80	4.50	2.03	0.00	100	4.44
UA1301-9	71.33	0.34	16.00	2.17	0.05	0.66	2.89	4.52	2.02	0.02	100	3.18
UA1301-5	71.65	0.27	16.12	2.24	0.05	0.73	2.78	4.27	1.87	0.01	100	4.12
UA1301-4	71.13	0.22	16.05	2.29	0.04	0.63	3.01	4.66	1.96	0.00	100	6.09
UA1460-4	71.12	0.25	16.29	2.19	0.09	0.73	2.78	4.66	1.85	0.05	100	3.81

UA1460-18	71.62	0.35	16.19	2.08	0.01	0.77	2.70	4.40	1.88	0.01	100	0.11	
UA1460-15	71.62	0.26	16.68	1.90	0.02	0.66	2.40	4.53	1.89	0.05	100	0.88	
UA1460-2	71.68	0.23	16.16	2.06	0.06	0.68	2.68	4.54	1.87	0.05	100	0.76	
UA1460-10	71.77	0.28	15.93	2.26	0.03	0.74	2.76	4.41	1.75	0.06	100	0.50	
UA1460-6	71.81	0.39	16.12	2.10	0.03	0.72	2.66	4.32	1.81	0.05	100	0.65	
UA1460-3	71.85	0.31	16.05	2.05	0.07	0.68	2.55	4.54	1.86	0.04	100	2.80	
UA1460-16	72.12	0.25	16.09	2.09	0.01	0.68	2.58	4.40	1.78	0.01	100	0.82	
UA1460-1	72.41	0.26	15.66	1.94	0.05	0.75	2.53	4.50	1.88	0.02	100	3.35	
UA1460-17	72.95	0.25	15.77	1.60	0.05	0.63	2.40	4.27	2.06	0.02	100	3.07	
UA1460-9	73.32	0.13	15.62	1.61	0.10	0.62	2.34	4.22	1.96	0.07	100	3.05	
UA1464-11	71.21	0.29	15.69	2.22	0.05	1.09	2.98	4.54	1.87	0.04	100	2.37	
UA1464-16	71.47	0.25	16.23	2.08	0.10	0.78	2.72	4.41	1.92	0.04	100	5.60	
UA1464-12	71.52	0.37	15.98	2.17	0.06	0.75	2.63	4.66	1.84	0.02	100	1.68	
UA1464-18	71.59	0.28	16.39	1.95	0.07	0.78	2.77	4.31	1.85	0.00	100	1.48	
UA1464-8	71.61	0.28	16.27	2.08	0.01	0.74	2.67	4.55	1.78	0.03	100	2.49	
UA1464-17	71.83	0.28	16.01	2.07	0.09	0.84	2.72	4.24	1.91	0.01	100	5.39	
UA1464-13	71.89	0.29	16.05	1.96	0.05	0.79	2.64	4.41	1.92	0.00	100	4.11	
UA1464-14	71.94	0.29	16.19	1.93	0.04	0.70	2.52	4.34	2.03	0.00	100	2.37	
UA1464-15	71.99	0.31	16.00	1.98	0.06	0.74	2.53	4.56	1.83	0.01	100	1.23	
UA1464-6	72.01	0.29	16.33	2.05	0.03	0.73	2.72	3.99	1.85	0.00	100	1.58	
UA1464-10	72.12	0.24	16.26	1.89	0.00	0.69	2.64	4.19	1.90	0.06	100	3.47	
UA1464-1	72.19	0.25	16.35	1.62	0.06	0.63	2.79	4.35	1.74	0.01	100	2.82	
UA1464-7	72.21	0.26	16.08	2.00	0.07	0.76	2.66	4.20	1.72	0.04	100	1.76	
UA1464-4	72.32	0.23	16.19	1.70	0.05	0.66	2.56	4.45	1.83	0.02	100	3.45	
UA1472-19	71.26	0.32	16.28	2.06	0.00	0.73	2.79	4.73	1.81	0.03	100	1.63	
UA1472-9	72.05	0.28	16.14	2.01	0.06	0.69	2.52	4.37	1.86	0.03	100	2.41	
UA1472-20	72.28	0.16	15.76	2.02	0.03	0.74	2.54	4.53	1.88	0.06	100	8.40	
UA1472-8	72.61	0.29	15.69	1.94	0.06	0.71	2.40	4.25	1.99	0.05	100	4.60	
UA1472-18	72.78	0.29	15.81	1.72	0.05	0.63	2.41	4.15	2.11	0.04	100	3.63	
UA1472-2	72.88	0.27	15.44	1.89	0.09	0.51	2.04	4.44	2.34	0.09	100	4.74	
UA1472-5	72.88	0.19	16.01	1.69	0.03	0.55	2.33	4.46	1.83	0.03	100	2.64	
UA1472-12	72.98	0.25	15.75	1.64	0.01	0.61	2.26	4.37	2.10	0.02	100	1.98	
UA1472-13	73.06	0.19	15.68	1.62	0.07	0.65	2.37	4.39	1.95	0.02	100	2.21	
UA1472-14	73.26	0.24	15.47	1.61	0.06	0.55	2.32	4.47	2.01	0.02	100	2.96	
UA1472-11	73.50	0.24	15.26	1.57	0.07	0.62	2.28	4.26	2.17	0.03	100	3.43	
UA1472-15	73.52	0.29	15.72	1.66	0.08	0.63	2.27	3.72	2.06	0.03	100	5.52	
UA1472-7	74.65	0.20	14.84	1.58	0.03	0.60	1.97	4.12	1.98	0.03	100	3.91	
UA1474-1	72.80	0.30	15.92	1.80	0.02	0.71	2.35	4.13	1.96	0.02	100	3.31	
UA1474-2	72.42	0.27	15.59	1.82	0.06	0.72	2.38	4.69	1.97	0.09	100	7.98	
UA1474-3	72.66	0.27	15.72	1.68	0.06	0.68	2.37	4.67	1.87	0.03	100	3.43	
UA1474-4	71.41	0.27	16.18	2.04	0.07	0.72	2.64	4.84	1.81	0.01	100	5.17	
UA1474-6	72.33	0.26	15.59	1.86	0.02	0.70	2.47	4.72	2.02	0.03	100	4.18	
UA1474-7	71.71	0.31	15.76	2.08	0.07	0.83	2.74	4.73	1.77	0.00	100	8.33	
UA1474-8	72.11	0.31	15.62	1.89	0.11	0.66	2.65	4.63	1.92	0.12	100	7.61	
UA1474-10	72.82	0.25	15.72	1.72	0.01	0.63	2.31	4.61	1.88	0.04	100	3.84	
UA1474-12	71.40	0.33	16.16	2.05	0.04	0.69	2.73	4.70	1.87	0.03	100	6.01	
UA1474-13	71.71	0.27	16.02	1.92	0.03	0.81	2.73	4.53	1.96	0.02	100	3.63	
AVERAGE	72.24	0.26	15.79	1.93	0.05	0.67	2.59	4.45	1.97	0.04	100	3.52	93
STDEV	0.88	0.05	0.52	0.22	0.03	0.11	0.29	0.24	0.28	0.04	0	1.87	

Palisades-11: Boneyard tephra

Ua1126-2	76.31	0.08	14.16	0.47	0.13	0.04	1.07	3.65	3.85	0.24	100	8.06
Ua1126-3	76.34	0.01	14.27	0.63	0.12	0.13	1.05	3.82	3.57	0.07	100	8.09

Ua1126-6	76.33	0.10	14.49	0.58	0.13	0.16	1.12	3.47	3.56	0.06	100	9.02
Ua1126-7	76.24	0.00	14.20	0.55	0.16	0.09	1.04	4.04	3.55	0.13	100	7.36
Ua1126-8	75.94	0.05	14.23	0.58	0.15	0.15	1.05	4.11	3.67	0.07	100	7.29
Ua1126-9	76.18	0.06	14.25	0.55	0.13	0.12	1.04	3.91	3.68	0.06	100	7.74
Ua1126-10	76.56	0.08	14.26	0.52	0.15	0.06	1.02	3.70	3.50	0.14	100	7.14
Ua1126-12	76.25	0.06	14.16	0.55	0.16	0.13	1.07	4.04	3.47	0.10	100	7.11
Ua1126-13	76.49	0.03	13.94	0.58	0.19	0.14	1.09	3.86	3.63	0.06	100	9.32
Ua1126-14	75.96	0.08	14.36	0.48	0.15	0.12	1.06	3.98	3.71	0.09	100	7.04
Ua1126-15	76.53	0.01	14.17	0.53	0.14	0.06	1.08	3.90	3.54	0.04	100	6.78
Ua1126-16	76.52	0.05	14.29	0.50	0.17	0.07	1.02	3.84	3.51	0.03	100	7.69
Ua1126-17	75.90	0.03	14.57	0.67	0.17	0.18	1.00	3.86	3.55	0.08	100	7.06
Ua1126-19	76.17	0.03	14.56	0.51	0.15	0.12	1.08	3.69	3.60	0.07	100	8.01
Ua1126-20	75.84	0.09	14.37	0.66	0.09	0.25	1.04	4.00	3.60	0.06	100	6.77
Ua1126-21	76.35	0.04	14.22	0.58	0.18	0.14	1.02	3.80	3.58	0.11	100	7.05
Ua1126-22	76.37	0.10	14.19	0.51	0.19	0.15	1.07	3.77	3.55	0.10	100	7.53
UA 1126-7	76.09	0.03	14.41	0.41	0.11	0.05	1.05	4.60	3.16	0.10	100	6.22
UA 1126-2	76.11	0.03	14.00	0.48	0.12	0.12	1.10	3.97	3.94	0.12	100	6.37
UA 1126-18	76.12	0.03	14.05	0.53	0.15	0.11	1.02	4.24	3.59	0.17	100	5.84
UA 1126-5	76.12	0.03	14.14	0.56	0.13	0.10	1.07	4.17	3.55	0.12	100	6.44
UA 1126-13	76.21	0.03	14.13	0.46	0.12	0.11	1.08	3.95	3.72	0.19	100	5.57
UA 1126-25	76.23	0.02	13.83	0.58	0.14	0.11	1.09	4.26	3.57	0.18	100	5.54
UA 1126-23	76.24	0.03	14.04	0.53	0.11	0.09	1.04	4.31	3.50	0.11	100	5.48
UA 1126-3	76.33	0.05	14.03	0.56	0.15	0.11	1.06	3.91	3.73	0.07	100	6.18
UA 1126-14	76.34	0.07	13.85	0.59	0.17	0.10	1.01	3.89	3.83	0.15	100	6.32
UA 1126-4	76.35	0.03	13.90	0.52	0.10	0.16	0.97	4.07	3.80	0.10	100	6.54
UA 1126-8	76.38	0.01	14.21	0.44	0.13	0.07	1.00	3.81	3.84	0.11	100	6.68
UA 1126-11	76.41	0.04	13.93	0.48	0.13	0.08	0.89	3.85	4.11	0.07	100	6.36
UA 1126-12	76.43	0.05	14.06	0.46	0.14	0.11	1.02	4.10	3.59	0.06	100	5.63
UA 1126-29	76.49	0.05	14.02	0.58	0.17	0.12	1.01	3.89	3.65	0.03	100	5.94
UA 1126-24	76.50	0.01	13.98	0.48	0.12	0.09	1.14	3.85	3.80	0.04	100	6.41
UA 1126-15	76.52	0.05	13.96	0.58	0.12	0.11	1.07	3.91	3.58	0.09	100	5.43
UA 1126-26	76.54	0.04	14.01	0.53	0.17	0.09	1.02	4.08	3.42	0.08	100	6.75
UA 1126-22	76.58	0.03	13.91	0.48	0.15	0.12	1.04	4.09	3.48	0.13	100	5.41
UA 1126-21	76.59	0.03	13.99	0.53	0.10	0.08	0.99	4.10	3.53	0.08	100	4.99
UA 1126-10	76.59	0.02	14.16	0.52	0.13	0.14	1.04	4.06	3.28	0.06	100	6.54
UA 1126-17	76.63	0.03	13.92	0.58	0.12	0.14	1.09	4.00	3.47	0.03	100	6.08
UA 1126-6	76.66	0.06	13.99	0.52	0.18	0.09	1.04	3.84	3.53	0.08	100	7.00
UA 1126-30	76.67	0.03	13.98	0.41	0.13	0.10	1.03	4.02	3.54	0.07	100	5.38
UA 1126-16	76.69	0.03	13.94	0.55	0.15	0.12	1.00	3.94	3.52	0.06	100	5.80
UA 1126-1	76.72	0.00	13.88	0.52	0.11	0.14	1.05	3.91	3.65	0.02	100	5.92
UA 1126-27	76.73	0.07	13.94	0.57	0.12	0.11	1.01	3.92	3.49	0.05	100	5.77
UA 1126-19	76.75	0.04	13.86	0.49	0.12	0.11	1.06	3.89	3.60	0.09	100	5.93
UA 1126-20	76.82	0.06	13.74	0.53	0.16	0.08	0.95	4.13	3.44	0.07	100	5.35
UA 1126-28	76.82	0.04	13.68	0.49	0.18	0.07	1.01	3.97	3.71	0.03	100	5.73
UA1126-29	75.39	0.03	14.41	0.58	0.16	0.09	1.05	1.68	6.54	0.07	100	8.93
UA1126-12	75.58	0.02	14.51	0.55	0.18	0.09	1.05	4.25	3.68	0.08	100	7.26
UA1126-14	75.66	0.04	14.27	0.54	0.17	0.10	1.05	4.11	3.95	0.11	100	7.90
UA1126-23	75.67	0.05	14.32	0.46	0.13	0.07	1.08	4.36	3.72	0.16	100	7.01
UA1126-20	75.70	0.00	14.23	0.46	0.05	0.09	0.95	4.47	3.83	0.21	100	6.54
UA1126-15	75.74	0.06	14.46	0.51	0.22	0.07	1.04	4.20	3.61	0.09	100	6.49
UA1126-21	75.75	0.04	14.51	0.53	0.13	0.10	1.05	4.17	3.65	0.08	100	6.68
UA1126-17	75.77	0.05	14.33	0.52	0.17	0.09	1.03	4.20	3.74	0.10	100	7.26
UA1126-18	75.79	0.03	14.10	0.50	0.07	0.07	1.06	3.01	5.28	0.09	100	7.82

UA1126-11	75.81	0.04	14.22	0.57	0.13	0.11	1.05	4.12	3.85	0.11	100	6.72	
UA1126-16	75.85	0.02	14.18	0.55	0.18	0.12	1.06	4.14	3.68	0.21	100	7.06	
UA1126-26	75.87	0.05	14.36	0.60	0.10	0.16	1.02	4.10	3.67	0.07	100	6.55	
UA1126-19	75.87	0.08	14.22	0.47	0.20	0.11	1.08	4.18	3.71	0.08	100	6.89	
UA1126-2	75.88	0.00	14.22	0.56	0.17	0.08	1.06	4.35	3.61	0.08	100	7.41	
UA1126-24	75.95	0.07	14.27	0.58	0.18	0.08	1.02	4.16	3.59	0.10	100	6.72	
UA1126-9	75.96	0.00	14.39	0.58	0.13	0.06	1.05	4.12	3.62	0.09	100	7.50	
UA1126-13	75.99	0.07	14.27	0.58	0.18	0.07	1.02	4.15	3.63	0.07	100	6.68	
UA1126-30	76.01	0.02	14.23	0.47	0.17	0.06	1.02	4.20	3.66	0.17	100	7.09	
UA1126-7	76.03	0.08	14.29	0.55	0.11	0.12	1.08	4.29	3.42	0.03	100	1.67	
UA1126-3	76.05	0.02	14.44	0.56	0.10	0.11	1.08	4.02	3.54	0.08	100	6.84	
UA1126-25	76.05	0.08	14.13	0.62	0.11	0.09	1.06	4.22	3.55	0.08	100	6.74	
UA1126-27	76.05	0.09	14.27	0.55	0.08	0.11	1.07	4.11	3.60	0.06	100	6.55	
UA1126-28	76.12	0.07	14.42	0.50	0.16	0.12	1.04	3.93	3.57	0.07	100	7.48	
UA1126-1	76.17	0.02	14.21	0.62	0.10	0.14	1.07	4.05	3.52	0.11	100	7.30	
UA1126-22	76.17	0.00	14.25	0.50	0.17	0.09	1.09	4.04	3.62	0.07	100	7.48	
UA1126-5	76.21	0.07	14.15	0.52	0.17	0.10	1.06	4.12	3.57	0.04	100	7.61	
UA1126-10	76.25	0.02	14.27	0.53	0.14	0.08	1.04	4.15	3.47	0.06	100	7.51	
UA1126-6	76.31	0.00	14.29	0.43	0.08	0.10	0.99	4.16	3.54	0.10	100	6.32	
UA 2082-28	75.45	0.00	14.56	0.67	0.13	0.09	1.06	4.06	3.78	0.18	100	6.74	
UA 2082-14	75.77	0.02	14.34	0.77	0.17	0.10	1.03	4.26	3.34	0.20	100	5.00	
UA 2082-27	75.83	0.03	14.24	0.56	0.16	0.05	1.04	4.28	3.65	0.17	100	7.17	
UA 2082-22	75.84	0.04	14.86	0.72	0.13	0.07	0.88	3.73	3.64	0.08	100	6.70	
UA 2082-19	75.84	0.03	14.31	0.68	0.17	0.12	0.86	4.05	3.82	0.13	100	7.54	
UA 2082-31	75.88	0.08	14.46	0.74	0.13	0.15	1.08	3.84	3.55	0.09	100	8.57	
UA 2082-13	75.90	0.08	14.26	0.67	0.13	0.11	1.05	3.94	3.80	0.06	100	7.43	
UA 2082-3	75.90	0.01	14.31	0.67	0.17	0.03	0.98	4.09	3.76	0.07	100	5.21	
UA 2082-21	75.91	0.00	14.21	0.66	0.18	0.12	1.04	4.10	3.73	0.05	100	6.84	
UA 2082-16	75.96	0.09	14.19	0.70	0.11	0.14	1.07	4.08	3.59	0.07	100	7.29	
UA 2082-6	76.01	0.05	14.18	0.60	0.19	0.10	1.04	4.04	3.72	0.08	100	6.75	
UA 2082-11	76.01	0.09	14.34	0.66	0.15	0.09	1.04	3.96	3.58	0.08	100	7.38	
UA 2082-10	76.01	0.09	13.97	0.68	0.11	0.10	0.99	3.56	4.27	0.22	100	8.43	
UA 2082-2	76.07	0.12	14.27	0.64	0.15	0.11	1.01	3.94	3.60	0.07	100	6.22	
UA 2082-18	76.08	0.00	14.26	0.61	0.17	0.11	1.05	3.80	3.86	0.05	100	6.84	
UA 2082-7	76.09	0.04	14.40	0.63	0.08	0.11	1.06	3.93	3.60	0.07	100	6.88	
UA 2082-24	76.12	0.02	14.18	0.61	0.18	0.13	1.01	4.06	3.62	0.09	100	7.15	
UA 2082-29	76.17	0.07	14.09	0.58	0.10	0.12	0.92	4.32	3.54	0.09	100	6.34	
UA 2082-12	76.22	0.03	14.27	0.60	0.18	0.09	1.08	3.71	3.70	0.11	100	7.02	
UA 2082-23	76.23	0.04	14.33	0.65	0.10	0.08	1.03	3.97	3.49	0.08	100	7.75	
UA 2082-20	76.23	0.02	14.37	0.56	0.05	0.09	1.01	3.61	3.98	0.09	100	8.83	
UA 2082-17	76.23	0.02	14.30	0.69	0.13	0.14	1.03	3.90	3.50	0.06	100	6.60	
MEAN	76.16	0.04	14.20	0.56	0.14	0.10	1.04	3.98	3.68	0.09	100	6.79	96
STDEV	0.32	0.03	0.20	0.07	0.03	0.03	0.05	0.32	0.37	0.05	0	1.04	
UA 2082-26	68.82	0.75	15.21	3.43	0.09	0.78	2.15	5.18	3.50	0.08	100	6.20	

Palisades-12: new tephra bed

UA 2167-18	75.04	0.45	12.94	2.14	0.06	0.37	1.89	4.19	2.75	0.17	100	1.83
UA 2167-24	75.11	0.43	12.98	1.94	0.05	0.40	1.85	4.30	2.69	0.25	100	2.92
UA 2167-6	75.28	0.38	12.94	1.97	0.04	0.31	1.82	4.25	2.80	0.21	100	5.21
UA 2167-26	75.32	0.35	13.00	1.95	0.05	0.37	1.91	4.18	2.66	0.21	100	2.77
UA 2167-4	75.40	0.32	13.00	1.95	0.06	0.37	1.80	4.23	2.65	0.23	100	3.15
UA 2167-32	75.44	0.28	12.90	2.03	0.00	0.40	1.83	4.28	2.66	0.18	100	3.75
UA 2167-27	75.70	0.42	12.90	1.89	0.03	0.37	1.83	4.02	2.66	0.19	100	4.33

UA 2167-10	75.76	0.37	12.94	1.85	0.06	0.32	1.74	4.13	2.68	0.15	100	1.53	
UA 2167-5	75.89	0.27	12.82	1.77	0.00	0.35	1.72	4.25	2.74	0.20	100	2.70	
UA 2167-2	75.24	0.42	12.96	1.92	0.10	0.38	1.91	4.26	2.57	0.23	100	2.95	
UA 2167-11	75.52	0.42	12.76	1.92	0.02	0.33	1.82	4.33	2.73	0.15	100	4.14	
UA 2167-3	75.60	0.36	12.93	1.89	0.06	0.36	1.74	4.20	2.62	0.24	100	1.14	
UA 2167-4	75.68	0.44	12.80	1.84	0.04	0.33	1.84	4.12	2.71	0.22	100	4.37	
Mean	75.46	0.38	12.91	1.93	0.04	0.36	1.82	4.21	2.69	0.20	100	3.14	13
StDev	0.26	0.06	0.08	0.09	0.03	0.03	0.06	0.09	0.06	0.03	0	1.20	

Palisades-13: new tephra bed

UA 2167-9	76.11	0.08	13.29	1.02	0.08	0.15	0.81	4.35	3.96	0.14	100	5.76	
UA 2167-7	76.77	0.14	13.19	0.87	0.10	0.07	0.75	4.17	3.87	0.08	100	5.58	
UA 2167-13	76.80	0.17	13.26	0.81	0.10	0.13	0.78	4.14	3.71	0.09	100	6.36	
UA 2167-33	76.93	0.14	13.05	0.85	0.05	0.15	0.77	4.14	3.83	0.08	100	6.42	
UA 2167-30	77.00	0.11	12.80	1.02	0.08	0.09	0.86	4.14	3.62	0.27	100	5.35	
UA 2167-3	77.23	0.07	12.78	0.81	0.04	0.10	0.64	4.11	4.12	0.08	100	5.30	
UA 2167-20	77.24	0.05	12.86	0.75	0.10	0.09	0.71	4.08	4.04	0.06	100	5.73	
UA 2167-1	77.24	0.08	12.85	0.81	0.08	0.13	0.69	4.13	3.88	0.10	100	5.68	
UA 2167-21	77.36	0.13	12.76	0.85	0.04	0.11	0.72	4.06	3.89	0.07	100	5.12	
UA 2167-2	77.37	0.11	12.82	0.73	0.09	0.09	0.61	3.99	4.09	0.09	100	5.74	
UA 2167-25	77.43	0.14	12.94	0.69	0.03	0.07	0.57	3.86	4.19	0.08	100	4.67	
UA 2167-11	77.55	0.09	12.66	0.78	0.09	0.09	0.66	4.03	3.94	0.10	100	6.05	
UA 2167-23	77.57	0.07	12.65	0.66	0.05	0.09	0.56	4.05	4.17	0.12	100	5.29	
UA 2167-35	77.76	0.10	12.80	0.62	0.01	0.07	0.55	4.01	4.00	0.07	100	5.27	
UA 2167-34	77.80	0.08	12.76	0.74	0.04	0.11	0.65	3.84	3.92	0.07	100	5.77	
UA 2167-14	78.13	0.08	12.56	0.65	0.07	0.13	0.60	3.76	3.95	0.09	100	5.99	
UA 2167-28	76.66	0.15	13.31	0.88	0.06	0.15	0.80	4.17	3.73	0.09	100	4.92	
UA 2167-5	76.67	0.14	13.14	0.95	0.09	0.13	0.81	4.29	3.69	0.09	100	4.95	
UA 2167-22	76.79	0.12	13.03	0.89	0.11	0.16	0.82	4.28	3.68	0.11	100	4.79	
UA 2167-30	76.88	0.14	13.09	0.89	0.05	0.16	0.79	4.27	3.60	0.14	100	4.59	
UA 2167-17	77.38	0.12	12.72	0.84	0.10	0.15	0.72	3.99	3.84	0.15	100	4.17	
UA 2167-25	77.41	0.14	12.81	0.79	0.02	0.09	0.71	3.96	3.92	0.15	100	6.05	
UA 2167-20	77.48	0.07	12.55	0.72	0.03	0.10	0.64	4.00	4.22	0.19	100	5.19	
UA 2167-1	77.53	0.11	12.64	0.75	0.07	0.10	0.59	4.02	4.10	0.08	100	4.94	
UA 2167-15	77.62	0.08	12.49	0.77	0.10	0.08	0.63	4.07	4.03	0.14	100	5.99	
UA 2167-24	77.63	0.18	12.45	0.76	0.06	0.11	0.65	3.99	4.07	0.10	100	5.43	
UA 2167-7	77.75	0.10	12.67	0.72	0.12	0.08	0.66	3.90	3.89	0.11	100	5.14	
UA 2167-29	77.76	0.15	12.59	0.68	0.03	0.06	0.68	3.95	4.01	0.09	100	5.78	
UA 2167-23	77.78	0.13	12.45	0.59	0.08	0.10	0.60	4.00	4.17	0.11	100	5.92	
UA 2167-14	77.83	0.07	12.61	0.68	0.05	0.11	0.63	3.88	4.02	0.13	100	5.32	
UA 2167-6	77.87	0.04	12.45	0.72	0.02	0.06	0.65	4.08	3.99	0.12	100	6.44	
UA 2167-16	77.91	0.11	12.62	0.68	0.11	0.11	0.67	3.80	3.86	0.12	100	5.12	
UA 2167-18	77.92	0.10	12.49	0.74	0.05	0.08	0.60	3.77	4.16	0.08	100	4.66	
UA 2167-27	77.97	0.11	12.55	0.71	0.06	0.09	0.65	3.83	3.89	0.14	100	5.19	
Mean	77.39	0.11	12.78	0.78	0.07	0.11	0.68	4.03	3.94	0.11	100	5.43	34
StDev	0.47	0.03	0.25	0.10	0.03	0.03	0.08	0.15	0.17	0.04	0	0.56	

Old Crow

UA1124-6	75.07	0.31	13.21	1.93	0.03	0.32	1.54	3.65	3.68	0.26	100	4.59
UA1124-5	75.07	0.22	13.22	1.81	0.06	0.31	1.54	3.71	3.75	0.31	100	3.91
UA1124-12	75.14	0.35	13.15	1.79	0.08	0.28	1.50	3.89	3.58	0.23	100	1.23
UA1124-3	75.17	0.23	13.10	1.80	0.02	0.27	1.53	4.01	3.59	0.29	100	3.62
UA1124-8	75.20	0.38	13.06	1.74	0.07	0.30	1.51	3.73	3.75	0.26	100	4.75

UA1124-5	75.22	0.34	13.03	1.69	0.06	0.29	1.55	3.92	3.63	0.28	100	4.66
UA1124-1	75.25	0.32	13.04	1.82	0.01	0.31	1.50	3.84	3.62	0.30	100	3.95
UA1124-4	75.33	0.33	13.02	1.83	0.11	0.29	1.54	3.69	3.61	0.25	100	5.94
UA1124-10	75.34	0.34	13.06	1.81	0.09	0.30	1.45	3.71	3.64	0.28	100	2.92
UA1124-11	75.36	0.30	13.07	1.75	0.11	0.25	1.51	3.69	3.69	0.26	100	4.63
UA1124-9	75.37	0.23	13.13	1.72	0.03	0.27	1.51	3.81	3.67	0.25	100	2.59
UA1124-4	75.47	0.29	12.93	1.74	0.07	0.26	1.48	3.87	3.63	0.27	100	1.55
UA1124-7	75.49	0.28	13.00	1.74	0.05	0.27	1.40	3.92	3.57	0.30	100	4.14
UA1124-6	75.49	0.32	12.85	1.79	0.06	0.29	1.41	3.88	3.69	0.23	100	4.27
UA1124-2	75.49	0.31	13.18	1.64	0.05	0.32	1.41	3.95	3.39	0.26	100	2.20
UA1124-1	75.50	0.23	13.00	1.81	0.02	0.31	1.46	3.72	3.71	0.24	100	4.54
UA1124-8	75.52	0.29	12.88	1.71	0.05	0.26	1.49	3.89	3.59	0.33	100	2.34
UA1125-1	75.28	0.29	13.22	1.79	0.03	0.35	1.43	3.59	3.77	0.24	100	6.45
UA1125-2	75.26	0.34	13.01	1.71	0.07	0.33	1.50	3.89	3.62	0.28	100	1.61
UA1125-3	75.25	0.27	13.00	1.79	0.03	0.25	1.48	3.70	3.92	0.32	100	6.37
UA1125-5	75.20	0.35	13.07	1.76	0.07	0.27	1.50	3.91	3.58	0.29	100	4.67
UA1125-6	75.31	0.33	13.04	1.63	0.09	0.31	1.51	3.73	3.77	0.26	100	4.56
UA1125-7	75.29	0.24	13.27	1.82	0.06	0.29	1.48	3.57	3.72	0.26	100	7.40
UA1125-8	75.34	0.25	13.19	1.75	0.08	0.32	1.55	3.57	3.69	0.26	100	6.01
UA1125-10	74.91	0.30	13.38	1.81	0.03	0.28	1.54	3.86	3.58	0.29	100	7.68
UA1125-11	75.06	0.23	13.03	1.76	0.10	0.31	1.54	3.84	3.82	0.30	100	4.30
UA1125-12	75.14	0.30	13.02	1.75	0.07	0.27	1.53	3.68	3.95	0.29	100	5.15
UA1125-13	75.53	0.26	13.10	1.74	0.06	0.28	1.52	3.42	3.79	0.29	100	7.27
UA1125-14	75.09	0.33	13.14	1.75	0.08	0.31	1.52	3.84	3.68	0.26	100	3.84
UA1125-15	75.34	0.33	12.99	1.75	0.09	0.32	1.37	3.86	3.71	0.24	100	4.94
UA1125-17	75.26	0.33	13.29	1.63	0.12	0.28	1.52	3.68	3.64	0.26	100	4.55
UA1125-18	75.26	0.35	13.12	1.77	0.03	0.24	1.48	3.91	3.59	0.25	100	2.09
Ua1129-8	75.26	0.33	13.10	1.85	0.02	0.29	1.53	3.70	3.65	0.27	100	6.11
Ua1129-15	75.23	0.29	12.64	1.89	0.06	0.25	1.46	4.06	3.85	0.29	100	7.42
Ua1129-16	74.80	0.29	13.24	1.77	0.08	0.31	1.53	4.03	3.75	0.22	100	4.07
Ua1129-17	75.48	0.31	12.95	1.76	0.06	0.29	1.52	3.75	3.57	0.30	100	6.22
Ua1129-20	74.84	0.34	13.11	1.86	0.02	0.31	1.50	4.00	3.75	0.27	100	3.25
UA1198-19	74.81	0.21	13.19	1.76	0.10	0.32	1.56	3.91	3.86	0.29	100	5.80
UA1198-16	74.81	0.34	13.25	1.77	0.06	0.33	1.49	3.80	3.83	0.32	100	4.88
UA1198-3	74.85	0.31	13.20	1.77	0.10	0.32	1.49	3.90	3.77	0.29	100	4.97
UA1198-21	74.88	0.36	13.31	1.74	0.03	0.29	1.50	3.79	3.79	0.30	100	5.30
UA1198-14	74.95	0.27	12.99	1.66	0.11	0.30	1.63	3.93	3.82	0.34	100	5.81
UA1198-20	74.96	0.24	13.06	1.74	0.10	0.31	1.56	3.94	3.79	0.30	100	5.16
UA1198-18	75.03	0.29	13.22	1.71	0.06	0.25	1.54	3.85	3.73	0.31	100	4.77
UA1198-8	75.04	0.18	13.25	1.83	0.13	0.31	1.47	3.62	3.92	0.24	100	6.69
UA1198-1	75.08	0.28	13.13	1.78	0.12	0.27	1.41	3.97	3.68	0.28	100	3.36
UA1198-2	75.11	0.29	13.13	1.76	0.05	0.27	1.50	3.90	3.67	0.33	100	5.30
UA1198-11	75.11	0.33	13.12	1.74	0.03	0.23	1.54	3.77	3.84	0.30	100	3.39
UA1198-6	75.12	0.38	13.15	1.72	0.06	0.30	1.51	3.79	3.67	0.30	100	5.17
UA1198-13	75.14	0.26	13.17	1.78	0.02	0.30	1.49	3.87	3.66	0.31	100	1.21
UA1198-4	75.17	0.29	13.15	1.70	0.05	0.33	1.55	3.82	3.62	0.32	100	5.87
UA1198-17	75.17	0.30	13.08	1.82	0.03	0.28	1.45	3.80	3.71	0.33	100	5.26
UA1198-12	75.18	0.30	13.15	1.66	0.02	0.28	1.53	3.85	3.71	0.33	100	2.04
UA1198-9	75.34	0.38	12.93	1.79	0.02	0.28	1.57	3.76	3.61	0.31	100	6.11
UA1198-7	75.36	0.31	12.90	1.84	0.08	0.30	1.46	3.76	3.70	0.29	100	4.18
UA1198-15	75.40	0.27	13.19	1.74	0.02	0.30	1.54	3.69	3.57	0.29	100	5.06
UA1299-1	75.14	0.20	13.19	1.82	0.08	0.27	1.59	3.67	3.74	0.30	100	2.90
UA1299-2	75.48	0.29	13.02	1.70	0.03	0.23	1.51	3.71	3.70	0.34	100	4.27

UA1299-3	75.61	0.23	12.94	1.77	0.10	0.26	1.60	3.56	3.63	0.29	100	4.05
UA1299-4	75.24	0.29	12.98	1.80	0.04	0.28	1.59	3.77	3.77	0.25	100	4.10
UA1299-5	75.64	0.31	12.73	1.87	0.09	0.25	1.48	3.76	3.60	0.27	100	3.66
UA1299-6	75.39	0.29	12.99	1.74	0.05	0.38	1.54	3.75	3.56	0.30	100	1.48
UA1299-7	75.79	0.21	12.85	1.70	0.10	0.24	1.55	3.51	3.75	0.30	100	4.17
UA1299-8	75.74	0.34	12.79	1.74	0.10	0.22	1.53	3.57	3.71	0.26	100	5.09
UA1299-9	75.41	0.24	13.10	1.80	0.05	0.25	1.59	3.64	3.68	0.25	100	3.84
UA1299-10	75.40	0.35	12.90	1.83	0.04	0.25	1.51	3.83	3.58	0.31	100	1.15
UA1299-11	75.46	0.28	13.05	1.83	0.07	0.29	1.53	3.53	3.69	0.27	100	4.35
UA1299-12	75.56	0.27	13.07	1.83	0.08	0.32	1.55	3.55	3.54	0.23	100	4.44
UA1299-13	75.27	0.21	12.88	1.85	0.07	0.29	1.59	3.98	3.56	0.31	100	2.52
UA1299-14	75.04	0.33	12.74	1.90	0.06	0.29	1.58	4.02	3.77	0.27	100	3.86
UA1299-15	75.72	0.25	12.97	1.78	0.07	0.27	1.55	3.34	3.78	0.28	100	4.96
UA1300-1	75.46	0.27	12.98	1.84	0.07	0.29	1.49	3.62	3.65	0.34	100	2.61
UA1300-2	75.38	0.31	12.78	1.88	0.04	0.28	1.61	3.74	3.60	0.37	100	3.19
UA1300-3	75.66	0.28	12.82	1.68	0.06	0.29	1.60	3.73	3.60	0.27	100	4.67
UA1300-4	75.58	0.28	12.95	1.82	0.05	0.27	1.46	3.54	3.74	0.31	100	4.68
UA1300-5	75.66	0.26	12.84	1.82	0.07	0.26	1.53	3.51	3.80	0.24	100	5.16
UA1300-6	75.39	0.33	12.98	1.85	0.05	0.28	1.47	3.60	3.70	0.33	100	2.85
UA1300-7	75.23	0.27	12.85	1.83	0.06	0.31	1.55	3.92	3.69	0.28	100	3.40
UA1300-8	75.33	0.34	12.92	1.95	0.11	0.35	1.55	3.60	3.55	0.29	100	3.45
UA1300-9	75.18	0.31	12.93	1.91	0.09	0.33	1.48	3.77	3.70	0.30	100	3.94
UA1300-10	75.25	0.31	13.06	1.76	0.08	0.21	1.53	3.86	3.66	0.27	100	2.91
UA1300-11	75.24	0.31	12.91	1.85	0.05	0.22	1.58	3.90	3.70	0.24	100	1.21
UA1300-12	75.02	0.31	13.12	1.84	0.06	0.27	1.56	3.90	3.67	0.26	100	1.93
UA1300-13	74.94	0.28	13.04	1.91	0.06	0.30	1.61	3.78	3.77	0.31	100	3.21
UA1300-14	75.48	0.37	12.93	1.74	0.04	0.29	1.54	3.67	3.65	0.29	100	2.05
UA1300-15	75.33	0.26	13.04	1.79	0.06	0.27	1.59	3.99	3.40	0.27	100	1.52
UA1303-1	75.64	0.26	13.00	1.85	0.05	0.20	1.52	3.63	3.61	0.25	100	2.12
UA1303-2	75.19	0.24	13.03	1.82	0.03	0.31	1.53	3.94	3.62	0.29	100	1.75
UA1303-3	75.65	0.26	12.98	1.94	0.04	0.30	1.40	3.46	3.67	0.30	100	3.77
UA1303-5	75.51	0.32	12.91	1.62	0.06	0.27	1.56	3.85	3.59	0.31	100	3.35
UA1303-6	75.40	0.29	13.08	1.94	0.10	0.28	1.55	3.55	3.57	0.24	100	3.98
UA1303-7	76.02	0.28	12.64	1.79	0.09	0.28	1.59	3.51	3.52	0.26	100	5.47
UA1303-8	75.66	0.26	13.10	1.78	0.00	0.31	1.56	3.31	3.75	0.26	100	4.88
UA1303-9	75.55	0.25	12.96	1.78	0.06	0.26	1.45	3.63	3.74	0.31	100	4.35
UA1303-10	75.42	0.36	13.05	1.82	0.12	0.32	1.48	3.56	3.61	0.26	100	3.66
UA1303-11	75.38	0.31	13.00	1.82	0.05	0.28	1.56	3.63	3.71	0.26	100	4.04
UA1303-12	75.42	0.31	13.01	1.88	0.01	0.31	1.54	3.70	3.54	0.29	100	3.10
UA1303-13	75.27	0.24	12.87	1.86	0.07	0.25	1.47	3.88	3.82	0.27	100	2.91
UA1303-14	75.37	0.27	12.80	1.85	0.06	0.25	1.49	4.00	3.60	0.31	100	2.17
UA1303-15	75.22	0.26	13.04	1.88	0.13	0.27	1.53	3.86	3.51	0.31	100	1.02
UA1304-1	75.43	0.28	13.16	1.76	0.04	0.30	1.52	3.70	3.55	0.26	100	1.32
UA1304-2	75.59	0.40	12.94	1.76	0.08	0.26	1.52	3.56	3.59	0.29	100	4.94
UA1304-3	75.39	0.25	12.91	1.84	0.07	0.29	1.64	3.69	3.65	0.28	100	4.04
UA1304-4	75.31	0.26	12.92	1.89	0.09	0.27	1.50	3.72	3.75	0.30	100	4.43
UA1304-5	75.40	0.30	13.05	1.82	0.08	0.28	1.53	3.49	3.78	0.27	100	4.28
UA1304-6	75.38	0.32	12.92	1.86	0.09	0.30	1.59	3.76	3.51	0.28	100	3.18
UA1304-7	75.45	0.23	13.15	1.88	0.04	0.32	1.48	3.56	3.59	0.29	100	4.68
UA1304-8	75.15	0.28	12.96	1.84	0.10	0.34	1.59	3.91	3.58	0.25	100	1.20
UA1304-9	75.55	0.36	12.94	1.69	0.06	0.29	1.59	3.58	3.68	0.26	100	5.35
UA1304-10	75.39	0.24	12.91	1.78	0.08	0.26	1.53	3.74	3.75	0.32	100	3.88
UA1304-11	75.55	0.31	12.99	1.79	0.02	0.25	1.62	3.70	3.53	0.23	100	3.97

UA1304-12	75.26	0.35	12.88	1.83	0.07	0.29	1.57	3.73	3.70	0.32	100	4.40
UA1304-13	75.29	0.32	12.97	1.79	0.09	0.31	1.59	3.63	3.80	0.22	100	3.75
UA1304-14	75.11	0.29	13.00	1.89	0.04	0.29	1.63	3.88	3.61	0.25	100	2.18
UA1304-15	75.26	0.34	13.10	1.88	0.04	0.30	1.60	3.60	3.58	0.28	100	4.35
UA1304-16	75.22	0.29	12.96	1.86	0.03	0.25	1.54	3.96	3.60	0.29	100	2.07
BV UA1313-	75.60	0.32	12.74	1.78	0.03	0.42	1.52	3.63	3.67	0.30	100	4.76
BV UA1313-	75.51	0.28	12.80	1.80	0.08	0.26	1.58	3.60	3.84	0.26	100	4.33
BV UA1313-	75.54	0.36	12.92	1.76	0.06	0.26	1.59	3.31	3.93	0.27	100	6.07
BV UA1313-	75.32	0.30	12.93	1.81	0.07	0.36	1.60	3.73	3.58	0.30	100	2.70
BV UA1313-	75.83	0.29	12.94	1.86	0.11	0.30	1.52	3.27	3.66	0.22	100	5.53
BV UA1313-	75.58	0.27	12.96	1.72	0.11	0.31	1.55	3.58	3.68	0.24	100	4.32
BV UA1313-	75.70	0.26	12.96	1.83	0.10	0.28	1.48	3.46	3.55	0.37	100	4.45
BV UA1313-	75.36	0.30	13.01	1.84	0.06	0.32	1.51	3.66	3.66	0.29	100	4.03
BV UA1313-	75.29	0.31	13.01	1.87	0.07	0.29	1.53	3.64	3.70	0.28	100	4.71
BV UA1313-	75.45	0.30	13.02	1.80	0.04	0.27	1.57	3.56	3.76	0.23	100	4.48
BV UA1313-	75.47	0.32	13.03	1.73	0.11	0.26	1.51	3.66	3.68	0.25	100	2.09
BV UA1313-	75.70	0.28	13.04	1.77	0.04	0.29	1.58	3.45	3.62	0.24	100	5.24
BV UA1313-	75.44	0.36	13.06	1.77	0.09	0.28	1.48	3.62	3.65	0.25	100	3.95
BV UA1313-	75.49	0.29	13.09	1.75	0.02	0.28	1.48	3.53	3.74	0.33	100	4.37
BV UA1313-	75.43	0.44	13.12	1.74	0.02	0.25	1.56	3.50	3.66	0.26	100	5.03
UA 1422-1	75.76	0.27	12.82	1.73	0.08	0.31	1.44	3.81	3.54	0.24	100	4.74
UA 1422-2	75.73	0.27	12.95	1.71	0.07	0.33	1.48	3.53	3.70	0.25	100	5.08
UA 1422-4	75.72	0.27	13.05	1.68	0.01	0.31	1.49	3.69	3.53	0.26	100	5.57
UA 1422-5	75.53	0.33	12.97	1.76	0.08	0.28	1.43	3.70	3.66	0.26	100	4.11
UA 1422-6	75.70	0.27	13.05	1.68	0.07	0.26	1.51	3.67	3.53	0.26	100	4.86
UA 1422-7	75.65	0.27	12.91	1.74	0.11	0.29	1.40	3.75	3.61	0.27	100	4.32
UA 1422-8	75.69	0.29	12.99	1.73	0.06	0.28	1.38	3.67	3.69	0.23	100	4.69
UA 1422-9	75.57	0.28	13.04	1.68	0.04	0.27	1.59	3.70	3.57	0.26	100	4.67
UA 1422-10	75.40	0.35	13.12	1.70	0.07	0.32	1.43	3.54	3.81	0.26	100	5.16
UA 1422-11	75.68	0.31	12.87	1.73	0.07	0.26	1.36	3.65	3.80	0.26	100	4.41
UA 1422-12	75.70	0.30	12.86	1.76	0.06	0.33	1.40	3.64	3.65	0.29	100	4.75
UA 1422-13	75.45	0.34	13.12	1.76	0.08	0.28	1.43	3.71	3.60	0.24	100	4.84
UA 1422-14	75.31	0.32	13.13	1.88	0.00	0.30	1.46	3.85	3.48	0.27	100	3.99
UA 1422-15	75.39	0.29	13.14	1.74	0.03	0.27	1.46	3.74	3.67	0.26	100	4.20
UA 1422-16	75.63	0.30	12.93	1.67	0.07	0.28	1.53	3.74	3.55	0.29	100	4.36
UA 1422-17	75.49	0.29	13.02	1.74	0.06	0.30	1.40	3.74	3.70	0.26	100	4.02
UA 1422-18	75.69	0.26	12.95	1.67	0.07	0.30	1.43	3.55	3.79	0.28	100	4.04
UA 1422-19	76.78	0.32	12.45	1.65	0.07	0.27	1.07	3.50	3.63	0.26	100	4.78
UA 1422-20	75.36	0.30	13.18	1.72	0.06	0.32	1.42	3.83	3.49	0.31	100	3.80
UA 1423-1	75.63	0.23	13.00	1.75	0.07	0.23	1.46	3.70	3.67	0.25	100	4.58
UA 1423-2	75.64	0.25	12.92	1.67	0.09	0.29	1.49	3.68	3.69	0.27	100	4.56
UA 1423-3	75.56	0.32	13.00	1.70	0.06	0.26	1.42	3.78	3.68	0.23	100	4.14
UA 1423-4	75.65	0.27	12.91	1.75	0.07	0.26	1.45	3.76	3.57	0.30	100	3.69
UA 1423-5	75.42	0.21	13.01	1.76	0.06	0.33	1.46	3.86	3.67	0.22	100	4.14
UA 1423-6	75.60	0.33	13.01	1.74	0.07	0.33	1.47	3.52	3.68	0.25	100	4.90
UA 1423-7	75.75	0.31	12.98	1.68	0.10	0.15	1.45	3.71	3.61	0.26	100	5.15
UA 1423-8	75.02	0.35	13.02	1.76	0.03	0.30	1.51	3.86	3.88	0.27	100	3.79
UA 1423-9	75.92	0.29	12.98	1.69	0.07	0.26	1.41	3.48	3.71	0.19	100	3.84
UA 1423-10	75.45	0.32	12.94	1.76	0.07	0.30	1.48	3.79	3.61	0.28	100	4.61
UA 1423-11	75.61	0.28	13.11	1.70	0.06	0.30	1.42	3.50	3.77	0.26	100	3.99
UA 1423-12	75.59	0.34	13.22	1.83	0.08	0.27	1.37	3.38	3.69	0.23	100	3.83
UA 1423-13	75.80	0.28	12.89	1.81	0.05	0.28	1.39	3.57	3.69	0.23	100	4.25
UA 1423-14	74.99	0.32	13.24	1.82	0.13	0.29	1.44	3.93	3.62	0.24	100	2.55

UA 1423-15	75.60	0.26	13.04	1.78	0.06	0.28	1.50	3.73	3.48	0.27	100	4.07
UA 1423-16	75.55	0.31	13.10	1.68	0.03	0.29	1.39	3.71	3.69	0.25	100	4.03
UA 1423-17	75.42	0.28	13.22	1.73	0.12	0.30	1.51	3.63	3.59	0.20	100	4.85
UA 1423-18	75.12	0.21	13.23	1.93	0.09	0.43	1.50	3.51	3.69	0.28	100	7.91
UA 1423-19	75.56	0.23	13.15	1.75	0.04	0.32	1.39	3.77	3.53	0.25	100	3.73
UA 1423-20	75.33	0.29	12.96	1.71	0.08	0.35	1.41	3.75	3.80	0.33	100	6.56
UA1461-1	75.20	0.33	13.36	1.79	0.04	0.28	1.42	3.73	3.57	0.28	100	-0.21
UA1461-2	75.61	0.27	13.18	1.76	0.05	0.13	1.36	3.67	3.67	0.30	100	4.16
UA1461-3	75.14	0.24	13.25	1.85	0.02	0.30	1.50	3.67	3.75	0.28	100	0.06
UA1461-4	75.67	0.20	13.19	1.73	0.05	0.32	1.45	3.57	3.51	0.31	100	3.39
UA1461-5	75.23	0.30	13.15	1.63	0.10	0.30	1.48	3.92	3.61	0.28	100	0.83
UA1461-6	75.38	0.25	13.34	1.78	0.07	0.29	1.47	3.46	3.65	0.31	100	2.42
UA1461-7	75.08	0.31	13.39	1.80	0.08	0.34	1.49	3.73	3.52	0.26	100	0.18
UA1461-8	75.23	0.38	13.29	1.75	0.03	0.31	1.50	3.56	3.67	0.29	100	2.82
UA1461-9	75.06	0.33	13.14	1.72	0.05	0.36	1.47	3.80	3.77	0.31	100	2.87
UA1461-10	75.51	0.26	13.26	1.73	0.06	0.29	1.52	3.41	3.69	0.27	100	3.68
UA1461-11	76.02	0.18	13.37	1.69	0.06	0.27	1.38	3.32	3.47	0.24	100	4.31
UA1461-12	75.32	0.29	13.19	1.69	0.04	0.34	1.35	3.93	3.57	0.27	100	0.05
UA1461-13	75.29	0.30	12.92	1.78	0.06	0.34	1.42	3.85	3.78	0.27	100	0.43
UA1461-14	75.61	0.29	13.06	1.72	0.06	0.26	1.46	3.64	3.63	0.27	100	2.55
UA1461-15	75.47	0.24	13.08	1.71	0.08	0.31	1.45	3.69	3.72	0.26	100	4.02
UA1463-1	75.56	0.32	13.07	1.71	0.08	0.32	1.50	3.61	3.51	0.32	100	2.39
UA1463-2	75.51	0.30	13.11	1.66	0.05	0.30	1.44	3.80	3.56	0.27	100	1.44
UA1463-3	75.37	0.39	13.20	1.74	0.06	0.35	1.43	3.73	3.46	0.28	100	1.66
UA1463-4	75.81	0.37	12.89	1.72	0.08	0.29	1.46	3.62	3.53	0.24	100	3.24
UA1463-5	75.36	0.23	13.09	1.71	0.08	0.27	1.35	3.90	3.76	0.25	100	3.01
UA1463-6	75.58	0.28	12.97	1.83	0.10	0.31	1.52	3.52	3.63	0.27	100	2.51
UA1463-7	75.47	0.26	13.20	1.81	0.05	0.27	1.50	3.55	3.64	0.25	100	3.28
UA1463-8	75.61	0.26	13.10	1.68	0.09	0.35	1.48	3.59	3.60	0.25	100	2.68
UA1463-9	75.69	0.23	12.99	1.68	0.04	0.28	1.43	3.63	3.67	0.35	100	0.06
UA1463-10	75.41	0.23	13.49	1.62	0.06	0.28	1.46	3.55	3.62	0.28	100	4.68
UA1463-11	75.17	0.33	13.40	1.71	0.02	0.27	1.51	3.60	3.74	0.25	100	4.41
UA1463-12	75.61	0.34	13.12	1.72	0.07	0.27	1.42	3.56	3.64	0.25	100	4.61
UA1463-13	74.89	0.34	13.26	1.81	0.12	0.34	1.48	3.76	3.72	0.28	100	3.49
UA1463-14	75.17	0.33	13.21	1.76	0.06	0.29	1.48	3.84	3.62	0.25	100	1.66
UA1463-15	75.24	0.29	13.21	1.85	0.03	0.24	1.57	3.76	3.53	0.28	100	2.31
UA1463-16	75.48	0.26	13.17	1.83	0.04	0.26	1.56	3.50	3.59	0.32	100	4.06
UA1463-17	75.19	0.29	13.34	1.77	0.02	0.31	1.59	3.52	3.72	0.26	100	0.12
UA1463-18	75.27	0.26	13.13	1.72	0.05	0.27	1.46	3.79	3.79	0.25	100	1.02
UA1466-12	75.16	0.27	13.32	1.80	0.06	0.30	1.44	3.73	3.62	0.30	100	2.46
UA1466-8	75.28	0.33	13.14	1.85	0.11	0.29	1.52	3.54	3.66	0.29	100	6.04
UA1466-17	75.29	0.29	13.14	1.82	0.01	0.25	1.50	3.71	3.70	0.29	100	3.01
UA1466-14	75.46	0.36	13.31	1.73	0.07	0.30	1.50	3.54	3.47	0.26	100	4.87
UA1466-4	75.50	0.34	13.13	1.75	0.02	0.29	1.46	3.58	3.65	0.27	100	4.73
UA1466-2	75.53	0.34	13.19	1.81	0.07	0.30	1.44	3.44	3.64	0.26	100	6.37
UA1466-16	75.55	0.40	13.28	1.68	0.09	0.24	1.43	3.24	3.81	0.29	100	5.11
UA1466-11	75.56	0.33	13.14	1.78	0.04	0.29	1.52	3.55	3.52	0.27	100	3.39
UA1466-13	75.74	0.29	12.96	1.84	0.02	0.25	1.49	3.44	3.64	0.33	100	5.63
UA1466-10	75.83	0.27	13.02	1.89	0.07	0.31	1.39	3.48	3.46	0.28	100	5.91
UA1466-7	75.93	0.30	12.87	1.85	0.07	0.26	1.35	3.54	3.57	0.27	100	5.77
UA1471-2	76.00	0.29	12.94	1.72	0.06	0.29	1.44	3.41	3.56	0.30	100	5.81
UA1471-3	75.48	0.31	13.04	1.76	0.10	0.30	1.46	3.46	3.77	0.32	100	4.90
UA1471-4	75.24	0.29	13.21	1.79	0.10	0.32	1.45	3.64	3.70	0.27	100	3.77

UA1471-5	75.71	0.22	12.99	1.78	0.07	0.30	1.46	3.64	3.52	0.30	100	4.50
UA1471-6	75.55	0.29	13.01	1.67	0.06	0.34	1.55	3.58	3.63	0.31	100	4.22
UA1471-7	75.44	0.32	13.06	1.74	0.02	0.29	1.44	3.64	3.79	0.27	100	3.51
UA1471-8	75.74	0.26	13.11	1.69	0.07	0.29	1.51	3.34	3.70	0.28	100	4.42
UA1471-9	75.69	0.33	13.10	1.75	0.11	0.24	1.42	3.42	3.64	0.30	100	5.78
UA1471-10	75.81	0.22	12.95	1.73	0.05	0.32	1.51	3.46	3.61	0.34	100	4.16
UA1471-11	75.74	0.20	13.15	1.72	0.06	0.32	1.45	3.52	3.58	0.25	100	4.08
UA1471-12	75.63	0.35	13.00	1.80	0.06	0.31	1.43	3.51	3.65	0.25	100	2.42
UA1471-13	75.30	0.38	13.10	1.75	0.09	0.31	1.50	3.61	3.70	0.25	100	4.03
UA1471-14	75.18	0.24	13.29	1.68	0.09	0.34	1.49	3.57	3.84	0.30	100	5.19
UA1471-15	75.58	0.24	13.07	1.74	0.06	0.33	1.42	3.56	3.68	0.31	100	4.48
UA1471-18	75.53	0.27	13.34	1.67	0.07	0.24	1.46	3.39	3.81	0.22	100	5.15
UA1471-19	75.46	0.29	13.18	1.72	0.07	0.23	1.43	3.64	3.75	0.24	100	3.23
UA1471-20	75.17	0.28	13.37	1.77	0.04	0.30	1.52	3.60	3.67	0.27	100	3.93
UA1473-1	75.39	0.32	12.90	1.89	0.05	0.33	1.43	3.94	3.45	0.29	100	2.22
UA1473-2	75.67	0.26	13.23	1.77	0.09	0.27	1.47	3.58	3.46	0.20	100	4.82
UA1473-3	75.66	0.29	13.27	1.66	0.09	0.28	1.51	3.45	3.55	0.24	100	4.94
UA1473-4	75.78	0.29	12.83	1.73	0.06	0.27	1.47	3.66	3.59	0.33	100	4.64
UA1473-5	75.28	0.27	13.21	1.76	0.06	0.26	1.52	3.58	3.73	0.32	100	5.49
UA1473-6	74.99	0.30	13.12	1.94	0.05	0.30	1.42	4.09	3.53	0.26	100	3.18
UA1473-7	75.51	0.32	12.99	1.72	0.05	0.30	1.48	3.64	3.70	0.30	100	5.90
UA1473-8	75.54	0.31	13.01	1.83	0.04	0.25	1.55	3.48	3.66	0.32	100	3.57
UA1473-9	75.20	0.22	13.69	1.57	0.02	0.23	1.60	3.62	3.60	0.25	100	3.40
UA1473-10	75.39	0.30	13.11	1.79	0.04	0.28	1.50	3.70	3.61	0.28	100	2.92
UA1473-11	75.56	0.28	13.18	1.72	0.04	0.26	1.48	3.32	3.90	0.25	100	3.96
UA1473-12	75.44	0.39	13.36	1.68	0.06	0.29	1.41	3.60	3.49	0.29	100	2.74
UA1473-13	75.21	0.28	13.16	1.83	0.04	0.29	1.43	3.92	3.55	0.29	100	1.77
UA1473-14	75.46	0.28	13.12	1.78	0.01	0.33	1.51	3.66	3.57	0.28	100	2.46
UA1473-15	75.18	0.24	13.26	1.79	0.09	0.29	1.45	3.64	3.75	0.30	100	4.25
UA1473-16	75.51	0.31	13.18	1.72	0.09	0.28	1.44	3.48	3.71	0.29	100	4.00
UA1473-17	75.42	0.28	13.23	1.80	0.04	0.29	1.46	3.56	3.62	0.30	100	2.95
UA1473-18	75.55	0.32	13.07	1.72	0.09	0.36	1.42	3.62	3.61	0.24	100	4.19
UA1475-1	75.61	0.33	13.00	1.69	0.05	0.28	1.42	3.65	3.68	0.30	100	4.14
UA1475-2	75.60	0.31	13.31	1.70	0.01	0.27	1.57	3.18	3.74	0.30	100	6.64
UA1475-3	75.67	0.29	13.15	1.63	0.00	0.17	1.40	3.80	3.70	0.20	100	2.68
UA1475-4	75.50	0.25	12.88	1.64	0.04	0.36	1.53	3.79	3.77	0.25	100	4.42
UA1475-5	75.10	0.26	13.23	1.69	0.09	0.28	1.51	3.89	3.69	0.28	100	0.63
UA1475-6	77.11	0.18	12.36	1.30	0.07	0.18	0.98	3.41	4.08	0.33	100	3.72
UA1475-7	75.64	0.39	12.92	1.68	0.04	0.29	1.42	3.72	3.64	0.25	100	5.04
UA1475-8	75.66	0.34	13.09	1.63	0.07	0.28	1.46	3.54	3.65	0.28	100	4.88
UA1475-9	75.69	0.27	12.99	1.69	0.07	0.30	1.49	3.61	3.65	0.23	100	4.64
UA1475-10	75.98	0.22	13.00	1.58	0.07	0.29	1.43	3.47	3.67	0.30	100	6.10
UA1475-11	75.41	0.36	13.29	1.71	0.08	0.28	1.54	3.54	3.51	0.28	100	4.84
UA1475-12	75.21	0.32	13.05	1.71	0.00	0.34	1.54	3.91	3.69	0.24	100	2.42
UA1475-13	75.41	0.29	13.11	1.75	0.02	0.33	1.53	3.63	3.62	0.32	100	3.85
UA1475-14	75.40	0.31	13.14	1.66	0.06	0.31	1.43	3.73	3.63	0.33	100	2.10
UA1480-1	75.91	0.24	12.58	1.80	0.04	0.35	1.43	3.62	3.80	0.24	100	6.42
UA1480-2	75.53	0.27	13.28	1.74	0.06	0.25	1.50	3.51	3.62	0.25	100	3.78
UA1480-3	75.59	0.29	13.07	1.75	0.00	0.25	1.53	3.58	3.70	0.23	100	3.58
UA1480-4	75.43	0.32	13.06	1.63	0.08	0.29	1.49	3.61	3.83	0.25	100	4.66
UA1480-6	75.67	0.19	13.10	1.70	0.06	0.26	1.46	3.59	3.70	0.28	100	3.88
UA1480-7	75.58	0.33	12.94	1.76	0.04	0.31	1.50	3.66	3.55	0.33	100	7.21
UA1480-8	75.71	0.28	12.83	1.74	0.03	0.30	1.53	3.72	3.61	0.25	100	7.42

UA1480-9	75.52	0.34	12.92	1.60	0.06	0.27	1.55	3.86	3.57	0.31	100	4.03
UA1480-10	75.65	0.23	13.11	1.69	0.12	0.27	1.46	3.64	3.53	0.30	100	3.94
UA1480-11	75.33	0.25	13.13	1.79	0.09	0.33	1.51	3.60	3.67	0.30	100	4.16
UA1480-12	75.69	0.26	13.13	1.77	0.05	0.24	1.33	3.66	3.65	0.22	100	3.39
UA1480-13	75.38	0.33	12.91	1.81	0.10	0.28	1.55	3.66	3.64	0.35	100	4.79
UA1480-14	75.51	0.27	13.09	1.74	0.06	0.28	1.46	3.74	3.55	0.30	100	2.73
UA1480-15	75.77	0.23	13.08	1.71	0.04	0.30	1.39	3.45	3.75	0.27	100	4.22
UA1480-16	75.49	0.27	13.20	1.69	0.03	0.31	1.54	3.59	3.60	0.29	100	4.07
UA1480-17	75.39	0.32	13.07	1.73	0.09	0.29	1.47	3.64	3.68	0.32	100	3.63
UA1480-18	75.69	0.31	13.17	1.62	0.03	0.30	1.53	3.58	3.50	0.27	100	4.41
UA 2083-26	74.81	0.29	13.16	1.81	0.09	0.29	1.56	3.98	3.76	0.27	100	6.03
UA 2083-28	74.88	0.36	13.51	1.76	0.06	0.28	1.49	3.64	3.76	0.27	100	5.86
UA 2083-4	74.89	0.28	13.17	1.81	0.02	0.30	1.57	3.88	3.82	0.25	100	4.90
UA 2083-31	74.95	0.33	13.18	1.80	0.08	0.25	1.42	3.95	3.75	0.29	100	5.55
UA 2083-1	74.95	0.31	13.15	1.83	0.09	0.29	1.47	3.93	3.67	0.30	100	3.80
UA 2083-27	74.95	0.36	13.01	1.76	0.03	0.30	1.51	3.89	3.91	0.28	100	4.72
UA 2083-19	75.01	0.28	13.02	1.86	0.12	0.34	1.51	3.80	3.81	0.26	100	5.01
UA 2083-6	75.02	0.39	13.32	1.71	0.05	0.28	1.51	3.69	3.77	0.26	100	6.10
UA 2083-21	75.04	0.36	13.31	1.81	0.05	0.29	1.45	3.63	3.77	0.29	100	6.10
UA 2083-17	75.06	0.27	13.08	1.78	0.06	0.26	1.45	3.92	3.86	0.26	100	6.27
UA 2083-32	75.09	0.31	13.30	1.72	0.07	0.29	1.58	3.57	3.80	0.27	100	7.02
UA 2083-12	75.10	0.27	13.41	1.78	0.06	0.25	1.43	3.67	3.78	0.24	100	8.58
UA 2083-8	75.11	0.29	13.21	1.76	0.03	0.30	1.48	3.89	3.61	0.30	100	5.55
UA 2083-24	75.13	0.29	13.22	1.87	0.12	0.31	1.56	3.42	3.82	0.27	100	7.84
UA 2083-14	75.20	0.39	12.96	1.70	0.10	0.28	1.41	3.93	3.72	0.31	100	5.14
UA 2083-30	75.22	0.31	13.09	1.88	0.08	0.29	1.54	3.75	3.62	0.23	100	6.78
UA 2083-13	75.25	0.30	13.23	1.68	0.08	0.28	1.40	3.72	3.79	0.28	100	4.77
UA 2083-18	75.26	0.29	13.39	1.67	0.02	0.27	1.47	3.55	3.81	0.27	100	7.41
UA 2083-5	75.27	0.25	13.21	1.76	0.06	0.29	1.50	3.85	3.52	0.29	100	5.09
UA 2083-3	75.30	0.24	13.03	1.70	0.12	0.31	1.47	3.86	3.68	0.30	100	4.46
UA 2083-10	75.30	0.29	13.12	1.89	0.06	0.27	1.52	3.73	3.58	0.24	100	5.75
UA 2083-33	75.31	0.33	13.25	1.77	0.08	0.25	1.44	3.76	3.56	0.26	100	5.78
UA 2083-29	75.34	0.28	13.03	1.71	0.01	0.30	1.52	3.82	3.71	0.28	100	5.36
UA 2083-11	75.36	0.34	12.93	1.80	0.10	0.30	1.51	3.78	3.66	0.24	100	4.23
UA 2083-2	75.38	0.27	12.92	1.76	0.01	0.34	1.49	3.91	3.66	0.27	100	5.54
UA 2083-15	75.56	0.30	13.07	1.79	0.07	0.22	1.46	3.54	3.72	0.27	100	6.14
UA 2163-5	74.56	0.32	13.28	1.95	0.01	0.31	1.53	3.84	4.00	0.20	100	5.19
UA 2163-1	74.81	0.33	13.16	1.85	0.11	0.30	1.53	3.75	3.90	0.25	100	4.99
UA 2163-17	74.85	0.27	13.19	1.76	0.06	0.32	1.46	3.79	4.03	0.29	100	4.46
UA 2163-8	74.89	0.40	13.07	1.73	0.04	0.31	1.53	3.94	3.87	0.23	100	5.69
UA 2163-14	74.94	0.34	12.90	1.82	0.04	0.27	1.54	3.99	3.87	0.28	100	3.12
UA 2163-16	74.97	0.27	13.32	1.70	0.08	0.28	1.46	3.94	3.70	0.28	100	4.73
UA 2163-19	75.05	0.36	13.12	1.72	0.08	0.25	1.51	3.90	3.71	0.30	100	1.91
UA 2163-2	75.07	0.38	12.99	1.76	0.06	0.27	1.51	3.76	3.94	0.25	100	6.21
UA 2163-4	75.08	0.24	13.06	1.86	0.06	0.31	1.45	3.89	3.82	0.24	100	6.62
UA 2163-25	75.08	0.28	13.00	1.80	0.09	0.28	1.60	3.90	3.66	0.30	100	4.97
UA 2163-20	75.12	0.31	13.14	1.80	0.06	0.28	1.43	3.89	3.70	0.26	100	5.64
UA 2163-22	75.12	0.31	13.16	1.80	0.02	0.23	1.43	3.86	3.80	0.28	100	5.44
UA 2163-6	75.16	0.33	13.28	1.67	0.09	0.33	1.45	3.62	3.81	0.24	100	6.34
UA 2163-10	75.19	0.26	13.03	1.63	0.12	0.30	1.55	3.89	3.75	0.29	100	4.83
UA 2163-18	75.20	0.28	13.19	1.72	0.05	0.29	1.44	3.85	3.73	0.25	100	5.20
UA 2163-7	75.23	0.32	13.03	1.79	0.11	0.30	1.46	3.74	3.79	0.25	100	4.58
UA 2163-13	75.30	0.27	12.88	1.72	0.06	0.33	1.54	3.77	3.83	0.29	100	5.45

UA 2163-23	75.33	0.32	13.02	1.77	0.03	0.29	1.50	3.60	3.86	0.28	100	5.61	
UA 2163-21	75.42	0.33	13.14	1.72	0.07	0.25	1.47	3.58	3.70	0.31	100	5.14	
UA 2163-12	75.45	0.28	12.96	1.68	0.03	0.30	1.43	3.81	3.78	0.28	100	5.63	
AVERAGE	75.39	0.29	13.07	1.76	0.06	0.29	1.49	3.69	3.67	0.28	100	4.17	##
STDEV	0.28	0.04	0.16	0.08	0.03	0.03	0.07	0.17	0.11	0.03	0	1.53	

Palisades-14: new tephra bed

Ua1147-3	68.67	0.72	15.48	4.00	0.09	1.09	3.40	4.61	1.79	0.15	100	4.26
Ua1147-5	68.33	0.73	15.46	4.19	0.13	1.04	3.54	4.69	1.76	0.13	100	1.07
Ua1147-6	67.99	0.70	15.16	4.31	0.11	1.18	3.71	4.78	1.84	0.22	100	1.38
Ua1147-7	68.30	0.67	15.32	4.32	0.12	1.13	3.73	4.55	1.67	0.17	100	1.65
Ua1147-10	68.20	0.73	15.26	4.36	0.12	1.11	3.66	4.67	1.68	0.20	100	2.28
Ua1147-11	68.59	0.65	15.25	4.17	0.12	1.16	3.51	4.71	1.67	0.18	100	2.14
Ua1147-12	69.00	0.64	15.52	4.05	0.08	1.06	3.44	4.32	1.71	0.18	100	1.81
Ua1147-14	68.18	0.66	15.46	4.17	0.09	1.13	3.58	4.82	1.69	0.21	100	1.89
Ua1147-15	68.47	0.70	15.49	4.19	0.15	1.10	3.62	4.45	1.69	0.15	100	1.23
Ua1147-16	68.96	0.68	15.08	4.14	0.08	1.07	3.59	4.48	1.75	0.18	100	3.28
Ua1147-17	68.62	0.70	15.03	4.37	0.10	1.12	3.58	4.59	1.75	0.15	100	4.54
Ua1147-19	68.55	0.69	15.19	4.12	0.22	1.15	3.80	4.44	1.66	0.16	100	2.56
Ua1147-20	67.55	0.67	15.34	4.60	0.08	1.23	4.09	4.61	1.66	0.16	100	1.80
Ua1147-22	68.64	0.71	15.19	4.27	0.05	1.05	3.53	4.65	1.71	0.20	100	3.45
UA1197-7	67.64	0.66	15.56	4.27	0.14	1.08	3.71	4.94	1.81	0.18	100	4.39
UA1197-18	67.67	0.67	15.64	4.20	0.19	1.23	4.01	4.56	1.69	0.13	100	1.29
UA1197-20	67.90	0.63	15.37	4.21	0.05	1.12	3.87	4.98	1.67	0.20	100	0.55
UA1197-17	68.16	0.74	15.33	4.34	0.13	1.11	3.89	4.50	1.65	0.16	100	0.83
UA1197-4	68.32	0.72	15.50	4.12	0.13	1.12	3.47	4.71	1.74	0.17	100	1.66
UA1197-11	68.39	0.68	15.38	4.09	0.10	1.10	3.56	4.86	1.62	0.23	100	0.13
UA1197-16	68.40	0.66	15.32	4.14	0.15	1.11	3.73	4.57	1.78	0.16	100	0.78
UA1197-28	68.42	0.73	15.32	4.10	0.17	1.06	3.74	4.60	1.65	0.21	100	-0.13
UA1197-27	68.60	0.60	15.93	3.98	0.13	1.13	3.49	4.31	1.61	0.23	100	6.56
UA1197-21	68.70	0.69	15.45	4.11	0.10	1.03	3.54	4.51	1.71	0.16	100	0.82
UA1197-5	68.72	0.69	15.35	4.04	0.09	1.06	3.67	4.56	1.67	0.16	100	1.47
UA1197-15	68.77	0.71	15.39	4.12	0.09	1.18	3.53	4.32	1.75	0.16	100	3.11
UA1197-10	68.78	0.69	15.60	4.18	0.08	1.03	3.36	4.34	1.76	0.18	100	1.34
UA1197-9	68.88	0.78	15.47	4.17	0.08	1.08	3.46	4.26	1.68	0.15	100	0.52
UA1197-8	69.01	0.70	15.30	4.22	0.07	0.97	3.43	4.45	1.70	0.14	100	0.91
UA1197-25	69.13	0.61	15.45	4.11	0.03	1.03	3.48	4.17	1.81	0.18	100	1.14
UA1197-29	69.20	0.70	15.14	4.02	0.08	1.03	3.55	4.41	1.68	0.18	100	1.09
UA1197-19	69.33	0.65	15.16	3.98	0.06	0.99	3.45	4.48	1.75	0.16	100	1.86
UA 1476-17	67.61	0.72	15.60	4.35	0.07	1.22	3.97	4.63	1.71	0.13	100	1.33
UA 1476-21	67.80	0.79	15.46	4.44	0.09	1.15	4.01	4.46	1.61	0.20	100	2.11
UA 1476-6	68.19	0.60	15.11	4.63	0.06	1.14	4.00	4.19	1.80	0.29	100	7.98
UA 1476-22	68.50	0.66	15.15	4.49	0.13	1.12	3.72	4.24	1.80	0.19	100	1.34
UA 1476-16	68.63	0.78	15.19	4.22	0.09	0.96	3.77	4.44	1.77	0.16	100	0.61
UA 1476-10	68.65	0.79	14.90	4.31	0.10	1.07	3.56	4.76	1.62	0.25	100	1.32
UA 1476-25	68.77	0.76	15.20	4.19	0.07	0.98	3.56	4.50	1.82	0.15	100	1.45
UA 1476-3	68.81	0.74	15.30	4.12	0.10	1.09	3.51	4.46	1.66	0.21	100	0.63
UA 1476-18	68.82	0.73	15.42	4.00	0.10	1.03	3.88	4.15	1.65	0.21	100	2.56
UA 1476-14	68.86	0.75	15.34	4.19	0.06	1.10	3.89	3.92	1.71	0.17	100	2.27
UA 1476-15	68.87	0.68	15.19	4.19	0.10	1.02	3.63	4.41	1.70	0.22	100	1.59
UA 1476-11	68.89	0.62	15.17	4.00	0.13	1.09	3.80	4.42	1.72	0.14	100	4.64
UA 1476-19	68.91	0.64	15.35	4.08	0.05	1.07	3.81	3.95	1.93	0.21	100	2.59
UA 1476-9	69.00	0.67	15.32	3.97	0.08	1.02	3.59	4.45	1.69	0.21	100	1.53

UA 1476-20	69.01	0.74	15.09	4.21	0.06	1.07	3.65	4.12	1.84	0.20	100	3.00	
UA 1476-23	69.01	0.69	15.35	3.95	0.07	1.04	3.58	4.43	1.70	0.17	100	1.42	
UA 1477-21	65.40	0.89	15.46	5.57	0.12	1.56	5.09	4.26	1.48	0.16	100	1.17	
UA 1477-23	67.23	0.70	15.25	4.68	0.14	1.27	4.04	4.83	1.66	0.19	100	1.49	
UA 1477-14	67.30	0.79	15.62	4.86	0.08	1.36	4.00	4.22	1.59	0.17	100	2.98	
UA 1477-11	67.94	0.72	15.10	4.18	0.11	1.17	4.06	4.80	1.71	0.21	100	0.71	
UA 1477-8	68.27	0.74	15.39	4.13	0.06	1.16	3.87	4.59	1.68	0.12	100	1.38	
UA 1477-7	68.28	0.64	14.98	4.15	0.09	1.01	3.71	5.24	1.71	0.19	100	0.91	
UA 1477-19	68.57	0.74	15.33	4.07	0.11	1.10	3.88	4.36	1.68	0.16	100	1.62	
UA 1477-10	68.64	0.70	15.57	4.28	0.18	0.99	3.58	4.13	1.76	0.18	100	1.61	
UA 1477-9	68.66	0.66	15.19	4.26	0.18	1.13	3.88	4.07	1.75	0.21	100	2.22	
UA 1477-17	68.69	0.75	15.31	4.01	0.09	1.04	3.64	4.46	1.83	0.18	100	3.05	
UA 1477-5	68.72	0.77	15.25	4.13	0.10	1.07	3.55	4.46	1.72	0.22	100	1.34	
UA 1477-20	68.79	0.65	15.07	4.21	0.10	1.13	3.89	4.21	1.74	0.22	100	1.96	
UA 1477-15	68.79	0.70	15.07	3.95	0.10	1.16	3.55	4.51	1.85	0.33	100	1.37	
UA 1477-12	68.79	0.66	15.11	4.00	0.12	1.06	3.78	4.58	1.69	0.21	100	3.22	
UA 1477-1	68.95	0.73	15.32	4.07	0.05	1.02	3.66	4.25	1.73	0.21	100	1.00	
UA 1477-4	69.00	0.70	15.31	4.05	0.00	1.06	3.79	4.21	1.74	0.13	100	4.34	
UA 1477-13	69.05	0.70	15.24	4.03	0.09	1.00	3.68	4.34	1.68	0.18	100	1.82	
UA 1477-16	69.08	0.72	15.15	3.94	0.10	1.02	3.54	4.54	1.74	0.17	100	0.82	
UA 1478-10	67.80	0.72	15.19	4.80	0.06	1.20	4.17	4.21	1.59	0.26	100	2.49	
UA 1478-23	67.97	0.67	14.99	4.28	0.10	1.16	4.14	4.85	1.66	0.19	100	0.19	
UA 1478-1	68.02	0.75	14.97	4.22	0.14	1.11	3.75	5.03	1.78	0.23	100	1.17	
UA 1478-24	68.09	0.73	15.22	4.31	0.09	1.11	3.69	4.80	1.71	0.24	100	0.59	
UA 1478-4	68.26	0.77	15.34	4.28	0.12	1.12	3.82	4.43	1.66	0.20	100	1.86	
UA 1478-7	68.45	0.65	15.14	4.23	0.08	1.10	3.73	4.65	1.77	0.20	100	1.13	
UA 1478-9	68.56	0.79	15.25	4.25	0.10	0.99	3.61	4.58	1.68	0.19	100	1.53	
UA 1478-17	68.59	0.64	15.21	4.29	0.13	1.07	3.87	4.31	1.69	0.20	100	2.39	
UA 1478-20	68.61	0.69	15.27	4.13	0.13	1.14	3.77	4.26	1.78	0.23	100	5.17	
UA 1478-6	68.67	0.74	15.20	4.04	0.10	1.08	3.65	4.68	1.60	0.24	100	0.89	
UA 1478-25	68.69	0.78	15.02	4.26	0.06	1.09	3.68	4.48	1.77	0.18	100	2.27	
UA 1478-16	68.72	0.78	15.15	4.26	0.07	1.05	3.69	4.47	1.62	0.18	100	3.50	
UA 1478-11	68.79	0.74	15.11	3.97	0.06	1.03	3.93	4.48	1.66	0.22	100	1.33	
UA 1478-14	68.82	0.73	15.41	3.93	0.12	1.01	3.74	4.39	1.69	0.17	100	4.29	
UA 1478-21	68.83	0.67	15.21	4.20	0.10	0.98	3.66	4.37	1.81	0.19	100	1.38	
UA 1478-19	68.87	0.58	15.22	3.94	0.12	1.04	3.49	4.74	1.80	0.20	100	1.46	
UA 1478-3	68.87	0.70	15.45	3.99	0.11	1.08	3.65	4.28	1.68	0.21	100	2.56	
UA 1478-12	68.92	0.71	15.21	3.91	0.14	1.03	3.69	4.51	1.69	0.19	100	1.00	
UA 1478-5	68.93	0.67	15.31	4.00	0.12	1.09	3.56	4.37	1.74	0.21	100	2.96	
UA 1478-2	68.94	0.61	15.07	4.02	0.09	1.06	3.58	4.71	1.75	0.16	100	2.78	
UA 1478-18	69.09	0.76	15.40	3.99	0.15	1.04	3.64	4.12	1.69	0.13	100	1.54	
UA 1478-22	69.18	0.70	15.12	4.15	0.08	1.04	3.77	4.04	1.74	0.18	100	1.35	
UA 1478-15	69.18	0.65	15.28	4.04	0.11	1.02	3.49	4.34	1.77	0.12	100	4.23	
AVERAGE	68.53	0.70	15.29	4.19	0.10	1.09	3.71	4.48	1.71	0.19	100	2.01	89
STDEV	0.56	0.05	0.18	0.24	0.04	0.09	0.23	0.24	0.07	0.04	0	1.39	
UA1197-13	74.39	0.41	13.33	2.25	0.07	0.43	1.88	4.14	2.87	0.23	100	4.31	
UA1197-14	74.56	0.45	13.39	2.20	0.05	0.43	1.81	4.20	2.68	0.24	100	5.04	
UA 1478-13	74.09	0.42	13.51	2.41	0.10	0.45	2.14	4.10	2.58	0.20	100	1.34	
AVERAGE	74.35	0.43	13.41	2.29	0.07	0.44	1.94	4.14	2.71	0.22	100	3.56	3
STDEV	0.23	0.02	0.09	0.11	0.02	0.01	0.17	0.05	0.15	0.02	0	1.96	
UA1197-1	64.12	0.87	15.67	6.16	0.06	1.82	5.11	4.51	1.54	0.15	100	0.33	outlier
UA1197-2	63.09	0.91	15.75	6.49	0.12	2.07	5.48	4.54	1.36	0.18	100	-0.15	
UA1197-3	64.00	0.80	15.72	6.23	0.14	1.91	5.20	4.45	1.41	0.14	100	0.43	

AVERAGE	63.74	0.86	15.71	6.29	0.11	1.94	5.26	4.50	1.44	0.15	100	0.20	3	
STDEV	0.56	0.06	0.04	0.18	0.04	0.13	0.20	0.04	0.09	0.02	0	0.31		
UA 1476-12	77.55	0.18	12.02	1.56	0.00	0.14	1.19	3.43	3.57	0.36	100	5.85		outlier

Palisades-15: Halfway House tephra

UA1462-16	72.73	0.54	14.16	2.72	0.14	0.61	2.32	4.81	1.84	0.13	100	-0.14	
UA1462-7	72.85	0.52	14.40	2.70	0.09	0.70	2.29	4.51	1.80	0.14	100	1.10	
UA1462-14	73.10	0.55	14.02	2.82	0.13	0.61	2.18	4.70	1.74	0.15	100	1.69	
UA1462-15	73.31	0.44	14.21	2.59	0.09	0.55	2.09	4.65	1.90	0.16	100	0.25	
UA1462-5	73.63	0.49	14.11	2.49	0.10	0.55	1.98	4.70	1.81	0.14	100	0.65	
UA1462-9	73.88	0.46	14.15	2.31	0.11	0.54	1.90	4.64	1.88	0.13	100	-0.14	
UA1462-4	74.03	0.51	13.91	2.26	0.08	0.52	1.73	4.96	1.89	0.11	100	1.16	
UA1462-13	74.04	0.45	14.20	2.37	0.11	0.54	1.93	4.47	1.77	0.12	100	-0.10	
UA1462-11	74.12	0.38	14.25	2.33	0.10	0.52	1.95	4.34	1.89	0.12	100	1.10	
UA1462-2	74.19	0.44	14.21	2.28	0.14	0.49	1.65	4.63	1.86	0.12	100	0.85	
UA1462-8	74.23	0.35	14.17	1.99	0.14	0.42	1.91	4.85	1.82	0.12	100	1.02	
UA1462-18	74.26	0.38	14.23	2.02	0.10	0.46	1.75	4.78	1.85	0.16	100	-0.19	
UA1462-6	74.47	0.37	13.94	2.28	0.16	0.48	1.68	4.58	1.86	0.18	100	0.82	
UA1462-12	74.73	0.42	13.92	2.17	0.09	0.50	1.62	4.50	1.95	0.09	100	-0.62	
UA1462-3	74.74	0.42	13.94	2.24	0.10	0.46	1.68	4.39	1.88	0.14	100	1.23	**P2O5**
UA 1462-15	67.10	0.83	15.48	4.76	0.16	1.36	4.20	4.40	1.44	0.08	100	0.08	0.19
UA 1462-1	68.04	0.72	15.22	4.48	0.12	1.36	3.74	4.56	1.42	0.12	100	2.32	0.22
UA 1462-8	69.29	0.67	15.26	3.78	0.18	0.96	2.69	5.23	1.67	0.11	100	2.95	0.17
UA 1462-7	70.21	0.66	15.28	3.32	0.19	0.98	3.06	4.37	1.59	0.15	100	1.40	0.20
UA 1462-23	72.01	0.54	14.74	3.19	0.11	0.73	2.46	4.22	1.78	0.11	100	0.86	0.11
UA 1462-14	72.48	0.55	14.39	2.69	0.11	0.58	2.18	4.93	1.78	0.17	100	2.14	0.14
UA 1462-20	73.18	0.48	14.22	2.48	0.13	0.56	2.06	4.73	1.84	0.16	100	1.96	0.15
UA 1462-3	73.23	0.44	14.21	2.31	0.10	0.53	1.79	5.33	1.86	0.13	100	1.53	0.08
UA 1462-22	73.27	0.39	14.28	2.42	0.09	0.50	1.94	4.98	1.81	0.16	100	1.95	0.16
UA 1462-26	73.27	0.52	14.36	2.64	0.06	0.60	2.28	4.29	1.80	0.10	100	2.74	0.09
UA 1462-10	73.29	0.51	14.27	2.49	0.10	0.55	1.83	4.89	1.83	0.13	100	1.93	0.11
UA 1462-12	73.39	0.51	14.11	2.31	0.17	0.49	1.86	5.01	1.86	0.18	100	1.35	0.10
UA 1462-2	73.58	0.38	14.00	2.38	0.11	0.42	1.79	5.22	1.89	0.16	100	2.56	0.06
UA 1462-21	73.60	0.48	14.14	2.39	0.14	0.50	1.84	4.91	1.80	0.12	100	1.89	0.08
UA 1462-25	73.60	0.49	13.97	2.42	0.15	0.52	1.77	4.91	1.95	0.08	100	4.70	0.13
UA 1462-30	73.60	0.55	14.32	2.46	0.13	0.55	1.93	4.26	1.94	0.15	100	2.10	0.12
UA 1462-28	73.71	0.33	14.37	2.14	0.09	0.50	1.80	4.96	1.88	0.11	100	4.68	0.10
UA 1462-5	73.82	0.44	14.25	2.28	0.13	0.45	1.77	4.80	1.89	0.14	100	1.69	0.04
UA 1462-9	73.85	0.40	14.31	1.89	0.10	0.49	1.60	5.35	1.82	0.13	100	7.21	0.07
UA 1462-13	73.90	0.41	13.99	2.19	0.12	0.47	1.92	4.82	1.91	0.18	100	1.86	0.08
UA 1462-29	74.04	0.44	14.07	2.19	0.13	0.50	1.95	4.54	1.94	0.13	100	5.71	0.08
UA 1462-18	74.17	0.42	14.04	2.24	0.15	0.48	1.59	4.97	1.75	0.12	100	3.18	0.08
UA 1462-27	74.27	0.42	14.16	2.12	0.18	0.45	1.64	4.70	1.91	0.13	100	2.55	0.02
UA 1462-4	74.28	0.44	13.99	2.23	0.15	0.48	1.64	4.66	1.88	0.12	100	0.91	0.14
UA 1462-11	74.29	0.48	14.09	2.19	0.10	0.50	1.68	4.64	1.80	0.14	100	2.96	0.09
UA 1462-17	74.40	0.45	13.98	2.10	0.13	0.45	1.73	4.72	1.81	0.13	100	0.98	0.09
UA 1462-6	74.59	0.46	13.96	2.20	0.08	0.46	1.69	4.53	1.93	0.09	100	1.49	0.01
UA 1462-16	71.14	0.57	14.52	3.11	0.07	0.70	2.53	5.39	1.82	0.14	100	2.92	0.11
UA 1462-17	72.10	0.47	14.54	2.63	0.16	0.56	2.22	5.39	1.83	0.11	100	2.62	0.05
UA 1462-1	72.68	0.48	14.16	2.67	0.17	0.56	2.08	5.21	1.88	0.13	100	2.23	
UA 1462-25	72.90	0.44	14.09	2.47	0.14	0.56	1.93	5.38	1.95	0.13	100	0.26	
UA 1462-12	72.98	0.51	13.85	2.64	0.14	0.54	1.98	5.32	1.88	0.16	100	3.01	
UA 1462-29	72.98	0.53	14.05	2.65	0.12	0.59	1.94	5.10	1.89	0.15	100	0.73	

UA 1462-27	73.00	0.45	14.13	2.48	0.13	0.48	2.00	5.21	2.02	0.11	100	1.81		
UA 1462-3	73.00	0.40	14.26	2.35	0.08	0.52	1.98	5.42	1.86	0.14	100	2.89		
UA 1462-22	73.02	0.56	14.00	2.59	0.12	0.46	1.89	5.47	1.80	0.11	100	1.85		
UA 1462-26	73.10	0.45	14.22	2.28	0.16	0.54	1.85	5.45	1.84	0.12	100	1.03		
UA 1462-13	73.11	0.48	13.75	2.53	0.15	0.55	1.85	5.53	1.93	0.12	100	3.26		
UA 1462-4	73.11	0.51	14.13	2.09	0.12	0.52	1.83	5.77	1.78	0.13	100	6.67		
UA 1462-5	73.19	0.48	14.23	2.44	0.10	0.53	1.86	5.17	1.89	0.13	100	1.93		
UA 1462-8	73.21	0.35	14.25	2.23	0.17	0.49	1.86	5.47	1.83	0.14	100	3.84		
UA 1462-11	73.38	0.49	13.88	2.24	0.16	0.53	1.88	5.27	2.00	0.17	100	2.46		
UA 1462-30	73.44	0.40	14.17	2.23	0.12	0.43	1.64	5.46	2.02	0.09	100	2.64		
UA 1462-23	73.49	0.44	14.26	2.03	0.10	0.42	1.68	5.41	2.00	0.17	100	2.33		
UA 1462-21	73.55	0.45	14.22	2.04	0.08	0.46	1.81	5.40	1.86	0.13	100	1.82		
UA 1462-2	73.61	0.45	14.00	2.15	0.12	0.47	1.70	5.39	1.98	0.15	100	2.24		
UA 1462-18	73.67	0.38	13.80	2.19	0.09	0.46	1.71	5.50	2.04	0.14	100	2.26		
UA 1462-10	73.76	0.37	13.95	2.09	0.15	0.40	1.61	5.43	2.11	0.12	100	2.14		
UA 1462-9	73.92	0.34	13.91	2.15	0.11	0.46	1.67	5.40	1.88	0.14	100	2.37		
UA 1462-24	73.94	0.39	13.80	2.23	0.14	0.45	1.67	5.31	1.94	0.14	100	1.91		
UA 2134-4	70.74	0.56	14.62	3.34	0.16	0.76	2.61	5.32	1.74	0.15	100	1.22		
UA 2134-16	71.04	0.58	14.36	3.31	0.15	0.72	2.58	5.32	1.80	0.14	100	1.18		
UA 2134-22	71.27	0.54	14.68	3.07	0.09	0.69	2.53	5.17	1.80	0.15	100	0.50		
UA 2134-24	72.29	0.49	14.34	2.63	0.17	0.63	2.23	5.19	1.90	0.13	100	0.29		
UA 2134-5	73.10	0.50	14.07	2.57	0.11	0.51	2.08	4.96	1.98	0.12	100	3.73		
UA 2134-12	73.21	0.51	13.80	2.32	0.18	0.48	1.74	5.60	1.99	0.15	100	3.83		
UA 2134-19	73.26	0.44	14.15	2.25	0.15	0.51	1.71	5.41	1.98	0.16	100	1.07		
UA 2134-11	73.46	0.42	14.12	2.32	0.12	0.49	1.77	5.24	1.90	0.15	100	1.76		
UA 2134-8	73.48	0.46	13.83	2.43	0.19	0.44	1.76	5.36	1.89	0.15	100	1.30		
UA 2134-14	73.49	0.48	13.90	2.44	0.10	0.52	1.87	5.12	1.92	0.15	100	0.47		
UA 2134-9	73.50	0.45	14.03	2.38	0.16	0.46	1.78	5.19	1.88	0.15	100	2.39		
UA 2134-18	73.52	0.47	13.81	2.54	0.14	0.52	1.85	5.10	1.92	0.13	100	1.63		
UA 2134-10	73.53	0.48	13.96	2.50	0.11	0.52	1.88	4.88	2.02	0.14	100	1.08		
UA 2134-17	73.69	0.48	13.90	2.28	0.10	0.44	1.81	5.35	1.83	0.13	100	1.32		
UA 2134-7	73.72	0.39	14.06	2.11	0.16	0.44	1.80	5.25	1.93	0.15	100	1.39		
UA 2134-6	73.77	0.45	13.80	2.28	0.17	0.50	1.81	5.08	2.00	0.13	100	4.13		
UA 2134-1	73.93	0.42	13.99	2.13	0.11	0.42	1.59	5.12	2.15	0.13	100	1.23		
Mean	73.17	0.47	14.18	2.48	0.13	0.55	1.97	5.01	1.87	0.13	100	1.93	82	
StDev	1.31	0.08	0.33	0.48	0.03	0.16	0.43	0.38	0.11	0.02	0	1.43		
UA1462-17	64.21	0.95	15.84	6.15	0.19	1.78	5.10	4.40	1.29	0.09	100	-0.21		outlier
UA 2134-23	62.41	1.02	15.90	6.78	0.19	2.05	5.52	4.87	1.16	0.10	100	1.19		outlier

ANALYSES FOR REFERENCE SAMPLES AND CORRELATIVE SAMPLES FROM EXTERNAL SITES

Tephra ID	**Sample**	**SiO_2**	**TiO_2**	**Al_2O_3**	**FeO**	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**Cl**	**Total**	**H_2Odifl**	**n**	**Notes**
PA	**UA355-19**	70.72	0.54	14.10	2.69	0.07	0.55	2.18	4.19	4.18	0.78	100	5.03		Reference samples from Gold Hill
	UA355-2	72.29	0.43	13.44	2.64	0.01	0.41	1.79	3.83	4.29	0.86	100	4.77		Provided by J.Westgate, except
	UA355-16	73.06	0.38	13.09	2.45	0.07	0.37	1.44	3.47	4.84	0.83	100	4.68		UA 1327, collected by B.Jensen
	UA355-17	73.16	0.38	13.19	2.37	0.09	0.38	1.53	3.73	4.34	0.82	100	4.90		at Gold Hill II (see Preece et al., 1999)

UA355-4	74.64	0.31	12.82	1.90	0.04	0.29	1.24	3.36	4.73	0.66	100	4.61
UA355-14	74.70	0.39	12.40	1.95	0.01	0.26	1.20	3.33	5.03	0.72	100	4.56
UA355-10	75.00	0.47	12.57	2.01	0.02	0.27	1.28	3.19	4.56	0.62	100	5.64
UT 497 11	70.85	0.45	13.97	2.80	0.09	0.45	1.86	4.08	4.76	0.69	100	6.87
UT 497 5	72.23	0.35	13.46	2.57	0.07	0.38	1.79	3.67	4.75	0.73	100	5.16
UT 497 17	72.37	0.48	13.30	2.59	0.03	0.42	1.69	3.99	4.45	0.67	100	8.40
UT 497 18	72.56	0.39	13.08	2.61	0.08	0.36	1.70	3.52	4.97	0.74	100	5.63
UT 497 4	72.77	0.41	13.33	2.51	0.03	0.43	1.68	3.53	4.64	0.67	100	6.12
UT 497 9	72.84	0.37	13.22	2.45	0.06	0.41	1.50	3.78	4.55	0.81	100	7.46
UT 497 8	72.92	0.39	13.06	2.53	0.08	0.37	1.59	3.36	4.90	0.79	100	6.15
UT 497 13	72.93	0.43	13.04	2.38	0.00	0.35	1.47	3.56	5.07	0.78	100	7.57
UT 497 15	73.09	0.54	13.14	2.53	0.05	0.26	1.55	3.95	4.42	0.47	100	7.57
UT 497 19	73.25	0.30	13.03	2.49	0.03	0.35	1.46	3.93	4.39	0.76	100	6.27
UT 497 2	73.28	0.40	13.22	2.43	0.06	0.33	1.50	3.53	4.58	0.67	100	6.54
UT 497 14	73.38	0.33	12.69	2.43	0.04	0.26	1.70	3.24	5.19	0.72	100	9.02
UT 497 10	73.62	0.37	12.84	2.25	0.03	0.29	1.39	3.40	5.25	0.57	100	7.09
UT 497 3	73.78	0.38	12.92	2.29	0.07	0.36	1.49	3.40	4.56	0.76	100	5.76
UT 497 1	73.81	0.35	12.87	2.23	0.02	0.33	1.35	3.47	4.88	0.70	100	6.36
UT 497 23	73.88	0.41	12.69	2.45	0.06	0.35	1.32	3.44	4.71	0.68	100	5.77
UT 497 20	73.99	0.38	12.85	2.17	0.08	0.30	1.35	3.51	4.74	0.63	100	6.14
UT 497 22	74.05	0.33	12.70	2.18	0.05	0.27	1.30	3.54	4.84	0.74	100	6.24
UT 497 24	74.21	0.49	12.85	2.10	0.11	0.26	1.40	3.17	4.80	0.61	100	5.26
UT 497 7	74.96	0.32	12.27	2.20	0.05	0.31	1.47	3.01	4.71	0.70	100	6.32
UT 497 6	75.03	0.35	12.47	2.14	0.09	0.00	1.34	3.31	4.68	0.57	100	6.66
PA-4	72.42	0.51	13.41	2.67	0.06	0.45	1.83	3.36	4.60	0.69	100	4.39
PA-2	72.50	0.39	13.19	2.78	0.06	0.47	1.67	3.81	4.21	0.92	100	4.62
PA-3	72.86	0.46	13.24	2.77	0.03	0.43	1.87	3.43	4.29	0.61	100	5.37
PA-11	73.02	0.52	13.08	2.73	0.02	0.48	1.76	3.41	4.37	0.61	100	5.26
PA-6	73.66	0.42	12.99	2.43	0.06	0.36	1.59	3.37	4.43	0.70	100	5.69
PA-8	73.67	0.39	12.81	2.38	0.07	0.32	1.53	3.38	4.65	0.80	100	4.72
PA-10	73.73	0.41	12.89	2.50	0.11	0.34	1.50	3.44	4.30	0.79	100	7.34
PA-1	73.80	0.32	12.88	2.46	0.08	0.39	1.48	3.75	4.15	0.69	100	3.76
PA-7	73.82	0.37	12.79	2.36	0.09	0.31	1.43	3.18	4.96	0.69	100	4.75
PA-14	73.92	0.37	12.93	2.29	0.04	0.31	1.46	3.22	4.74	0.71	100	5.52
PA-15	74.00	0.28	12.87	2.31	0.06	0.49	1.39	3.24	4.62	0.75	100	4.78
PA-13	74.00	0.42	12.61	2.39	0.03	0.34	1.46	3.23	4.82	0.71	100	4.94
PA-9	74.09	0.32	12.74	2.37	0.05	0.29	1.45	3.17	4.77	0.76	100	5.43
PA-5	74.12	0.32	12.90	2.48	0.04	0.32	1.39	3.38	4.36	0.69	100	4.00
PA-18	74.20	0.36	12.84	2.24	0.09	0.34	1.47	3.40	4.40	0.67	100	6.14
PA-17	74.28	0.35	12.74	2.18	0.03	0.30	1.34	3.15	4.91	0.72	100	5.42
PA-16	74.64	0.33	12.75	1.99	0.05	0.32	1.33	3.04	4.85	0.70	100	5.74
PA-12	74.93	0.33	12.54	1.96	0.00	0.31	1.23	3.21	4.89	0.60	100	4.70
UA 1327-1	73.25	0.35	13.04	2.51	0.05	0.36	1.45	3.39	4.87	0.73	100	6.54
UA 1327-3	73.41	0.39	13.29	2.73	0.07	0.31	1.44	2.67	5.08	0.59	100	8.51
UA 1327-18	73.42	0.40	13.14	2.34	0.03	0.33	1.53	3.58	4.43	0.79	100	7.26
UA 1327-10	73.49	0.42	13.02	2.48	0.05	0.34	1.49	3.17	4.86	0.68	100	5.32
UA 1327-15	73.72	0.37	12.86	2.47	0.05	0.35	1.49	3.14	4.81	0.74	100	4.61
UA 1327-11	73.80	0.33	13.01	2.39	0.06	0.26	1.34	3.07	5.06	0.69	100	6.29
UA 1327-5	73.92	0.41	12.85	2.35	0.05	0.31	1.39	3.45	4.53	0.73	100	7.88
UA 1327-19	73.94	0.39	13.06	2.57	0.04	0.34	1.45	3.19	4.26	0.77	100	5.64
UA 1327-8	74.30	0.33	12.84	2.24	0.09	0.31	1.38	3.08	4.67	0.76	100	4.31
UA 1327-17	76.56	0.24	12.24	1.21	0.04	0.14	0.84	3.32	5.07	0.35	100	7.74
UA1327-2	69.57	0.46	15.26	2.72	0.07	0.69	2.54	4.06	4.05	0.57	100	4.50

UA1327-7	70.23	0.45	14.86	2.68	0.08	0.57	2.29	3.82	4.35	0.66	100	5.41	
UA1327-1	72.94	0.41	13.17	2.69	0.06	0.37	1.81	3.63	4.34	0.59	100	5.96	
UA1327-9	73.18	0.41	13.27	2.51	0.02	0.33	1.68	3.21	4.78	0.60	100	4.17	
UA1327-17	73.29	0.40	13.28	2.35	0.07	0.36	1.69	3.37	4.52	0.67	100	5.22	
UA1327-12	73.67	0.37	13.11	2.29	0.06	0.33	1.47	3.22	4.85	0.64	100	4.79	
UA1327-6	73.77	0.37	12.84	2.50	0.07	0.27	1.54	3.70	4.23	0.72	100	5.84	
UA1327-14	73.79	0.34	13.07	2.29	0.01	0.32	1.55	3.46	4.53	0.64	100	4.73	
UA1327-4	73.87	0.31	12.93	2.42	0.04	0.28	1.42	3.36	4.76	0.60	100	5.34	
UA1327-8	74.03	0.38	12.94	2.22	0.06	0.29	1.55	3.39	4.37	0.78	100	5.15	
UA1327-15	74.16	0.41	12.93	2.40	0.06	0.31	1.53	2.43	5.08	0.70	100	6.25	
UA1327-19	74.72	0.28	12.58	2.07	0.05	0.27	1.37	3.26	4.82	0.58	100	5.05	
UA1327-5	74.74	0.29	12.58	2.18	0.02	0.27	1.52	3.14	4.65	0.60	100	5.77	
UA1327-16	74.78	0.31	12.81	2.00	0.06	0.28	1.24	3.46	4.50	0.56	100	4.98	
UA1327-13	74.81	0.37	12.44	2.22	0.02	0.29	1.26	3.25	4.77	0.57	100	5.21	
UA1327-20	74.98	0.31	12.53	2.07	0.08	0.35	1.26	3.03	4.79	0.59	100	6.30	
UA1327-3	75.11	0.39	12.62	2.08	0.09	0.00	1.20	3.47	4.44	0.60	100	5.43	
UA1327-11	76.94	0.21	12.09	1.26	0.05	0.16	0.93	3.00	5.00	0.36	100	6.42	
UA 1327-15	69.62	0.53	14.48	3.29	0.03	0.65	2.42	4.29	4.13	0.56	100	5.31	
UA 1327-22	69.87	0.60	14.47	2.97	0.01	0.64	2.30	4.17	4.37	0.60	100	5.52	
UA 1327-13	72.27	0.38	14.01	2.59	0.00	0.39	1.45	3.43	4.77	0.69	100	6.83	
UA 1327-6	72.74	0.30	12.88	2.56	0.04	0.33	1.60	3.60	5.18	0.77	100	5.47	
UA 1327-5	72.96	0.36	13.13	2.45	0.01	0.34	1.48	3.80	4.79	0.68	100	6.49	
UA 1327-20	73.01	0.43	13.06	2.30	0.03	0.29	1.44	4.01	4.64	0.77	100	6.08	
UA 1327-12	73.06	0.37	13.06	2.51	0.09	0.34	1.50	3.67	4.61	0.77	100	5.49	
UA 1327-11	73.16	0.38	13.13	2.30	0.07	0.28	1.47	3.41	5.16	0.64	100	5.38	
UA 1327-23	73.30	0.25	12.93	2.32	0.02	0.26	1.42	3.47	5.30	0.73	100	5.26	
UA 1327-3	73.38	0.34	12.94	2.43	0.05	0.26	1.46	3.51	5.00	0.63	100	6.76	
UA 1327-19	73.52	0.42	12.73	2.34	0.04	0.32	1.44	3.46	5.04	0.68	100	6.15	
UA 1327-21	73.55	0.38	12.54	2.42	0.06	0.27	1.30	3.99	4.48	1.02	100	6.23	
UA 1327-7	74.03	0.39	12.64	2.36	0.04	0.31	1.36	3.67	4.63	0.56	100	5.60	
UA 1327-18	74.14	0.33	12.69	2.31	0.03	0.30	1.22	3.78	4.65	0.55	100	5.84	
UA 1327-24	74.57	0.42	12.37	2.08	0.07	0.27	1.24	3.19	5.16	0.63	100	5.98	
UA 1327-25	76.72	0.21	12.15	1.35	0.06	0.14	0.95	3.41	4.60	0.42	100	6.51	
AVERAGE	73.55	0.38	13.01	2.36	0.05	0.33	1.51	3.45	4.68	0.68	100	5.79	90
STDEV	1.28	0.07	0.52	0.31	0.03	0.11	0.28	0.32	0.29	0.11	0	1.03	
UA 1327-13	62.05	0.74	16.62	5.40	0.10	1.88	4.83	4.66	3.20	0.53	100	2.33	
UA1327-18	64.58	0.84	16.26	4.50	0.12	1.27	4.20	4.38	3.41	0.45	100	2.02	
UA1327-10	66.37	0.69	16.04	3.74	0.03	1.12	3.45	4.46	3.60	0.50	100	1.76	
UA 1327-14	66.92	0.62	15.36	3.75	0.09	0.96	3.11	4.68	3.90	0.61	100	2.94	
UA 1327-2	63.85	0.83	16.50	4.70	0.05	1.53	4.15	4.60	3.27	0.53	100	5.21	
UA 1327-16	64.17	0.81	16.04	4.65	0.07	1.47	4.17	4.60	3.44	0.58	100	2.47	
UA 1327-1	64.24	0.76	16.10	4.96	0.15	1.51	4.19	4.25	3.37	0.48	100	2.09	
UA 1327-9	64.35	0.77	16.32	4.75	0.09	1.47	3.98	4.52	3.48	0.27	100	1.25	
UA 1327-4	64.56	0.86	16.59	4.44	0.10	1.36	3.84	4.29	3.50	0.47	100	6.98	
UA 1327-8	64.58	0.83	16.28	4.82	0.05	1.43	4.12	4.13	3.33	0.41	100	2.98	
UA 1327-14	66.54	0.60	15.97	3.49	0.11	0.98	3.21	4.53	4.01	0.58	100	5.25	
Mean	64.75	0.76	16.19	4.47	0.09	1.36	3.93	4.46	3.50	0.49	100	3.21	11
StDev	1.40	0.09	0.35	0.58	0.03	0.27	0.50	0.18	0.25	0.09	0	1.80	
Mean	72.59	0.42	13.35	2.59	0.06	0.45	1.77	3.56	4.55	0.66	100	5.50	##
StDev	3.04	0.14	1.12	0.75	0.03	0.35	0.82	0.44	0.46	0.12	0	1.39	

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UA351-1	69.55	0.62	14.50	3.13	0.09	0.69	2.45	4.35	4.03	0.59	100	3.54		Reference sample, Fairbanks
UA351-15	69.57	0.53	14.57	3.18	0.06	0.73	2.67	4.32	3.74	0.63	100	1.57		Provided by J.Westgate
UA351-2	69.57	0.65	14.58	3.38	0.08	0.72	2.66	3.98	3.73	0.63	100	1.48		
UA351-20	69.59	0.58	14.23	3.06	0.07	0.69	2.48	4.90	3.83	0.57	100	1.31		
UA351-9	69.76	0.65	14.61	3.27	0.05	0.71	2.55	4.03	3.82	0.55	100	0.69		
UA351-17	69.83	0.60	14.38	3.15	0.11	0.74	2.64	4.13	3.79	0.62	100	1.28		
UA351-11	69.91	0.54	14.36	3.22	0.13	0.69	2.37	4.44	3.81	0.52	100	4.54		
UA351-14	69.93	0.57	14.55	3.12	0.04	0.66	2.55	4.04	3.97	0.58	100	2.92		
UA351-10	70.14	0.55	14.49	3.15	0.11	0.71	2.40	4.08	3.87	0.48	100	2.55		
UA351-12	70.27	0.56	14.79	3.09	0.10	0.68	2.40	3.90	3.72	0.50	100	1.24		
UA351-13	70.36	0.56	14.50	2.91	0.11	0.68	2.40	4.07	3.94	0.49	100	1.00		
UA 351 8	69.37	0.62	14.75	3.32	0.12	0.79	2.69	3.91	4.01	0.43	100	5.85		
UA 351 14	69.65	0.59	14.23	3.36	0.05	0.82	2.70	4.17	3.98	0.45	100	4.85		
UA 351 11	69.77	0.65	14.30	3.22	0.07	0.85	2.73	4.07	3.78	0.56	100	4.93		
UA 351 15	69.91	0.56	14.38	3.34	0.12	0.81	2.57	4.07	3.75	0.48	100	5.42		
UA 351 20	70.19	0.71	14.36	3.22	0.07	0.76	2.64	3.80	3.72	0.54	100	4.89		
AVERAGE	69.84	0.60	14.47	3.20	0.09	0.73	2.56	4.14	3.84	0.54	100	3.00	16	
STDEV	0.29	0.05	0.17	0.12	0.03	0.06	0.12	0.26	0.11	0.06	0	1.83		
UA351-8	71.21	0.44	13.82	2.85	0.04	0.57	2.27	4.07	4.09	0.64	100	4.27		
UA351-18	71.72	0.47	13.93	2.53	0.06	0.50	1.81	3.97	4.37	0.64	100	3.36		
UA351-6	72.08	0.54	13.67	2.61	0.07	0.49	1.80	3.84	4.31	0.59	100	3.21		
UA351-19	72.28	0.55	13.46	2.64	0.04	0.57	1.74	3.98	4.10	0.63	100	3.82		
UA351-5	72.30	0.56	13.59	2.51	0.07	0.43	1.77	3.77	4.43	0.58	100	2.80		
UA351-4	72.50	0.45	13.42	2.56	0.04	0.47	1.74	3.89	4.35	0.57	100	2.80		
UA 351 25	71.67	0.62	13.57	2.79	0.08	0.48	1.88	4.11	4.29	0.50	100	4.09		
UA 351 1	72.04	0.57	13.37	2.62	0.06	0.48	1.92	3.90	4.47	0.57	100	7.39		
UA 351 26	72.11	0.52	13.50	2.51	0.07	0.50	1.98	3.82	4.40	0.60	100	5.60		
UA 351 24	72.31	0.53	13.72	2.72	0.03	0.56	1.87	3.65	4.13	0.48	100	5.65		
UA 351 13	73.39	0.60	13.08	2.45	0.10	0.41	1.54	3.58	4.46	0.40	100	5.21		
UA 351 7	74.66	0.47	12.43	2.28	0.07	0.29	1.05	3.41	4.90	0.44	100	6.06		
AVERAGE	72.36	0.53	13.47	2.59	0.06	0.48	1.78	3.83	4.36	0.55	100	4.52	12	
STDEV	0.90	0.06	0.39	0.15	0.02	0.08	0.29	0.20	0.22	0.08	0	1.45		
AVERAGE	70.92	0.57	14.04	2.94	0.08	0.62	2.22	4.01	4.06	0.54	100	3.66	28	
STDEV	1.41	0.06	0.58	0.33	0.03	0.14	0.44	0.28	0.30	0.07	0	1.82		

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UA 1679-29	77.67	0.16	12.18	1.19	0.07	0.20	1.26	4.45	2.64	0.19	100	5.28	Alyeska Pipeline Viewing area, Alaska
UA 1679-8	77.69	0.23	12.48	1.27	0.10	0.21	1.25	4.16	2.48	0.14	100	6.44	Reference sample
UA 1679-22	77.78	0.22	12.19	1.28	0.09	0.18	1.16	4.46	2.40	0.23	100	5.45	Collected by B.Jensen
UA 1679-5	77.87	0.14	12.36	1.21	0.01	0.17	1.18	4.36	2.52	0.19	100	6.38	
UA 1679-6	77.90	0.25	12.41	1.25	0.05	0.19	1.21	4.17	2.44	0.14	100	6.32	
UA 1679-25	77.90	0.21	12.53	1.22	0.05	0.20	1.22	4.13	2.38	0.15	100	6.40	
UA 1679-1	77.91	0.24	12.29	1.17	0.08	0.22	1.21	4.30	2.43	0.15	100	5.94	
UA 1679-24	77.93	0.28	12.31	1.20	0.07	0.21	1.21	4.13	2.50	0.17	100	5.74	
UA 1679-10	78.00	0.18	12.18	1.24	0.10	0.23	1.30	4.30	2.29	0.18	100	5.21	
UA 1679-18	78.01	0.26	12.18	1.21	0.09	0.20	1.29	4.14	2.46	0.16	100	6.45	
UA 1679-19	78.03	0.21	12.32	1.26	0.05	0.17	1.26	4.19	2.40	0.11	100	6.15	

UA 1679-27	78.03	0.19	12.25	1.25	0.08	0.25	1.25	4.19	2.36	0.16	100	5.63	
UA 1679-9	78.04	0.18	11.99	1.30	0.01	0.18	1.24	4.52	2.37	0.17	100	5.25	
UA 1679-13	78.05	0.19	12.35	1.22	0.03	0.21	1.13	4.24	2.45	0.13	100	5.98	
UA 1679-26	78.08	0.21	12.37	1.29	0.06	0.23	1.28	3.89	2.47	0.10	100	6.22	
UA 1679-28	78.12	0.24	12.10	1.13	0.08	0.19	1.19	4.42	2.39	0.14	100	5.12	
UA 1679-17	78.12	0.21	12.27	1.29	0.08	0.20	1.26	3.91	2.49	0.16	100	4.66	
UA 1679-30	78.15	0.19	12.23	1.22	0.07	0.20	1.23	4.07	2.50	0.16	100	5.52	
UA 1679-12	78.17	0.19	12.21	1.21	0.02	0.22	1.26	4.15	2.46	0.13	100	6.06	
UA 1679-15	78.18	0.18	12.09	1.23	0.04	0.21	1.19	4.26	2.47	0.14	100	6.82	
UA 1679-11	78.18	0.19	12.27	1.26	0.04	0.21	1.16	4.13	2.37	0.19	100	6.83	
UA 1679-7	78.22	0.19	12.35	1.20	0.00	0.20	1.20	3.97	2.49	0.19	100	6.38	
UA 1679-2	78.26	0.17	12.15	1.09	0.08	0.19	1.20	4.38	2.36	0.12	100	5.68	
UA 1679-3	78.27	0.16	12.05	1.19	0.05	0.22	1.24	4.25	2.47	0.09	100	5.28	
UA 1679-4	78.34	0.21	12.09	1.09	0.08	0.19	1.34	4.19	2.30	0.17	100	6.97	
UA 1679-20	78.56	0.16	12.24	1.24	0.05	0.21	1.25	3.59	2.53	0.18	100	6.55	
UA 1679-16	78.60	0.26	12.17	1.18	0.04	0.25	1.16	3.80	2.38	0.16	100	6.78	
UA 1679-14	78.63	0.12	12.22	1.27	0.01	0.19	1.21	3.77	2.46	0.11	100	7.63	
UA 1679-21	78.74	0.23	12.04	1.11	0.07	0.15	1.09	4.10	2.27	0.20	100	6.45	
UA 1679-7	76.97	0.32	12.79	1.56	0.02	0.32	1.31	4.07	2.41	0.29	100	14.26	
UA 1679-16	77.66	0.16	12.47	1.24	0.11	0.20	1.19	4.33	2.51	0.17	100	4.78	
UA 1679-20	77.82	0.24	12.29	1.31	0.10	0.22	1.24	4.11	2.58	0.15	100	5.12	
UA 1679-2	77.93	0.21	12.37	1.21	0.04	0.20	1.26	4.24	2.39	0.20	100	7.25	
UA 1679-24	77.94	0.19	12.24	1.34	0.11	0.23	1.27	4.16	2.39	0.17	100	5.55	
UA 1679-25	77.97	0.23	12.36	1.27	0.04	0.18	1.14	4.27	2.41	0.17	100	5.06	
UA 1679-14	78.00	0.18	12.34	1.25	0.00	0.21	1.27	4.07	2.55	0.16	100	5.83	
UA 1679-10	78.06	0.25	12.26	1.25	0.05	0.21	1.25	4.08	2.50	0.13	100	5.45	
UA 1679-13	78.06	0.20	12.30	1.19	0.10	0.19	1.23	4.22	2.35	0.20	100	5.85	
UA 1679-12	78.08	0.25	12.28	1.20	0.08	0.24	1.31	4.17	2.30	0.14	100	6.40	
UA 1679-22	78.17	0.27	12.20	1.28	0.07	0.21	1.21	4.10	2.37	0.17	100	5.17	
UA 1679-15	78.19	0.16	12.12	1.26	0.09	0.18	1.29	4.27	2.31	0.15	100	5.64	
UA 1679-17	78.26	0.22	12.09	1.26	0.05	0.21	1.22	4.25	2.30	0.18	100	5.16	
UA 1679-19	78.37	0.27	12.02	1.24	0.03	0.16	1.26	4.18	2.36	0.15	100	5.21	
UA 1679-1	78.42	0.22	12.27	1.28	0.04	0.20	1.25	3.98	2.23	0.14	100	6.33	
UA 1679-18	78.43	0.18	12.12	1.19	0.02	0.23	1.21	4.13	2.36	0.17	100	5.75	
UA 1679-8	78.46	0.19	12.13	1.05	0.04	0.19	1.26	4.10	2.46	0.17	100	4.17	
UA 1679-9	78.52	0.24	12.08	1.19	0.04	0.24	1.27	3.97	2.32	0.15	100	8.39	
UA 1679-21	78.53	0.22	12.17	1.25	0.07	0.13	1.28	3.86	2.38	0.14	100	5.38	
UA 1679-23	78.63	0.18	11.95	1.15	0.01	0.19	1.32	3.98	2.43	0.20	100	6.49	
UA 1679-3	78.66	0.20	12.18	1.09	0.06	0.21	1.24	3.98	2.28	0.13	100	5.58	
UA 1679-5	78.69	0.27	11.94	1.20	0.07	0.17	1.24	4.08	2.21	0.16	100	6.47	
UA 1679-6	78.80	0.25	11.93	1.19	0.01	0.17	1.22	3.96	2.34	0.17	100	6.70	
UA 1679-4	79.03	0.24	12.26	1.19	0.00	0.24	1.24	3.30	2.36	0.18	100	6.65	
UA 1679-11	79.23	0.18	12.04	1.19	0.01	0.18	1.17	3.65	2.25	0.14	100	6.35	
Mean	78.19	0.21	12.22	1.22	0.05	0.20	1.23	4.11	2.41	0.16	100	6.12	54
StDev	0.38	0.04	0.16	0.08	0.03	0.03	0.05	0.22	0.09	0.03	0	1.37	
UA 1679-23	66.20	1.05	15.42	4.74	0.13	1.35	3.42	4.66	2.93	0.10	100	1.15	P2b

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UA 1542-27	77.46	0.26	12.29	1.59	0.04	0.22	1.20	4.35	2.40	0.20	100	5.92	Chester Bluff, Alaska
UA 1542-26	77.61	0.16	12.19	1.23	0.06	0.18	1.17	4.69	2.50	0.21	100	4.47	Collected by B.Jensen at a new,
UA 1542-16	77.68	0.18	12.32	1.20	0.05	0.21	1.26	4.57	2.40	0.12	100	5.92	

UA 1542-18	77.72	0.23	12.14	1.25	0.04	0.21	1.26	4.50	2.50	0.15	100	5.00	
UA 1542-22	77.74	0.27	12.17	1.14	0.07	0.21	1.18	4.64	2.40	0.18	100	6.47	
UA 1542-30	77.84	0.14	12.37	1.14	0.06	0.21	1.20	4.45	2.39	0.19	100	5.33	
UA 1542-24	77.86	0.24	12.20	1.21	0.03	0.24	1.24	4.42	2.44	0.13	100	6.74	
UA 1542-4	77.88	0.20	12.45	1.18	0.12	0.25	1.28	4.01	2.45	0.18	100	6.27	
UA 1542-8	77.93	0.17	12.19	1.24	0.03	0.22	1.31	4.21	2.52	0.18	100	6.21	
UA 1542-14	77.97	0.20	12.17	1.22	0.04	0.20	1.14	4.51	2.48	0.07	100	4.20	
UA 1542-23	78.05	0.24	11.86	1.21	0.09	0.21	1.16	4.63	2.41	0.13	100	5.64	
UA 1542-19	78.09	0.17	12.28	1.18	0.03	0.22	1.29	4.30	2.29	0.17	100	5.52	
UA 1542-25	78.10	0.20	12.10	1.24	0.01	0.17	1.17	4.52	2.37	0.12	100	4.94	
UA 1542-13	78.23	0.22	12.25	1.20	0.04	0.23	1.24	3.99	2.41	0.20	100	5.23	
UA 1542-17	78.24	0.11	12.18	1.22	0.06	0.21	1.20	4.12	2.51	0.15	100	5.84	
UA 1542-28	78.25	0.22	12.25	1.27	0.03	0.20	1.21	4.04	2.37	0.15	100	6.74	
UA 1542-29	78.28	0.26	12.15	1.11	0.02	0.20	1.26	4.23	2.37	0.12	100	5.63	
UA 1542-15	78.29	0.20	12.08	1.19	0.10	0.17	1.29	4.20	2.40	0.08	100	5.77	
UA 1542-2	78.30	0.19	12.03	1.18	0.03	0.15	1.37	4.11	2.52	0.12	100	5.42	
UA 1542-7	78.34	0.21	12.07	1.14	0.11	0.14	1.19	4.24	2.38	0.18	100	4.93	
UA 1542-1	78.46	0.26	12.06	1.28	0.01	0.23	1.23	3.83	2.53	0.12	100	5.79	
UA 1542-12	78.48	0.18	12.26	1.21	0.01	0.21	1.20	3.83	2.51	0.12	100	6.18	
UA 1542-3	78.53	0.25	12.34	1.31	0.03	0.23	1.26	3.43	2.43	0.19	100	7.67	
UA 1542-20	78.58	0.19	12.12	1.22	0.08	0.22	1.30	3.74	2.37	0.19	100	7.08	
UA 1542-5	78.59	0.15	12.02	1.12	0.07	0.18	1.15	4.08	2.42	0.21	100	5.77	
UA 1542-6	78.60	0.17	12.17	1.17	0.06	0.22	1.18	4.00	2.29	0.15	100	5.65	
UA 1542-10	78.84	0.23	11.98	1.22	0.07	0.15	1.21	3.84	2.33	0.13	100	6.20	
UA 1542-11	78.87	0.18	12.15	1.20	0.00	0.22	1.22	3.71	2.30	0.14	100	6.68	
UA 1542-14	77.77	0.26	12.43	1.25	0.05	0.21	1.24	4.33	2.34	0.17	100	5.40	
UA 1542-7	77.78	0.20	12.34	1.37	0.04	0.16	1.29	4.22	2.45	0.18	100	4.96	
UA 1542-15	77.88	0.18	12.37	1.22	0.02	0.17	1.29	4.31	2.45	0.14	100	5.02	
UA 1542-23	78.05	0.19	12.20	1.31	0.00	0.18	1.28	4.23	2.42	0.18	100	6.09	
UA 1542-22	78.08	0.27	12.23	1.28	0.04	0.21	1.31	3.99	2.48	0.14	100	5.78	
UA 1542-8	78.16	0.22	12.40	1.16	0.05	0.17	1.25	4.21	2.24	0.16	100	5.88	
UA 1542-20	78.16	0.21	12.27	1.24	0.05	0.18	1.30	4.04	2.39	0.19	100	5.32	
UA 1542-16	78.18	0.22	12.28	1.25	0.07	0.26	1.25	4.08	2.30	0.16	100	5.34	
UA 1542-17	78.18	0.27	12.15	1.28	0.02	0.15	1.27	4.27	2.29	0.14	100	6.44	
UA 1542-10	78.22	0.26	12.25	1.23	0.00	0.19	1.21	4.13	2.38	0.18	100	6.31	
UA 1542-3	78.26	0.25	12.16	1.13	0.02	0.21	1.26	4.27	2.33	0.14	100	5.71	
UA 1542-9	78.30	0.24	12.17	1.16	0.04	0.22	1.21	4.12	2.43	0.14	100	7.38	
UA 1542-18	78.32	0.20	12.20	1.25	0.03	0.19	1.28	4.02	2.41	0.14	100	6.33	
UA 1542-4	78.34	0.18	12.28	1.28	0.07	0.18	1.26	4.22	2.08	0.13	100	6.05	
UA 1542-12	78.35	0.19	12.33	1.11	0.05	0.17	1.20	4.16	2.32	0.15	100	5.80	
UA 1542-5	78.36	0.26	11.96	1.02	0.06	0.27	1.17	4.64	2.13	0.17	100	9.08	
UA 1542-6	78.44	0.29	12.13	1.19	0.04	0.17	1.22	4.14	2.27	0.15	100	4.70	
UA 1542-24	78.51	0.20	12.14	1.27	0.06	0.15	1.19	4.09	2.24	0.18	100	6.43	
UA 1542-11	78.56	0.20	12.03	1.18	0.05	0.17	1.24	4.09	2.37	0.15	100	5.34	
UA 1542-21	78.63	0.28	11.97	1.23	0.04	0.19	1.25	4.13	2.17	0.16	100	6.26	
UA 1542-1	78.65	0.33	11.93	1.05	0.08	0.15	1.21	4.11	2.35	0.17	100	6.92	
UA 1542-25	78.68	0.16	12.09	1.20	0.07	0.18	1.19	3.93	2.35	0.19	100	6.76	
UA 1542-19	78.69	0.25	11.86	1.22	0.05	0.21	1.22	4.05	2.33	0.15	100	5.92	
UA 1542-2	78.76	0.12	11.77	1.15	0.03	0.20	1.19	4.17	2.45	0.19	100	5.70	
Mean	78.23	0.21	12.17	1.21	0.05	0.20	1.23	4.18	2.38	0.16	100	5.93	52
StDev	0.34	0.04	0.15	0.08	0.03	0.03	0.05	0.25	0.10	0.03	0	0.84	
UA 1542-13	68.39	1.01	14.57	4.56	0.00	0.93	2.77	4.48	3.24	0.06	100	2.80	P2b
UA 1542-15	68.95	1.08	14.43	3.71	0.08	0.95	2.67	4.30	3.77	0.06	100	1.03	P2b

UA 1542-5	74.63	0.36	13.15	1.76	0.07	0.25	1.25	4.00	4.31	0.22	100	4.13		THt
UA 1542-21	74.96	0.31	13.10	1.73	0.06	0.20	1.11	3.97	4.37	0.19	100	5.67		THt

THt, APt and P2b?

UA 1448-33	74.29	0.35	13.53	1.65	0.01	0.27	1.35	3.86	4.51	0.21	100	5.01		Junction site, Alaska
UA 1448-9	74.61	0.38	13.18	1.78	0.04	0.22	1.15	4.01	4.42	0.29	100	4.39		sample for THt
UA 1448-7	74.62	0.33	13.23	1.78	0.12	0.24	1.20	3.68	4.61	0.25	100	5.54		Collected by B.Jensen
UA 1448-18	74.69	0.28	13.22	1.87	0.02	0.24	1.16	3.93	4.35	0.28	100	4.88		
UA 1448-26	74.73	0.32	13.18	1.88	0.10	0.22	1.14	3.78	4.44	0.27	100	4.01		
UA 1448-38	74.76	0.38	13.31	1.77	0.07	0.22	1.08	3.91	4.34	0.21	100	4.26		
UA 1448-30	74.84	0.28	13.13	1.80	0.07	0.24	1.19	3.93	4.31	0.27	100	5.14		
UA 1448-10	74.84	0.25	13.29	1.86	0.09	0.21	1.08	3.99	4.21	0.25	100	4.59		
UA 1448-27	74.87	0.37	13.26	1.65	0.01	0.22	1.08	4.06	4.28	0.27	100	4.62		
UA 1448-14	74.91	0.26	13.30	1.81	0.05	0.25	1.19	3.85	4.18	0.27	100	4.56		
UA 1448-1	74.92	0.23	13.31	1.79	0.06	0.23	1.11	3.85	4.31	0.25	100	4.92		
UA 1448-36	74.93	0.27	13.14	1.79	0.04	0.21	1.14	3.92	4.34	0.28	100	5.23		
UA 1448-44	74.93	0.26	13.02	1.82	0.03	0.20	1.13	4.03	4.37	0.26	100	5.30		
UA 1448-21	74.95	0.21	13.19	1.78	0.05	0.22	1.21	3.82	4.38	0.25	100	4.94		
UA 1448-24	75.01	0.32	13.07	1.83	0.06	0.24	1.15	3.90	4.23	0.24	100	5.23		
UA 1448-3	75.03	0.29	13.32	1.71	0.02	0.22	1.08	3.71	4.39	0.27	100	4.31		
UA 1448-29	75.08	0.32	13.04	1.63	0.05	0.23	1.12	4.01	4.34	0.23	100	5.36		
UA 1448-23	75.09	0.30	13.08	1.77	0.06	0.20	1.15	3.92	4.21	0.28	100	4.39		
UA 1448-13	75.12	0.21	13.25	1.85	0.02	0.22	1.11	3.84	4.22	0.21	100	4.95		
UA 1448-17	74.58	0.31	13.15	1.74	0.02	0.21	1.35	3.84	4.58	0.23	100	4.66		
UA 1448-6	74.77	0.21	13.21	1.83	0.01	0.26	1.09	4.05	4.35	0.21	100	5.40		
UA 1448-3	74.78	0.26	13.16	1.78	0.11	0.21	1.12	4.01	4.31	0.25	100	4.25		
UA 1448-15	74.83	0.25	13.27	1.74	0.06	0.20	1.14	3.86	4.43	0.23	100	5.17		
UA 1448-5	74.89	0.34	13.07	1.80	0.07	0.21	1.09	3.85	4.48	0.22	100	5.05		
UA 1448-19	74.90	0.28	13.05	1.73	0.00	0.22	1.18	3.99	4.45	0.20	100	4.88		
UA 1448-8	74.90	0.23	12.96	1.89	0.07	0.27	1.13	3.86	4.46	0.23	100	3.44		
UA 1448-10	75.01	0.32	13.25	1.80	0.06	0.24	1.07	3.82	4.14	0.29	100	4.91		
UA 1448-11	75.02	0.31	13.15	1.73	0.07	0.21	1.14	3.81	4.31	0.27	100	4.24		
UA 1448-1	75.14	0.26	13.02	1.74	0.02	0.20	1.13	4.05	4.20	0.23	100	3.75		
UA 1448-12	75.24	0.27	13.11	1.83	0.03	0.23	1.09	3.68	4.25	0.28	100	4.72		
UA 1448-30	74.96	0.25	13.34	1.85	0.03	0.22	1.18	3.61	4.26	0.29	100	5.95		
UA 1448-23	75.02	0.29	13.38	1.84	0.03	0.24	1.11	3.52	4.31	0.26	100	6.01		
UA 1448-25	75.15	0.30	13.12	1.86	0.06	0.20	1.15	3.64	4.25	0.27	100	6.25		
UA 1448-18	75.39	0.26	13.22	1.64	0.06	0.21	1.23	3.78	3.94	0.26	100	5.74		
Mean	74.91	0.29	13.19	1.78	0.05	0.22	1.15	3.86	4.33	0.25	100	4.88	34	Pop. 1: THt
StDev	0.21	0.05	0.12	0.07	0.03	0.02	0.07	0.13	0.13	0.03	0	0.63		
UA 1448-37	77.76	0.16	12.51	1.37	0.03	0.16	1.24	4.17	2.50	0.16	100	5.94		
UA 1448-15	78.05	0.18	12.39	1.27	0.00	0.17	1.23	4.29	2.33	0.12	100	5.00		
UA 1448-17	78.12	0.27	12.26	1.32	0.04	0.21	1.17	4.18	2.31	0.16	100	4.93		
UA 1448-41	78.13	0.28	12.11	1.22	0.09	0.25	1.23	4.09	2.49	0.14	100	4.76		
UA 1448-6	78.15	0.18	12.08	1.29	0.03	0.23	1.21	4.37	2.34	0.16	100	5.15		
UA 1448-8	78.38	0.19	12.05	1.20	0.06	0.19	1.20	4.24	2.37	0.17	100	4.88		
UA 1448-20	78.44	0.20	12.02	1.20	0.04	0.19	1.23	3.91	2.62	0.18	100	4.44		
UA 1448-39	78.49	0.29	12.05	1.35	0.03	0.17	1.20	3.94	2.36	0.16	100	5.23		
UA 1448-4	78.60	0.20	11.98	1.24	0.07	0.13	1.22	4.20	2.23	0.16	100	5.03		
UA 1448-13	78.00	0.23	12.04	1.22	0.05	0.19	1.29	4.34	2.47	0.17	100	5.62		
UA 1448-20	78.42	0.19	11.99	1.21	0.04	0.20	1.31	4.06	2.43	0.15	100	5.95		

UA 1448-4	78.59	0.17	11.88	1.26	0.07	0.18	1.33	4.32	2.05	0.15	100	3.83		
UA 1448-3	77.58	0.27	12.67	1.28	0.09	0.19	1.25	3.95	2.55	0.18	100	6.26		
UA 1448-12	78.03	0.20	12.54	1.40	0.04	0.18	1.25	3.81	2.46	0.09	100	5.24		
UA 1448-22	78.15	0.29	12.51	1.25	0.07	0.20	1.26	3.79	2.29	0.19	100	5.66		
UA 1448-7	78.26	0.27	12.05	1.28	0.06	0.20	1.25	4.20	2.28	0.16	100	5.19		
UA 1448-20	78.31	0.23	11.98	1.25	0.07	0.21	1.22	3.92	2.68	0.13	100	5.84		
UA 1448-11	78.32	0.21	12.25	1.28	0.08	0.22	1.27	3.93	2.28	0.16	100	5.21		
UA 1448-5	79.82	0.16	12.13	1.17	0.03	0.18	1.27	2.84	2.20	0.19	100	6.68		
Mean	78.29	0.22	12.18	1.27	0.05	0.19	1.24	4.03	2.38	0.16	100	5.31	19	Pop. 2: APt
StDev	0.45	0.05	0.23	0.06	0.02	0.03	0.04	0.34	0.15	0.02	0	0.66		
UA 1448-35	66.27	1.11	15.67	4.51	0.10	1.18	3.66	4.60	2.85	0.06	100	0.60		
UA 1448-5	66.52	1.00	15.56	4.65	0.09	1.29	3.37	4.45	3.00	0.08	100	1.18		
UA 1448-28	66.61	1.13	15.66	4.59	0.05	1.24	3.38	4.31	2.96	0.07	100	1.63		
UA 1448-32	66.65	1.16	15.32	4.69	0.09	1.18	3.19	4.45	3.23	0.06	100	-0.44		
UA 1448-16	66.67	1.02	15.60	4.47	0.07	1.35	3.24	4.51	3.02	0.06	100	3.38		
UA 1448-43	66.80	1.13	15.63	4.36	0.06	1.28	3.39	4.39	2.93	0.05	100	1.08		
UA 1448-19	66.93	1.22	15.10	4.58	0.08	1.26	3.08	4.61	3.09	0.06	100	-0.10		
UA 1448-31	67.08	1.07	15.15	4.66	0.12	1.15	3.18	4.40	3.15	0.06	100	0.64		
UA 1448-11	67.13	1.13	15.16	4.42	0.09	1.19	3.13	4.65	3.06	0.05	100	2.26		
UA 1448-2	67.15	1.09	15.00	4.47	0.07	1.17	3.22	4.68	3.10	0.06	100	1.40		
UA 1448-42	67.50	1.11	15.06	4.51	0.08	1.17	3.00	4.42	3.10	0.07	100	1.46		
UA 1448-34	67.51	1.07	15.09	4.64	0.06	1.04	3.06	4.44	3.03	0.08	100	0.97		
UA 1448-22	67.65	1.19	15.20	4.27	0.04	1.12	3.06	4.38	3.06	0.04	100	1.13		
UA 1448-18	66.67	1.01	15.06	4.71	0.08	1.34	3.44	4.59	3.02	0.07	100	1.70		
UA 1448-9	66.74	1.05	15.78	4.42	0.06	1.12	3.21	4.51	3.06	0.07	100	0.87		
UA 1448-16	66.78	1.12	15.01	4.59	0.10	1.25	3.31	4.47	3.33	0.03	100	1.03		
UA 1448-14	66.84	1.12	15.29	4.51	0.04	1.15	3.24	4.70	3.05	0.07	100	2.48		
UA 1448-7	66.91	1.06	15.18	4.45	0.04	1.17	3.29	4.65	3.22	0.03	100	1.12		
UA 1448-2	66.98	1.05	14.84	4.48	0.06	1.22	3.38	4.83	3.13	0.03	100	0.76		
UA 1448-10	65.59	1.11	15.92	4.79	0.09	1.34	3.66	4.55	2.87	0.08	100	1.83		
UA 1448-9	65.99	1.02	15.57	4.64	0.08	1.32	3.76	4.52	2.99	0.11	100	1.71		
UA 1448-24	66.36	1.12	16.02	4.48	0.06	1.19	3.46	4.20	3.03	0.09	100	5.20		
UA 1448-27	66.87	1.11	15.16	4.64	0.11	1.13	3.33	4.48	3.10	0.08	100	1.82		
UA 1448-4	66.89	1.16	15.47	4.41	0.09	1.24	3.46	4.31	2.89	0.07	100	2.36		
UA 1448-26	66.92	1.13	14.99	4.73	0.07	1.28	3.39	4.39	3.00	0.09	100	1.70		
UA 1448-29	66.97	1.08	15.48	4.41	0.11	1.22	3.41	4.04	3.20	0.07	100	1.15		
UA 1448-2	67.06	1.04	15.16	4.64	0.08	1.19	3.19	4.56	3.01	0.06	100	1.56		
UA 1448-19	67.34	1.09	15.13	4.64	0.10	1.06	3.25	4.33	3.01	0.05	100	2.64		
UA 1448-17	67.53	1.11	15.02	4.45	0.11	1.13	3.03	4.37	3.14	0.11	100	1.98		
UA 1448-15	67.54	1.06	15.02	4.51	0.11	1.08	3.14	4.10	3.38	0.07	100	2.36		
UA 1448-21	67.81	1.17	15.14	4.74	0.11	1.12	3.25	3.49	3.13	0.03	100	3.76		
Mean	66.91	1.10	15.31	4.55	0.08	1.20	3.29	4.43	3.07	0.06	100	1.65	31	Pop.3: Plots well with P2b
StDev	0.48	0.05	0.31	0.13	0.02	0.08	0.19	0.24	0.12	0.02	0	1.10		
UA 1448-16	75.60	0.29	13.33	1.87	0.04	0.25	1.12	2.76	4.52	0.23	100	5.86		
UA 1448-6	75.75	0.27	13.40	1.86	0.07	0.22	1.20	2.56	4.46	0.21	100	6.09		
UA 1448-8	76.10	0.39	13.28	1.72	0.07	0.23	1.02	2.63	4.35	0.20	100	6.57		
UA 1448-13	76.16	0.36	13.31	1.86	0.03	0.20	1.11	2.55	4.21	0.21	100	6.58		
Mean	75.90	0.33	13.33	1.83	0.05	0.22	1.11	2.63	4.38	0.21	100	6.27	4	with 1070/71/72
StDev	0.27	0.06	0.05	0.07	0.02	0.02	0.07	0.10	0.13	0.01	0	0.36		**(not present in Palisades samples)**

Noyes tephra

UA 1071-7	73.84	0.13	15.32	1.39	0.04	0.51	2.15	4.27	2.31	0.02	100	7.61		Chester Bluff, Alaska
UA 1072-4	74.08	0.17	15.26	1.36	0.01	0.38	1.99	4.35	2.40	0.02	100	4.30		Reference sample for Noyes
UA 1072-5	74.35	0.16	14.94	1.58	0.04	0.40	1.81	4.04	2.63	0.05	100	6.03		Collected by B.Jensen
UA 1072-3	74.61	0.19	14.84	1.39	0.06	0.45	1.72	3.99	2.69	0.06	100	8.45		(undescribed tephra in Fig. 3 of Jensen
UA 1071-11	74.67	0.22	14.85	1.30	0.07	0.43	1.78	4.13	2.48	0.07	100	6.14		et al., 2008)
UA 1072-15	74.69	0.19	14.66	1.58	0.09	0.49	1.75	3.97	2.56	0.03	100	8.24		
UA 1072-9	74.80	0.17	14.80	1.45	0.03	0.44	1.72	3.98	2.55	0.07	100	8.19		
UA 1072-13	74.86	0.16	14.90	1.37	0.00	0.45	1.80	3.92	2.48	0.06	100	9.11		
UA 1071-14	74.87	0.15	14.69	1.48	0.07	0.46	1.82	3.79	2.61	0.07	100	9.44		
UA 1072-2	74.96	0.23	14.68	1.31	0.04	0.41	1.59	4.07	2.66	0.06	100	6.36		
UA 1071-19	75.00	0.23	14.67	1.37	0.06	0.42	1.70	3.92	2.56	0.06	100	7.62		
UA 1071-18	75.17	0.20	14.72	1.30	0.00	0.40	1.78	3.86	2.55	0.02	100	5.95		
UA 1071-1	75.19	0.22	14.73	1.32	0.06	0.36	1.76	3.78	2.57	0.01	100	5.67		
UA1071-6	74.07	0.21	14.82	1.24	0.08	0.41	1.80	4.50	2.57	0.32	100	5.38		
UA1072-7	74.18	0.17	15.09	1.51	0.07	0.41	1.83	4.11	2.56	0.06	100	9.17		
UA1072-14	74.28	0.23	14.92	1.53	0.06	0.43	1.84	4.21	2.47	0.04	100	7.98		
UA1071-2	74.48	0.17	14.82	1.34	0.07	0.46	1.82	4.20	2.60	0.04	100	4.08		
UA1071-5	74.51	0.19	14.76	1.17	0.06	0.47	1.86	4.35	2.61	0.02	100	6.35		
UA1071-9	74.59	0.16	14.72	1.36	0.03	0.40	1.84	4.24	2.60	0.06	100	6.15		
UA1072-12	74.60	0.13	14.73	1.30	0.00	0.43	1.79	4.42	2.57	0.03	100	1.91		
UA1072-5	74.64	0.17	14.73	1.44	0.05	0.45	1.76	3.93	2.76	0.08	100	9.06		
UA1071-15	74.65	0.18	14.83	1.29	0.05	0.49	1.82	4.05	2.59	0.04	100	8.11		
UA1071-15	74.67	0.16	14.94	1.35	0.05	0.42	1.78	3.96	2.61	0.05	100	6.22		
UA1071-1	74.73	0.21	14.71	1.38	0.11	0.34	1.59	3.94	2.75	0.24	100	5.05		
UA1070-1	74.75	0.16	14.71	1.32	0.05	0.48	1.94	3.95	2.60	0.05	100	5.59		
UA1072-11	74.76	0.13	14.71	1.45	0.08	0.44	1.81	4.04	2.53	0.05	100	8.61		
UA1072-8	74.80	0.17	14.67	1.44	0.00	0.57	1.84	3.84	2.63	0.04	100	5.52		
UA1072-14	74.81	0.18	14.68	1.36	0.06	0.46	1.74	3.89	2.76	0.07	100	8.23		
UA1072-13	74.83	0.14	14.64	1.43	0.04	0.44	1.81	4.11	2.54	0.01	100	5.03		
UA1071-16	74.85	0.13	14.80	1.31	0.01	0.37	1.84	4.08	2.57	0.05	100	5.06		
UA1072-3	74.85	0.12	14.75	1.45	0.07	0.40	1.78	3.97	2.53	0.06	100	4.68		
UA1071-12	74.88	0.17	14.60	1.35	0.00	0.47	1.74	4.11	2.65	0.04	100	4.35		
UA1072-11	74.90	0.17	14.68	1.35	0.03	0.50	1.71	4.06	2.57	0.03	100	2.52		
UA1072-20	74.93	0.15	14.73	1.39	0.02	0.43	1.75	4.05	2.50	0.04	100	7.32		
UA1072-1	74.94	0.19	14.82	1.37	0.02	0.41	1.68	3.83	2.68	0.04	100	3.95		
UA1072-6	74.98	0.20	14.84	1.33	0.00	0.46	1.85	3.74	2.58	0.02	100	7.50		
UA1072-4	75.02	0.15	14.67	1.28	0.10	0.40	1.88	3.87	2.59	0.03	100	6.62		
UA1071-12	75.07	0.14	14.70	1.50	0.05	0.45	1.81	3.55	2.70	0.01	100	6.74		
UA1071-14	75.08	0.18	14.46	1.35	0.10	0.38	1.73	4.13	2.54	0.06	100	5.16		
UA1071-20	75.11	0.21	14.63	1.34	0.05	0.43	1.74	3.73	2.72	0.02	100	6.22		
UA1071-17	75.25	0.11	14.95	1.41	0.07	0.40	1.80	3.43	2.54	0.04	100	5.38		
UA1072-5	75.40	0.19	14.24	1.41	0.03	0.46	1.59	3.86	2.77	0.04	100	5.10		
Mean	74.75	0.17	14.77	1.38	0.05	0.43	1.79	4.00	2.59	0.05	100	6.34	42	Noyes
StDev	0.33	0.03	0.18	0.09	0.03	0.04	0.10	0.21	0.09	0.05	0	1.80		
UA 1071-10	74.38	0.32	13.74	2.01	0.09	0.34	1.14	3.46	4.26	0.27	100	7.80		
UA 1072-19	74.75	0.29	13.34	2.02	0.08	0.18	1.26	3.38	4.47	0.22	100	7.52		
UA 1072-12	74.87	0.25	13.35	2.00	0.01	0.16	1.07	3.60	4.44	0.25	100	7.69		
UA 1072-7	75.00	0.26	13.28	1.81	0.05	0.16	1.20	3.70	4.31	0.22	100	6.29		

UA 1072-16	75.05	0.23	13.16	1.95	0.08	0.20	1.12	3.50	4.51	0.20	100	5.83		
UA 1071-9	75.29	0.25	13.03	1.79	0.06	0.21	1.14	3.72	4.28	0.23	100	6.26		
UA 1072-14	75.41	0.26	13.27	1.75	0.02	0.21	1.14	3.25	4.48	0.21	100	6.26		
UA1071-7	74.56	0.33	13.50	1.77	0.02	0.25	1.17	3.90	4.26	0.26	100	9.36		
UA1071-1	74.59	0.29	13.28	1.94	0.03	0.21	1.14	3.64	4.65	0.23	100	7.13		
UA1071-3	74.67	0.37	13.26	1.94	0.07	0.21	1.11	3.66	4.47	0.24	100	5.70		
UA1072-18	74.71	0.27	13.07	2.01	0.05	0.26	1.16	3.67	4.51	0.28	100	4.81		
UA1071-4	74.74	0.31	13.34	2.00	0.03	0.19	1.19	3.54	4.39	0.28	100	5.06		
UA1071-5	74.78	0.30	13.09	1.93	0.03	0.26	1.16	3.66	4.56	0.24	100	4.17		
UA1071-6	74.84	0.27	13.01	2.04	0.01	0.23	1.18	3.76	4.37	0.28	100	4.96		
UA1071-17	74.90	0.28	13.28	1.86	0.04	0.21	1.13	3.82	4.21	0.28	100	5.81		
UA1072-10	74.93	0.22	13.12	1.95	0.08	0.24	1.15	3.61	4.42	0.29	100	4.37		
UA1072-18	74.95	0.33	13.20	1.86	0.05	0.21	1.11	3.74	4.27	0.27	100	3.98		
UA1072-17	74.96	0.31	13.24	1.87	0.02	0.20	1.16	3.63	4.33	0.29	100	4.73		
UA1071-2	74.96	0.29	13.16	1.97	0.07	0.21	1.09	3.53	4.48	0.22	100	5.68		
UA1071-11	74.98	0.30	13.08	1.83	0.05	0.25	1.10	3.73	4.42	0.28	100	4.82		
UA1072-9	75.06	0.29	13.08	1.97	0.00	0.19	1.27	3.85	4.04	0.26	100	5.04		
UA1072-8	75.06	0.26	12.97	1.92	0.07	0.21	1.19	3.80	4.27	0.25	100	4.55		
UA1071-20	75.09	0.31	13.03	1.76	0.04	0.26	1.13	3.95	4.20	0.22	100	3.60		
UA1072-9	75.36	0.28	13.06	1.85	0.05	0.21	1.16	3.35	4.37	0.29	100	4.98		
UA1072-6	75.48	0.26	13.24	1.90	0.05	0.15	1.06	3.46	4.18	0.21	100	4.82		
Mean	74.93	0.29	13.21	1.91	0.05	0.22	1.15	3.64	4.37	0.25	100	5.65	25	Pop.2: THt
StDev	0.27	0.03	0.17	0.09	0.02	0.04	0.05	0.17	0.14	0.03	0	1.38		
UA 1070-5	79.19	0.17	12.11	0.93	0.09	0.16	1.22	3.37	2.63	0.13	100	7.06		
UA 1071-8	78.64	0.23	12.28	1.34	0.05	0.16	1.28	3.61	2.29	0.12	100	6.39		
UA 1071-15	79.66	0.27	12.07	1.20	0.04	0.20	1.35	2.60	2.45	0.16	100	7.84		
UA 1072-6	78.51	0.16	12.04	1.34	0.06	0.23	1.28	3.92	2.28	0.18	100	5.82		
UA1070-11	77.96	0.19	12.59	1.16	0.02	0.26	1.32	3.59	2.71	0.21	100	5.76		
UA1071-10	78.17	0.16	12.11	1.29	0.08	0.20	1.29	4.19	2.36	0.16	100	5.11		
UA1071-16	78.19	0.22	12.04	1.24	0.07	0.24	1.25	4.21	2.40	0.15	100	2.53		
UA1071-8	78.20	0.23	12.28	1.26	0.03	0.20	1.29	4.01	2.32	0.18	100	5.33		
UA1071-9	78.24	0.23	12.15	1.25	0.01	0.14	1.27	4.18	2.36	0.18	100	4.74		
UA1072-1	78.29	0.19	12.12	1.15	0.04	0.21	1.30	4.11	2.47	0.11	100	4.61		
UA1070-4	78.46	0.17	12.38	1.14	0.03	0.17	1.24	3.68	2.60	0.13	100	6.61		
UA1070-3	78.52	0.14	12.36	0.92	0.07	0.17	1.24	3.84	2.66	0.08	100	6.91		
Mean	78.50	0.20	12.21	1.19	0.05	0.20	1.28	3.78	2.46	0.15	100	5.73	12	Pop.3: APt
StDev	0.48	0.04	0.17	0.14	0.02	0.04	0.04	0.46	0.15	0.04	0	1.41		
UA 1072-17	75.92	0.29	13.47	1.54	0.04	0.29	1.67	3.75	2.78	0.24	100	5.73		
UA 1071-20	76.24	0.20	13.37	1.43	0.06	0.34	1.64	3.80	2.68	0.23	100	5.34		
UA1071-10	75.85	0.22	13.31	1.57	0.07	0.33	1.69	3.73	3.05	0.19	100	5.78		
UA1071-11	75.88	0.23	13.39	1.60	0.11	0.32	1.58	3.72	3.01	0.16	100	5.41		
UA1071-18	75.93	0.28	13.28	1.46	0.02	0.27	1.69	4.10	2.76	0.21	100	4.26		
UA1072-2	76.13	0.26	13.29	1.42	0.08	0.28	1.56	3.89	2.87	0.23	100	6.35		
Mean	75.99	0.25	13.35	1.50	0.06	0.30	1.64	3.83	2.86	0.21	100	5.48	6	Pop.4: VCt
StDev	0.16	0.03	0.07	0.08	0.03	0.03	0.06	0.14	0.14	0.03	0	0.70		
UA 1070-12	75.87	0.30	13.28	1.82	0.10	0.24	1.49	2.81	3.79	0.31	100	5.63		
UA 1071-6	75.92	0.33	13.35	1.73	0.04	0.19	1.20	2.56	4.41	0.25	100	6.04		
UA 1071-17	75.97	0.32	13.33	1.80	0.08	0.26	1.20	2.60	4.24	0.21	100	6.43		
Mean	75.92	0.32	13.32	1.78	0.07	0.23	1.29	2.66	4.15	0.26	100	6.03	3	with 1448 pop.4
StDev	0.05	0.02	0.04	0.05	0.03	0.03	0.17	0.13	0.32	0.05	0	0.40		**(Not present in Palisades beds)**

VCt

UT 1464-20	74.77	0.24	14.73	1.37	0.03	0.31	1.57	3.93	2.87	0.18	100	7.04		Stewart River, Yukon
UT 1464-8	75.48	0.27	13.63	1.50	0.07	0.31	1.65	4.02	2.90	0.17	100	5.63		Reference sample
UT 1464-30	75.52	0.14	13.60	1.41	0.10	0.35	1.59	4.26	2.87	0.17	100	6.94		
UT 1464-7	75.53	0.22	13.48	1.49	0.01	0.26	1.58	4.25	2.97	0.21	100	7.64		
UT 1464-21	75.57	0.24	13.52	1.51	0.07	0.29	1.62	4.07	2.92	0.19	100	8.11		
UT 1464-12	75.66	0.16	13.78	1.52	0.03	0.33	1.61	3.81	2.90	0.22	100	8.88		
UT 1464-28	75.66	0.28	13.30	1.37	0.00	0.29	1.66	4.41	2.88	0.16	100	6.73		
UT 1464-15	75.72	0.26	13.25	1.47	0.09	0.32	1.63	4.16	2.86	0.24	100	7.53		
UT 1464-19	75.72	0.19	13.45	1.42	0.08	0.28	1.62	4.25	2.77	0.22	100	6.45		
UT 1464-14	75.75	0.17	13.32	1.44	0.08	0.30	1.56	4.18	3.00	0.19	100	8.66		
UT 1464-16	75.80	0.21	13.27	1.41	0.04	0.31	1.63	4.09	3.02	0.22	100	7.34		
UT 1464-26	75.80	0.23	13.36	1.39	0.04	0.29	1.71	4.17	2.83	0.17	100	8.04		
UT 1464-11	75.84	0.20	13.50	1.42	0.04	0.28	1.63	4.02	2.87	0.21	100	6.89		
UT 1464-32	75.85	0.19	13.41	1.45	0.07	0.30	1.58	4.08	2.90	0.17	100	7.79		
UT 1464-4	75.87	0.21	13.49	1.43	0.04	0.32	1.66	3.94	2.88	0.17	100	6.91		
UT 1464-6	75.90	0.23	13.32	1.42	0.00	0.31	1.58	4.08	2.93	0.23	100	8.29		
UT 1464-5	75.92	0.16	13.33	1.43	0.04	0.34	1.55	4.15	2.88	0.19	100	8.60		
UT 1464-25	75.95	0.25	13.19	1.53	0.05	0.28	1.57	4.04	2.95	0.19	100	7.71		
UT 1464-29	75.97	0.25	13.11	1.34	0.05	0.33	1.58	4.17	2.95	0.23	100	7.52		
UT 1464-1	76.00	0.26	13.26	1.36	0.00	0.30	1.56	4.18	2.84	0.23	100	6.58		
UT 1464-31	76.01	0.25	13.31	1.42	0.03	0.30	1.54	3.99	2.90	0.25	100	9.25		
UT 1464-10	76.03	0.20	13.36	1.42	0.06	0.31	1.63	3.97	2.83	0.19	100	8.97		
UT 1464-22	76.12	0.21	13.31	1.19	0.03	0.32	1.62	4.10	2.92	0.18	100	6.32		
UT 1464-23	76.14	0.19	13.56	1.35	0.05	0.28	1.52	3.86	2.86	0.18	100	7.20		
UT 1464-24	76.15	0.21	13.26	1.34	0.05	0.31	1.51	4.14	2.86	0.17	100	7.45		
UT 1464-2	76.20	0.18	13.09	1.34	0.04	0.33	1.59	4.07	2.97	0.19	100	6.58		
UT 1464-17	76.28	0.25	13.30	1.37	0.04	0.27	1.54	3.86	2.91	0.17	100	7.59		
UT 1464-27	76.37	0.18	13.37	1.38	0.03	0.28	1.64	3.82	2.75	0.19	100	6.79		
Mean	75.84	0.22	13.42	1.41	0.05	0.30	1.60	4.07	2.89	0.20	100	7.48	28	
StDev	0.31	0.04	0.30	0.07	0.03	0.02	0.05	0.14	0.06	0.03	0	0.89		

VCt	**UA 1885-24**	75.37	0.28	13.74	1.44	0.02	0.27	1.67	4.20	2.83	0.19	100	8.04	Midstream exposure at Hollis Klondike, Yukon
	UA 1885-8	75.43	0.20	13.78	1.44	0.06	0.29	1.65	4.13	2.84	0.17	100	6.32	
	UA 1885-23	75.60	0.19	13.57	1.45	0.09	0.28	1.74	3.92	3.04	0.14	100	5.78	Collected by B.Jensen
	UA 1885-26	75.63	0.24	13.33	1.43	0.00	0.32	1.70	4.22	2.94	0.19	100	6.08	
	UA 1885-9	75.68	0.24	13.51	1.41	0.01	0.32	1.57	4.18	2.89	0.19	100	6.05	
	UA 1885-6	75.71	0.21	13.61	1.45	0.09	0.31	1.64	3.93	2.85	0.20	100	6.77	
	UA 1885-5	75.77	0.23	13.63	1.39	0.00	0.30	1.55	4.08	2.86	0.19	100	8.23	
	UA 1885-29	75.81	0.21	13.51	1.42	0.07	0.35	1.52	3.99	2.96	0.17	100	5.88	
	UA 1885-1	75.81	0.25	13.35	1.42	0.08	0.33	1.60	4.20	2.79	0.17	100	6.83	
	UA 1885-16	75.82	0.28	13.40	1.37	0.02	0.32	1.48	4.05	3.04	0.20	100	5.82	
	UA 1885-11	75.82	0.19	13.57	1.48	0.01	0.32	1.59	3.85	2.95	0.22	100	7.63	
	UA 1885-12	75.82	0.19	13.23	1.51	0.06	0.31	1.67	4.18	2.85	0.19	100	6.05	
	UA 1885-19	75.84	0.26	13.46	1.36	0.03	0.34	1.66	4.06	2.83	0.17	100	4.89	
	UA 1885-30	75.84	0.31	13.36	1.44	0.04	0.28	1.59	4.13	2.81	0.20	100	6.48	
	UA 1885-21	75.85	0.18	13.50	1.41	0.00	0.31	1.59	4.03	2.92	0.21	100	6.55	
	UA 1885-18	75.90	0.21	13.49	1.33	0.00	0.32	1.67	4.12	2.78	0.18	100	5.34	
	UA 1885-25	75.91	0.21	13.32	1.30	0.07	0.32	1.64	4.11	2.93	0.20	100	6.96	

UA 1885-2	75.92	0.25	13.30	1.43	0.01	0.32	1.61	4.07	2.91	0.20	100	7.27
UA 1885-14	75.92	0.24	13.42	1.37	0.02	0.28	1.60	3.95	3.01	0.19	100	7.12
UA 1885-20	75.92	0.17	13.37	1.41	0.01	0.34	1.68	4.18	2.75	0.19	100	5.81
UA 1885-4	76.00	0.18	13.66	1.50	0.01	0.25	1.65	3.78	2.84	0.14	100	7.48
UA 1885-10	76.01	0.18	13.54	1.35	0.08	0.31	1.60	4.00	2.72	0.21	100	5.84
UA 1885-28	76.03	0.22	13.18	1.41	0.02	0.27	1.53	4.26	2.88	0.19	100	5.19
UA 1885-17	76.05	0.24	13.34	1.37	0.03	0.27	1.63	3.96	2.91	0.20	100	6.50
UA 1885-7	76.17	0.22	13.34	1.44	0.00	0.25	1.70	3.98	2.72	0.18	100	5.73
UA 1885-15	76.21	0.18	13.37	1.40	0.00	0.30	1.59	3.93	2.81	0.21	100	7.05
UA 1885-22	76.25	0.27	13.19	1.27	0.07	0.32	1.53	4.12	2.81	0.17	100	5.40
UA 1885-13	76.43	0.14	13.14	1.31	0.08	0.20	1.34	4.09	3.04	0.21	100	5.51
Mean	75.88	0.22	13.44	1.40	0.04	0.30	1.61	4.06	2.88	0.19	100	6.38
StDev	0.23	0.04	0.16	0.06	0.03	0.03	0.08	0.12	0.09	0.02	0	0.86

LCCt

UT 92-23	75.60	0.25	13.28	1.39	0.07	0.33	1.65	4.24	2.99	0.20	100	5.55	Creek reference
UT 92-30	75.68	0.28	13.36	1.35	0.05	0.36	1.65	4.20	2.92	0.15	100	6.85	mining cut, Klondike
UT 92-5	75.73	0.25	13.94	1.38	0.02	0.31	1.55	3.90	2.76	0.16	100	7.13	Yukon (see Preece et al., 2000)
UT 92-3	75.76	0.29	13.27	1.32	0.03	0.28	1.65	4.37	2.83	0.22	100	6.03	Collected by R.Harington
UT 92-29	75.79	0.20	13.27	1.38	0.08	0.30	1.63	4.30	2.85	0.19	100	4.76	
UT 92-24	75.83	0.22	13.35	1.32	0.06	0.31	1.64	4.23	2.80	0.24	100	7.25	
UT 92-28	75.86	0.23	13.34	1.46	0.05	0.37	1.59	4.10	2.82	0.18	100	6.32	
UT 92-4	75.87	0.24	13.31	1.37	0.06	0.35	1.64	4.27	2.73	0.17	100	6.29	
UT 92-18	75.88	0.21	13.15	1.45	0.09	0.30	1.62	4.20	2.87	0.22	100	6.95	
UT 92-20	75.90	0.23	13.41	1.25	0.05	0.33	1.55	4.20	2.88	0.19	100	6.11	
UT 92-16	75.92	0.23	13.36	1.36	0.03	0.32	1.59	4.21	2.76	0.21	100	6.91	
UT 92-22	75.94	0.24	13.22	1.40	0.03	0.32	1.55	4.32	2.81	0.17	100	6.64	
UT 92-15	75.97	0.22	13.29	1.30	0.11	0.34	1.59	4.26	2.72	0.20	100	8.63	
UT 92-9	75.98	0.19	13.31	1.51	0.05	0.28	1.60	4.18	2.69	0.20	100	4.25	
UT 92-11	75.99	0.23	13.34	1.38	0.06	0.34	1.66	3.95	2.86	0.19	100	7.51	
UT 92-1	75.99	0.23	13.35	1.34	0.04	0.32	1.60	4.01	2.89	0.23	100	5.09	
UT 92-17	75.99	0.22	13.06	1.33	0.06	0.32	1.54	4.17	3.07	0.24	100	7.25	
UT 92-6	76.01	0.21	13.37	1.41	0.04	0.29	1.59	3.99	2.87	0.22	100	6.59	
UT 92-26	76.02	0.26	13.34	1.38	0.07	0.35	1.62	3.92	2.83	0.21	100	6.72	
UT 92-10	76.06	0.30	13.25	1.28	0.03	0.27	1.61	4.20	2.81	0.19	100	5.49	
UT 92-27	76.09	0.21	13.51	1.46	0.04	0.23	1.57	3.97	2.72	0.21	100	5.77	
UT 92-14	76.09	0.17	13.13	1.48	0.03	0.31	1.63	4.13	2.84	0.18	100	8.55	
UT 92-21	76.11	0.20	13.30	1.40	0.02	0.28	1.61	4.15	2.76	0.18	100	7.58	
UT 92-25	76.51	0.23	13.07	1.27	0.02	0.27	1.39	3.97	3.04	0.24	100	8.11	
UT 92-2	76.54	0.22	13.02	1.27	0.00	0.29	1.48	4.11	2.86	0.21	100	7.56	
UT 92-13	76.86	0.20	12.58	1.37	0.05	0.23	1.39	4.16	2.86	0.29	100	6.92	
Mean	76.00	0.23	13.28	1.37	0.05	0.31	1.58	4.14	2.84	0.20	100	6.65	
StDev	0.27	0.03	0.22	0.07	0.02	0.04	0.07	0.13	0.09	0.03	0	1.08	

CBt

UT 1894-28	73.70	0.23	14.76	1.60	0.04	0.49	1.94	4.35	2.85	0.02	100	4.58	Chester Bluff, Alaska
UT 1894-14	73.73	0.32	14.73	1.51	0.03	0.49	1.93	4.27	2.97	0.03	100	4.08	Reference samples
UT 1894-6	73.79	0.29	14.73	1.43	0.06	0.52	1.84	4.65	2.68	0.04	100	1.98	(see Jensen et al., 2008)

UT 1894-7	73.88	0.22	14.82	1.47	0.04	0.48	1.86	4.35	2.86	0.03	100	3.85	Collected by B.Jensen
UT 1894-3	74.03	0.22	14.64	1.34	0.10	0.48	1.87	4.49	2.78	0.05	100	4.46	
UT 1894-17	74.07	0.24	14.76	1.49	0.02	0.48	1.93	4.05	2.92	0.05	100	9.51	
UT 1894-22	74.18	0.24	14.85	1.37	0.02	0.44	1.87	4.14	2.85	0.05	100	5.05	
UT 1894-11	74.19	0.26	14.81	1.44	0.02	0.47	1.97	3.77	3.01	0.07	100	5.09	
UT 1894-13	74.28	0.15	14.68	1.37	0.05	0.44	1.88	4.29	2.84	0.03	100	4.46	
UT 1894-4	74.39	0.24	14.54	1.31	0.06	0.49	1.81	4.23	2.91	0.04	100	6.06	
UT 1894-15	74.41	0.22	14.49	1.27	0.05	0.43	1.66	4.27	3.13	0.08	100	2.65	
UT 1894-2	74.60	0.20	14.65	0.92	0.00	0.21	1.86	4.48	2.98	0.12	100	4.34	
UT 1894-12	74.89	0.18	14.60	1.57	0.06	0.52	1.92	3.42	2.83	0.03	100	5.28	
UT 1873-30	72.39	0.32	15.05	1.88	0.05	0.83	2.31	4.25	2.85	0.08	100	8.84	
UT 1873-4	73.58	0.29	15.08	1.43	0.02	0.38	1.90	4.40	2.88	0.05	100	4.14	
UT 1873-16	73.75	0.20	15.07	1.32	0.02	0.37	1.99	4.48	2.81	0.01	100	0.35	
UT 1873-15	73.82	0.25	14.70	1.47	0.04	0.47	1.92	4.39	2.93	0.03	100	4.53	
UT 1873-33	73.84	0.24	14.86	1.37	0.01	0.49	1.92	4.31	2.90	0.08	100	2.30	
UT 1873-25	73.87	0.19	14.81	1.37	0.06	0.50	1.94	4.37	2.83	0.07	100	1.83	
UT 1873-14	73.88	0.27	14.74	1.52	0.06	0.49	1.93	4.12	2.93	0.08	100	6.90	
UT 1873-27	74.02	0.21	14.84	1.45	0.05	0.47	1.94	4.16	2.81	0.06	100	2.42	
UT 1873-10	74.06	0.18	14.71	1.32	0.04	0.51	1.85	4.47	2.85	0.02	100	4.99	
UT 1873-38	74.10	0.18	14.78	1.38	0.02	0.48	1.90	4.23	2.92	0.02	100	5.35	
UT 1873-40	74.11	0.27	14.55	1.38	0.03	0.44	1.78	4.32	3.03	0.12	100	6.26	
UT 1873-1	74.17	0.29	14.48	1.45	0.05	0.40	1.80	4.42	2.83	0.15	100	5.33	
UT 1873-21	74.25	0.27	14.19	1.32	0.03	0.42	1.75	4.89	2.84	0.04	100	5.97	
UT 1873-26	74.28	0.19	14.77	1.34	0.00	0.43	1.79	4.40	2.75	0.06	100	4.72	
UT 1873-8	74.39	0.24	14.66	1.33	0.05	0.41	1.78	4.24	2.87	0.04	100	4.88	
UT 1873-39	74.41	0.19	14.35	1.36	0.00	0.46	1.72	4.25	3.22	0.05	100	6.39	
UT 1873-36	74.42	0.29	14.65	1.41	0.02	0.45	1.79	4.17	2.78	0.04	100	5.57	
UT 1873-32	74.51	0.21	14.52	1.39	0.05	0.43	1.83	4.21	2.85	0.02	100	5.21	
UT 1873-9	74.56	0.22	14.45	1.30	0.09	0.38	1.86	4.16	2.94	0.08	100	9.03	
UT 1873-37	74.56	0.24	14.43	1.35	0.03	0.47	1.79	4.10	3.01	0.03	100	6.14	
UT 1873-31	74.57	0.26	14.64	1.30	0.03	0.42	1.78	4.11	2.84	0.05	100	5.45	
UT 1873-13	74.61	0.25	14.36	1.43	0.07	0.43	1.69	4.18	2.94	0.06	100	7.28	
UT 1873-24	74.61	0.23	14.41	1.36	0.03	0.44	1.77	4.11	2.99	0.07	100	5.85	
UT 1873-22	74.63	0.22	14.35	1.41	0.06	0.40	1.80	4.20	2.90	0.03	100	5.49	
UT 1873-35	74.66	0.27	14.37	1.45	0.03	0.44	1.74	4.05	2.99	0.02	100	5.89	
UT 1873-2	74.67	0.27	14.63	1.26	0.06	0.39	1.66	4.02	3.01	0.04	100	0.86	
UT 1873-6	74.77	0.24	14.64	1.32	0.07	0.44	1.71	3.99	2.78	0.06	100	6.44	
UA 1049-1	73.97	0.23	15.15	1.35	0.06	0.41	1.75	4.09	2.95	0.03	100	6.85	
UA 1049-26	74.13	0.22	14.58	1.41	0.05	0.39	1.85	4.30	3.02	0.07	100	8.39	
UA 1049-3	74.21	0.18	14.61	1.48	0.08	0.41	1.77	4.35	2.87	0.03	100	5.95	
UA 1049-13	74.27	0.25	14.51	1.39	0.00	0.42	1.72	4.44	2.96	0.04	100	4.92	
UA 1049-18	74.28	0.19	14.63	1.26	0.10	0.44	1.70	4.40	2.94	0.05	100	1.91	
UA 1049-25	74.30	0.20	14.61	1.36	0.01	0.43	1.74	4.36	2.92	0.06	100	5.64	
UA 1049-19	74.33	0.30	14.39	1.40	0.08	0.46	1.71	4.26	3.00	0.06	100	3.87	
UA 1049-27	74.34	0.17	14.68	1.34	0.03	0.39	1.71	4.29	3.03	0.03	100	5.47	
UA 1049-7	74.35	0.26	14.59	1.24	0.10	0.41	1.77	4.19	3.03	0.06	100	7.80	
UA 1049-5	74.37	0.26	14.52	1.33	0.02	0.40	1.72	4.35	2.97	0.07	100	7.09	
UA 1049-16	74.41	0.21	14.58	1.40	0.00	0.42	1.77	4.23	2.92	0.05	100	6.51	
UA 1049-14	74.43	0.29	14.22	1.33	0.06	0.42	1.77	4.32	3.14	0.01	100	6.47	
UA 1049-28	74.43	0.22	14.41	1.34	0.01	0.47	1.71	4.41	2.95	0.06	100	5.23	
UA 1049-2	74.48	0.26	14.37	1.42	0.02	0.39	1.79	4.27	2.95	0.05	100	8.64	
UA 1049-9	74.50	0.26	14.54	1.30	0.00	0.46	1.72	4.32	2.86	0.04	100	4.59	
UA 1049-29	74.51	0.27	14.48	1.37	0.00	0.45	1.67	4.23	2.97	0.06	100	7.16	

UA 1049-23	74.52	0.26	14.47	1.33	0.05	0.48	1.74	4.28	2.83	0.03	100	5.95		
UA 1049-24	74.55	0.23	14.59	1.33	0.05	0.44	1.66	4.24	2.89	0.03	100	5.60		
UA 1049-15	74.55	0.24	14.59	1.35	0.00	0.36	1.76	4.21	2.91	0.04	100	4.90		
UA 1049-11	74.56	0.30	14.34	1.35	0.07	0.40	1.80	4.17	2.91	0.09	100	7.58		
UA 1049-12	74.58	0.27	14.35	1.43	0.09	0.43	1.75	4.26	2.82	0.02	100	6.97		
UA 1049-17	74.58	0.27	14.43	1.38	0.00	0.41	1.70	4.32	2.87	0.03	100	4.46		
UA 1049-30	74.59	0.20	14.33	1.34	0.02	0.50	1.75	4.27	2.97	0.04	100	4.95		
UA 1049-10	74.63	0.22	14.40	1.21	0.04	0.38	1.71	4.41	2.96	0.02	100	7.31		
UA 1049-6	74.65	0.34	14.35	1.28	0.01	0.42	1.76	4.22	2.93	0.05	100	6.06		
UA 1049-22	74.74	0.19	14.55	1.31	0.05	0.33	1.63	4.18	3.01	0.01	100	6.00		
UA 1049-20	74.80	0.22	14.37	1.38	0.08	0.40	1.70	4.25	2.78	0.02	100	5.51		
Mean	74.29	0.24	14.59	1.38	0.04	0.44	1.80	4.26	2.91	0.05	100	5.40	67	Pop.1: Main population (CB-1)
StDev	0.38	0.04	0.20	0.11	0.03	0.07	0.11	0.19	0.09	0.03	0	1.85		
UA 1050-5	76.21	0.41	12.91	1.35	0.08	0.25	1.09	3.74	3.94	0.03	100	6.12		
UA 1050-8	76.88	0.08	12.67	1.04	0.01	0.04	0.54	2.92	5.80	0.02	100	4.34		
UA 1050-7	77.63	0.23	12.91	0.90	0.09	0.26	1.39	2.61	3.94	0.03	100	8.37		
UA 1050-1	77.89	0.12	12.73	0.52	0.06	0.02	0.72	3.55	4.34	0.05	100	6.28		
UA 1050-2	77.99	0.22	12.58	0.47	0.02	0.16	1.00	3.35	4.15	0.05	100	5.16		
UA 1050-9	78.14	0.11	12.65	1.14	0.03	0.21	1.25	2.31	4.14	0.02	100	8.46		
UA 1050-17	78.35	0.26	12.28	0.61	0.05	0.15	0.87	3.19	4.22	0.02	100	5.22		
UA 1050-10	78.35	0.25	12.64	1.10	0.00	0.19	1.11	2.37	3.93	0.07	100	6.24		
UA 1050-12	78.38	0.28	11.78	0.91	0.00	0.11	0.30	3.33	4.85	0.06	100	5.67		
UA 1050-13	78.45	0.22	11.71	0.89	0.00	0.17	0.35	3.21	4.98	0.03	100	4.46		
UA 1050-14	78.61	0.29	12.63	1.07	0.03	0.20	1.19	2.03	3.90	0.05	100	6.38		
UA 1050-19	79.36	0.29	11.23	1.20	0.04	0.51	0.45	3.17	3.71	0.04	100	6.62		
UA 1050-11	79.83	0.24	11.23	0.87	0.05	0.12	0.37	3.26	4.01	0.02	100	4.87		
Mean	78.16	0.23	12.31	0.93	0.04	0.18	0.82	3.00	4.30	0.04	100	6.01	13	pink bed (CB-2)
StDev	0.93	0.09	0.61	0.26	0.03	0.12	0.38	0.52	0.58	0.02	0	1.30		
Mean	74.92	0.24	14.22	1.30	0.04	0.40	1.64	4.06	3.14	0.05	100	5.50	80	Both
StDev	1.52	0.05	0.90	0.22	0.03	0.12	0.41	0.54	0.57	0.03	0	1.78		

PAL

UT1280-1	72.86	0.35	13.90	2.25	0.04	0.37	1.75	3.79	4.12	0.57	100	4.10	Palisades, Alaska
UT1281-14	72.87	0.32	13.55	2.34	0.00	0.39	1.67	4.00	4.25	0.63	100	4.37	Mathues et al., (2003) reference sample,
UT1280-14	73.05	0.34	13.46	2.29	0.09	0.33	1.64	3.93	4.25	0.63	100	4.24	Analyzed with 1199/ 1200/01
UT1280-13	73.12	0.37	13.34	2.22	0.07	0.34	1.65	4.01	4.30	0.58	100	3.45	(PAL), the
UT1280-10	73.17	0.27	13.70	2.12	0.02	0.32	1.47	4.16	4.18	0.58	100	4.29	latter samples used as reference material.
UT1280-8	73.17	0.29	13.60	2.20	0.01	0.40	1.60	3.77	4.29	0.66	100	4.35	
UT1281-6	73.20	0.31	13.67	2.11	0.05	0.34	1.60	3.81	4.30	0.62	100	4.35	
UT1280-4	73.23	0.31	13.57	2.26	0.06	0.30	1.61	3.77	4.37	0.53	100	4.15	
UT1281-1	73.32	0.31	13.43	2.16	0.04	0.30	1.59	3.94	4.26	0.65	100	4.26	
UT1281-7	73.42	0.31	13.81	2.06	0.09	0.28	1.49	3.66	4.31	0.58	100	4.95	
UT1280-3	73.48	0.27	13.60	2.25	0.07	0.34	1.52	3.86	4.02	0.60	100	4.55	
UT1280-6	73.51	0.29	13.46	2.17	0.05	0.32	1.51	3.74	4.34	0.60	100	4.47	

UT1280-2	73.53	0.36	13.53	2.08	0.06	0.35	1.59	3.77	4.10	0.64	100	4.65		
UT1281-8	73.58	0.31	13.29	1.93	0.05	0.32	1.55	3.96	4.34	0.67	100	4.50		
UT1281-3	73.60	0.24	13.29	2.12	0.06	0.28	1.36	3.95	4.45	0.65	100	4.09		
UT1281-2	73.63	0.31	13.47	2.20	0.03	0.32	1.53	3.85	4.16	0.50	100	5.33		
UT1281-12	73.71	0.25	13.31	2.01	0.10	0.30	1.52	3.76	4.43	0.60	100	4.61		
UT1280-11	73.79	0.30	13.36	1.98	0.03	0.30	1.41	4.01	4.20	0.61	100	3.35		
UT1280-7	73.88	0.38	13.27	1.94	0.09	0.27	1.45	3.97	4.21	0.54	100	3.85		
UT1281-11	73.93	0.28	13.46	1.98	0.08	0.28	1.48	3.75	4.18	0.58	100	5.28		
UT1280-9	73.97	0.33	13.40	2.15	0.06	0.33	1.46	3.70	4.13	0.47	100	4.12		
UT1281-4	74.24	0.22	13.09	1.88	0.09	0.27	1.31	4.05	4.22	0.62	100	3.76		
UT1281-15	74.64	0.27	13.09	1.83	0.04	0.28	1.26	3.74	4.28	0.57	100	4.26		
AVERAGE	73.52	0.30	13.46	2.11	0.06	0.32	1.52	3.87	4.25	0.60	100	4.32	23	Pop.1
STDEV	0.43	0.04	0.20	0.14	0.03	0.04	0.12	0.13	0.11	0.05	0	0.48		
UT1281-5	70.85	0.45	14.72	2.77	0.14	0.52	2.15	4.13	3.83	0.45	100	4.04		
UT1281-10	71.44	0.43	14.11	2.79	0.01	0.48	2.19	3.98	3.96	0.60	100	4.79		
AVERAGE	71.15	0.44	14.41	2.78	0.08	0.50	2.17	4.06	3.89	0.52	100	4.41	2	Pop.2
STDEV	0.42	0.01	0.43	0.02	0.09	0.03	0.03	0.10	0.09	0.11	0	0.53		
UT1281-9	66.59	0.78	14.88	4.19	0.11	1.18	3.52	4.46	3.64	0.64	100	1.14		
Mean	73.33	0.32	13.54	2.16	0.06	0.33	1.57	3.88	4.22	0.59	100	4.33	25	Both
StDev	0.78	0.05	0.34	0.23	0.03	0.06	0.21	0.14	0.14	0.06	0	0.47		

Boneyard

UA1609-2	75.75	0.07	14.24	0.63	0.13	0.11	1.03	4.44	3.53	0.07	100	8.80	placer mining cut near Ester,
UA1609-11	75.75	0.08	14.21	0.60	0.14	0.13	1.06	4.30	3.60	0.12	100	7.36	Alaska (10 km west of Fairbanks)
UA1609-8	75.80	0.05	14.27	0.60	0.14	0.10	1.03	4.13	3.76	0.12	100	6.79	Collected by B.Jensen
UA1609-25	75.84	0.08	14.45	0.64	0.09	0.11	1.03	4.10	3.59	0.08	100	9.09	
UA1609-14	75.85	0.10	14.18	0.54	0.13	0.10	0.95	4.28	3.83	0.04	100	9.24	
UA1609-28	75.92	0.05	14.34	0.57	0.10	0.14	1.07	3.92	3.80	0.09	100	7.70	
UA1609-5	75.96	0.06	14.28	0.61	0.12	0.12	1.08	4.13	3.58	0.06	100	7.65	
UA1609-17	75.99	0.06	14.26	0.51	0.21	0.13	1.08	4.09	3.59	0.08	100	7.69	
UA1609-10	75.99	0.06	14.11	0.62	0.09	0.11	1.03	4.20	3.68	0.12	100	7.29	
UA1609-1	76.00	0.00	14.13	0.48	0.08	0.10	1.02	4.37	3.70	0.12	100	6.72	
UA1609-26	76.00	0.04	14.38	0.56	0.12	0.10	1.04	4.14	3.56	0.06	100	6.74	
UA1609-16	76.00	0.07	14.21	0.53	0.13	0.08	1.06	4.14	3.70	0.08	100	7.47	
UA1609-6	76.01	0.07	14.12	0.44	0.06	0.11	0.80	4.59	3.69	0.11	100	7.23	
UA1609-3	76.01	0.04	14.28	0.58	0.10	0.09	1.09	4.27	3.51	0.04	100	6.87	
UA1609-4	76.08	0.02	14.29	0.61	0.17	0.05	1.08	4.17	3.46	0.06	100	7.64	
UA1609-22	76.12	0.00	14.14	0.49	0.15	0.10	1.03	4.21	3.68	0.08	100	7.37	
UA1609-20	76.12	0.09	14.24	0.58	0.16	0.13	1.06	3.93	3.65	0.05	100	7.80	
UA1609-19	76.14	0.08	14.36	0.56	0.13	0.09	1.06	4.11	3.43	0.05	100	7.95	
UA1609-29	76.15	0.13	14.22	0.60	0.14	0.07	1.01	4.15	3.45	0.08	100	8.27	
UA1609-7	76.15	0.02	14.11	0.56	0.13	0.09	0.97	4.34	3.53	0.09	100	6.98	
UA1609-13	76.21	0.02	14.10	0.57	0.14	0.09	1.05	4.21	3.55	0.06	100	7.26	
UA1609-18	76.24	0.00	14.10	0.54	0.14	0.10	1.08	4.29	3.43	0.08	100	7.56	
UA1609-24	76.27	0.04	14.24	0.48	0.15	0.07	1.01	4.08	3.58	0.08	100	7.99	
UA1609-21	76.34	0.00	14.30	0.58	0.12	0.09	1.00	4.03	3.45	0.08	100	8.33	
UA1609-12	76.36	0.03	14.18	0.47	0.17	0.10	1.03	4.05	3.51	0.10	100	7.97	
UA1609-17	76.10	0.04	14.24	0.50	0.16	0.11	1.12	4.15	3.52	0.07	100	6.03	
UA1609-8	76.14	0.06	14.27	0.60	0.20	0.13	1.08	4.08	3.38	0.07	100	6.08	

UA1609-13	76.21	0.05	14.25	0.55	0.09	0.09	1.05	4.15	3.43	0.12	100	5.11	
UA1609-2	76.22	0.02	14.01	0.52	0.11	0.11	1.04	4.21	3.68	0.09	100	0.59	
UA1609-16	76.25	0.01	14.28	0.53	0.17	0.14	1.03	3.91	3.55	0.12	100	7.35	
UA1609-15	76.28	0.07	14.09	0.57	0.16	0.08	1.07	4.14	3.45	0.09	100	5.97	
UA1609-11	76.28	0.00	14.25	0.51	0.10	0.07	1.12	3.98	3.57	0.11	100	5.45	
UA1609-25	76.29	0.08	14.22	0.55	0.09	0.14	1.00	4.04	3.49	0.10	100	6.08	
UA1609-18	76.37	0.07	13.94	0.60	0.17	0.13	0.97	3.96	3.69	0.11	100	7.01	
UA1609-5	76.39	0.03	14.19	0.49	0.13	0.11	1.01	4.02	3.43	0.22	100	5.35	
UA1609-24	76.45	0.00	14.15	0.53	0.13	0.10	1.13	4.13	3.28	0.10	100	5.41	
UA1609-12	76.47	0.06	14.02	0.51	0.14	0.12	1.08	4.02	3.50	0.09	100	4.79	
UA1609-23	76.48	0.00	14.08	0.59	0.17	0.10	0.97	4.05	3.49	0.09	100	6.42	
UA1609-10	76.55	0.08	14.01	0.60	0.06	0.17	1.02	3.84	3.59	0.07	100	6.42	
UA1609-19	76.56	0.00	13.96	0.57	0.17	0.13	1.08	3.87	3.60	0.07	100	7.67	
UA1609-14	76.60	0.02	13.97	0.57	0.12	0.12	1.08	3.97	3.48	0.06	100	6.37	
UA1609-7	76.63	0.04	13.95	0.53	0.17	0.09	1.00	3.94	3.58	0.07	100	6.03	
UA1609-21	76.65	0.10	13.92	0.54	0.13	0.12	1.07	4.00	3.44	0.05	100	6.07	
UA1609-9	76.75	0.05	14.14	0.48	0.17	0.07	1.08	3.75	3.44	0.07	100	6.91	
UA1609-6	76.85	0.02	14.01	0.51	0.16	0.06	1.11	3.73	3.48	0.07	100	7.82	
Mean	76.21	0.05	14.17	0.55	0.13	0.10	1.04	4.10	3.55	0.09	100	6.90	45
StDev	0.27	0.03	0.13	0.05	0.03	0.02	0.06	0.17	0.12	0.03	0	1.41	

Boneyard

UA1874-30	75.55	0.02	14.69	0.57	0.14	0.11	1.03	4.23	3.63	0.04	100	5.86	House, Alaska
UA1874-29	75.77	0.03	14.03	0.48	0.10	0.07	0.74	4.59	3.97	0.21	100	6.18	Collected by B.Jensen
UA1874-26	75.79	0.02	14.40	0.59	0.11	0.11	1.10	4.06	3.75	0.07	100	7.16	
UA1874-27	75.80	0.02	14.47	0.68	0.12	0.08	1.00	4.14	3.57	0.11	100	6.51	
UA1874-5	75.83	0.04	14.38	0.48	0.16	0.03	1.06	4.23	3.70	0.10	100	7.39	
UA1874-25	75.88	0.00	14.24	0.66	0.19	0.07	1.06	4.09	3.73	0.08	100	7.26	
UA1874-10	75.91	0.13	14.06	0.53	0.18	0.09	1.00	4.30	3.63	0.18	100	6.83	
UA1874-23	75.91	0.03	14.20	0.60	0.12	0.09	1.04	4.13	3.66	0.23	100	6.70	
UA1874-6	75.93	0.05	14.29	0.62	0.16	0.17	1.09	4.09	3.50	0.09	100	6.87	
UA1874-1	75.96	0.01	14.28	0.58	0.14	0.13	1.03	4.27	3.54	0.08	100	6.57	
UA1874-15	76.00	0.08	14.29	0.54	0.10	0.13	0.96	4.20	3.61	0.10	100	6.86	
UA1874-7	76.01	0.07	14.26	0.66	0.11	0.10	1.03	4.14	3.61	0.03	100	6.91	
UA1874-3	76.02	0.14	14.33	0.55	0.19	0.12	1.04	3.88	3.69	0.04	100	8.34	
UA1874-9	76.03	0.00	14.27	0.60	0.19	0.13	1.06	4.24	3.41	0.06	100	7.29	
UA1874-2	76.04	0.00	14.41	0.59	0.20	0.13	1.01	4.13	3.45	0.04	100	6.17	
UA1874-12	76.13	0.09	14.23	0.60	0.12	0.12	0.99	4.16	3.50	0.07	100	7.17	
UA1874-21	76.13	0.04	14.13	0.61	0.16	0.12	1.13	3.52	4.10	0.07	100	9.79	
UA1874-19	76.14	0.00	13.97	0.37	0.05	0.13	0.92	4.52	3.70	0.20	100	7.52	
UA1874-16	76.19	0.02	14.11	0.55	0.20	0.05	1.06	3.86	3.89	0.07	100	8.69	
UA1874-14	76.23	0.01	14.17	0.51	0.11	0.08	1.04	4.16	3.61	0.09	100	7.44	
UA1874-28	76.24	0.03	14.16	0.52	0.13	0.11	0.99	4.23	3.54	0.04	100	6.82	
UA1874-11	76.31	0.04	14.02	0.56	0.16	0.14	1.01	4.11	3.55	0.10	100	7.17	
UA1874-18	76.39	0.04	14.01	0.55	0.10	0.11	1.03	4.16	3.53	0.09	100	7.91	
UA1874-22	76.50	0.08	14.21	0.50	0.15	0.09	0.99	3.71	3.69	0.08	100	7.54	
UA 1874-2	75.87	0.00	14.69	0.59	0.13	0.06	1.21	4.23	3.18	0.06	100	6.64	
UA 1874-22	75.95	0.05	14.24	0.55	0.20	0.06	1.04	4.20	3.58	0.16	100	6.53	
UA 1874-18	76.01	0.05	14.33	0.64	0.19	0.09	1.08	3.97	3.61	0.05	100	7.05	
UA 1874-21	76.05	0.01	14.43	0.55	0.14	0.06	1.06	3.88	3.69	0.15	100	7.00	
UA 1874-23	76.06	0.03	14.54	0.53	0.16	0.13	1.13	3.92	3.42	0.11	100	7.16	
UA 1874-19	76.18	0.04	14.32	0.61	0.14	0.13	0.93	3.97	3.59	0.10	100	7.72	

UA 1874-3	76.31	0.00	14.22	0.63	0.14	0.09	1.08	3.90	3.56	0.09	100	7.66	
UA 1874-16	76.38	0.08	14.10	0.47	0.14	0.11	0.97	4.18	3.46	0.15	100	6.58	
UA 1874-5	76.40	0.00	14.47	0.59	0.14	0.09	0.99	3.46	3.78	0.13	100	8.25	
UA 1874-1	76.43	0.00	14.36	0.50	0.15	0.12	1.09	3.74	3.54	0.08	100	8.22	
UA 1874-10	76.43	0.06	13.95	0.57	0.13	0.08	1.02	3.83	3.76	0.21	100	7.85	
UA 1874-20	76.44	0.05	14.29	0.62	0.16	0.12	1.09	3.84	3.37	0.03	100	7.21	
UA 1874-8	76.45	0.02	14.05	0.59	0.08	0.06	0.99	3.83	3.76	0.20	100	7.97	
UA 1874-24	76.47	0.00	14.19	0.60	0.13	0.11	0.96	3.85	3.60	0.12	100	7.74	
UA 1874-12	76.47	0.00	14.29	0.54	0.16	0.07	1.06	3.73	3.61	0.08	100	7.64	
UA 1874-25	76.48	0.05	14.20	0.56	0.17	0.11	1.10	3.65	3.62	0.07	100	7.70	
UA 1874-13	76.49	0.01	14.19	0.57	0.16	0.16	1.09	3.85	3.41	0.09	100	7.63	
UA 1874-9	76.62	0.00	14.26	0.51	0.21	0.09	1.14	3.78	3.33	0.09	100	8.15	
UA 1874-4	76.66	0.08	14.15	0.57	0.14	0.08	1.06	3.78	3.46	0.04	100	8.19	
Mean	76.16	0.03	14.25	0.57	0.15	0.10	1.04	4.02	3.60	0.10	100	7.35	43
StDev	0.27	0.03	0.17	0.06	0.04	0.03	0.07	0.24	0.17	0.05	0	0.75	

SC-F

UA207-16	70.91	0.33	16.12	2.17	0.03	0.98	2.90	4.64	1.85	0.06	100	3.76	Fairbanks, Alaska
UA207-17	71.01	0.23	16.20	2.20	0.06	0.78	2.94	4.72	1.87	0.01	100	1.44	Reference sample
UA207-12	71.09	0.31	16.00	2.06	0.00	0.81	2.91	4.87	1.90	0.05	100	1.74	Provided by J.Westgate
UA207-4	71.14	0.35	15.65	2.23	0.05	1.17	3.09	4.47	1.79	0.05	100	0.35	
UA207-5	71.49	0.33	15.84	2.09	0.03	0.70	2.76	4.77	1.94	0.07	100	2.37	
UA207-13	71.55	0.23	16.04	2.01	0.10	0.72	2.87	4.48	1.97	0.04	100	1.46	
UA207-6	71.55	0.20	16.31	1.96	0.01	0.66	2.80	4.64	1.86	0.00	100	2.24	
UA207-20	71.92	0.24	15.93	1.95	0.11	0.67	2.75	4.50	1.90	0.02	100	1.90	
UA207-8	71.94	0.25	15.82	1.86	0.06	0.69	2.77	4.63	1.95	0.03	100	1.98	
UA207-7	72.00	0.26	15.76	1.93	0.01	0.66	2.77	4.57	2.04	0.01	100	2.55	
UA207-15	72.07	0.13	15.94	1.85	0.03	0.62	2.64	4.80	1.86	0.06	100	2.42	
UA207-10	72.36	0.34	15.79	1.70	0.04	0.62	2.61	4.58	1.93	0.02	100	3.54	
UA207-9	72.43	0.25	15.83	1.85	0.08	0.58	2.56	4.41	1.98	0.04	100	3.58	
UA207-14	72.48	0.22	15.76	1.76	0.01	0.54	2.60	4.62	2.01	0.01	100	4.79	
UA207-11	72.62	0.31	15.64	1.71	0.05	0.58	2.69	4.45	1.93	0.02	100	5.18	
UA207-19	72.63	0.23	15.96	1.68	0.07	0.58	2.48	4.51	1.82	0.03	100	3.85	
UA207-2	72.70	0.25	15.57	1.68	0.06	0.54	2.49	4.67	2.00	0.03	100	0.82	
UA207-18	72.83	0.30	15.52	1.66	0.02	0.51	2.40	4.75	1.97	0.03	100	2.19	
UA207-1	72.84	0.18	15.79	1.58	0.04	0.53	2.59	4.43	1.95	0.07	100	0.02	
UA207-3	72.96	0.21	15.68	1.67	0.05	0.52	2.52	4.39	1.93	0.06	100	6.03	
AVERAGE	72.03	0.26	15.86	1.88	0.05	0.67	2.71	4.60	1.92	0.03	100	2.61	20
STDEV	0.67	0.06	0.21	0.20	0.03	0.16	0.18	0.14	0.07	0.02	0	1.58	

UT 1434- Togiak Bay Old Crow reference material

Old Crow-1	75.28	0.29	13.25	1.70	0.02	0.30	1.50	3.71	3.69	0.28	100	3.83
Old Crow-2	75.14	0.31	13.19	1.66	0.06	0.29	1.44	3.93	3.70	0.27	100	3.52
Old Crow-3	75.04	0.28	13.23	1.79	0.07	0.31	1.45	3.84	3.72	0.28	100	7.64
Old Crow-4	75.32	0.32	12.80	1.73	0.05	0.24	1.52	3.93	3.77	0.33	100	6.99
Old Crow-5	74.99	0.30	13.20	1.72	0.11	0.25	1.47	3.83	3.85	0.27	100	4.30
Old Crow-6	75.02	0.24	13.32	1.70	0.07	0.32	1.44	3.83	3.73	0.33	100	2.74
Old Crow-7	74.95	0.33	13.12	1.75	0.07	0.28	1.46	3.99	3.81	0.24	100	2.65
Old Crow-8	75.11	0.33	13.28	1.71	0.06	0.24	1.43	3.75	3.83	0.26	100	3.76
Old Crow-9	75.17	0.32	12.92	1.67	0.10	0.28	1.50	3.90	3.90	0.24	100	1.93
Old Crow-10	74.85	0.29	13.06	1.72	0.05	0.30	1.48	3.89	4.07	0.29	100	4.17

Old Crow-12	74.93	0.24	13.24	1.81	0.06	0.26	1.44	3.93	3.78	0.31	100	1.41	
Old Crow-13	74.98	0.34	13.11	1.68	0.02	0.30	1.51	3.88	3.88	0.29	100	0.53	
Old Crow-14	75.35	0.33	13.00	1.73	0.04	0.27	1.42	3.89	3.75	0.22	100	4.44	
Old Crow-15	75.22	0.28	13.09	1.72	0.08	0.26	1.47	3.86	3.72	0.29	100	5.39	
Old Crow-16	75.04	0.23	13.06	1.75	0.06	0.27	1.48	3.98	3.87	0.26	100	4.15	
Old Crow-17	74.96	0.32	13.20	1.69	0.06	0.28	1.50	3.86	3.87	0.27	100	2.54	
Old Crow-18	74.96	0.27	13.16	1.64	0.07	0.30	1.52	4.09	3.73	0.27	100	2.85	
Old Crow-19	75.25	0.29	13.23	1.68	0.00	0.25	1.47	3.77	3.76	0.30	100	5.62	
Old Crow-20	75.34	0.32	13.15	1.62	0.07	0.28	1.48	3.81	3.72	0.21	100	6.44	
Old Crow-21	75.23	0.32	13.19	1.66	0.05	0.30	1.47	3.75	3.76	0.28	100	6.47	
Old Crow-22	75.53	0.26	13.07	1.67	0.02	0.27	1.40	3.77	3.73	0.27	100	6.86	
Old Crow-23	75.27	0.29	13.04	1.77	0.05	0.29	1.49	3.85	3.69	0.27	100	6.31	
Old Crow-24	75.40	0.38	12.87	1.73	0.03	0.28	1.50	3.83	3.71	0.26	100	5.77	
Old Crow-25	75.05	0.33	13.15	1.63	0.08	0.34	1.54	3.81	3.82	0.24	100	4.85	
Old Crow-26	75.24	0.32	12.98	1.66	0.06	0.30	1.43	3.79	3.91	0.31	100	5.92	
Old Crow-27	75.24	0.29	12.88	1.77	0.06	0.32	1.52	3.93	3.71	0.28	100	7.20	
Old Crow-28	75.49	0.32	12.94	1.61	0.08	0.30	1.52	3.69	3.76	0.29	100	5.75	
AVERAGE	75.16	0.30	13.10	1.70	0.06	0.28	1.48	3.85	3.79	0.27	100	4.59	27
STDEV	0.18	0.03	0.14	0.05	0.02	0.02	0.04	0.09	0.09	0.03	0	1.90	

HHt- reference

UA 1453-7	67.46	0.76	15.06	4.79	0.19	1.28	3.96	4.61	1.49	0.14	100	2.61
UA 1453-19	71.35	0.51	14.73	3.04	0.12	0.74	2.51	5.02	1.66	0.11	100	1.98
UA 1453-23	71.68	0.53	14.74	3.05	0.13	0.74	2.49	4.58	1.74	0.13	100	2.15
UA 1453-17	73.09	0.52	14.18	2.65	0.10	0.58	1.82	4.94	1.89	0.15	100	8.59
UA 1453-25	73.27	0.47	14.15	2.10	0.11	0.42	1.73	5.58	1.94	0.13	100	3.27
UA 1453-12	73.34	0.51	14.15	2.38	0.14	0.50	1.89	5.04	1.75	0.16	100	2.73
UA 1453-9	73.46	0.55	14.23	2.33	0.15	0.58	1.86	4.70	1.89	0.14	100	2.87
UA 1453-18	73.53	0.44	14.18	2.14	0.11	0.44	1.73	5.43	1.83	0.15	100	2.19
UA 1453-11	73.61	0.42	14.16	2.02	0.11	0.52	1.68	5.34	2.00	0.12	100	8.39
UA 1453-2	73.65	0.49	14.09	2.38	0.11	0.48	1.83	4.83	1.90	0.13	100	2.48
UA 1453-6	73.75	0.38	13.94	2.34	0.08	0.56	1.91	4.85	1.90	0.16	100	3.00
UA 1453-3	73.78	0.42	13.95	2.26	0.14	0.47	1.74	5.03	1.97	0.16	100	2.59
UA 1453-4	73.81	0.48	14.14	2.18	0.13	0.46	1.73	5.06	1.80	0.13	100	2.45
UA 1453-15	73.83	0.47	13.88	2.17	0.15	0.52	1.75	5.14	1.86	0.11	100	1.88
UA 1453-5	73.89	0.52	14.16	2.24	0.09	0.49	1.68	4.72	1.92	0.17	100	3.13
UA 1453-22	73.91	0.49	14.01	2.28	0.14	0.51	1.81	4.67	1.91	0.17	100	2.38
UA 1453-16	73.93	0.49	13.89	2.12	0.19	0.51	1.71	5.05	1.91	0.14	100	3.37
UA 1453-20	74.11	0.35	14.09	2.15	0.12	0.45	1.62	5.06	1.85	0.16	100	2.53
UA 1453-10	74.11	0.49	14.05	2.23	0.13	0.47	1.62	4.84	1.81	0.13	100	4.38
UA 1453-1	74.13	0.49	14.01	2.23	0.09	0.44	1.66	4.73	1.98	0.15	100	3.55
UA 1453-21	74.15	0.52	13.93	2.19	0.16	0.46	1.75	4.79	1.92	0.10	100	2.18
UA 1453-14	74.22	0.48	14.03	2.10	0.12	0.43	1.59	5.01	1.86	0.09	100	7.05
UA 1453-13	74.34	0.40	13.97	2.06	0.08	0.45	1.62	4.91	1.85	0.15	100	3.03
UA 1453-24	74.37	0.43	13.97	2.17	0.11	0.45	1.75	4.63	1.84	0.16	100	2.99
UA 1453-15	68.66	0.67	15.48	3.74	0.16	0.89	3.52	5.24	1.56	0.10	100	0.38
UA 1453-22	69.63	0.62	14.64	3.79	0.13	0.91	3.22	5.24	1.68	0.16	100	0.54
UA 1453-17	72.13	0.54	14.38	2.63	0.16	0.56	2.17	5.48	1.83	0.12	100	1.57
UA 1453-2	73.07	0.47	14.08	2.31	0.13	0.47	1.87	5.60	1.85	0.16	100	2.60
UA 1453-27	73.23	0.47	13.94	2.37	0.22	0.50	1.82	5.41	1.90	0.15	100	1.87
UA 1453-19	73.30	0.46	13.94	2.37	0.09	0.52	1.86	5.49	1.85	0.12	100	2.76
UA 1453-26	73.50	0.40	13.90	2.28	0.16	0.46	1.83	5.37	1.96	0.13	100	1.57
UA 1453-13	73.53	0.45	14.21	2.17	0.14	0.47	1.77	5.26	1.86	0.14	100	1.35

UA 1453-3	73.53	0.42	13.99	2.12	0.13	0.43	1.70	5.58	1.93	0.17	100	1.53	
UA 1453-7	73.55	0.51	13.82	2.09	0.15	0.47	1.72	5.51	2.07	0.12	100	3.19	
UA 1453-18	73.56	0.45	13.70	2.24	0.17	0.51	1.73	5.47	2.03	0.13	100	2.39	
UA 1453-12	73.60	0.44	14.11	2.23	0.10	0.48	1.77	5.21	1.94	0.11	100	2.34	
UA 1453-1	73.70	0.40	14.05	2.10	0.13	0.46	1.66	5.44	1.90	0.15	100	2.73	
UA 1453-16	73.75	0.39	13.64	2.36	0.10	0.52	1.72	5.34	2.05	0.14	100	0.96	
UA 1453-5	73.77	0.47	14.06	2.28	0.11	0.45	1.73	5.20	1.80	0.13	100	1.17	
UA 1453-10	73.84	0.48	13.81	2.11	0.18	0.49	1.65	5.43	1.90	0.11	100	1.18	
UA 1453-30	73.86	0.42	13.99	2.23	0.10	0.46	1.67	5.29	1.86	0.13	100	1.27	
UA 1453-32	73.91	0.44	13.83	2.05	0.14	0.41	1.59	5.59	1.90	0.14	100	1.96	
UA 1453-20	73.91	0.32	13.79	2.25	0.16	0.46	1.68	5.34	1.93	0.15	100	1.14	
UA 1453-21	74.07	0.43	13.76	2.22	0.11	0.44	1.63	5.27	1.90	0.16	100	1.42	
UA 1453-8	74.10	0.40	13.94	2.18	0.16	0.39	1.59	5.28	1.83	0.14	100	2.64	
UA 1453-33	74.12	0.41	13.88	2.33	0.16	0.46	1.68	5.00	1.85	0.12	100	1.54	
Mean	73.28	0.47	14.10	2.39	0.13	0.53	1.89	5.14	1.87	0.14	100	2.61	46
StDev	1.41	0.08	0.34	0.52	0.03	0.16	0.49	0.30	0.11	0.02	0	1.67	

SELECTED ANALYSES FROM UA 5831 AND ID 3506, BOTH LIPARI OBSIDIANS

**each individual set brackets ~100 single glass shard analyses of unknowns

Sample	SiO2	TiO2	Al2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Cl	Total
UA5831-1 **	74.41	0.05	12.94	1.63	0.07	0.07	0.70	3.77	5.08	0.41	99
UA5831-2	74.66	0.08	13.36	1.60	0.08	0.07	0.72	3.94	5.11	0.27	100
UA5831-3	74.56	0.05	13.26	1.67	0.06	0.04	0.76	4.00	5.04	0.32	100
UA5831-4	74.69	0.02	13.07	1.63	0.06	0.03	0.66	3.88	4.87	0.35	99
UA5831-5	74.56	0.07	13.26	1.56	0.11	0.02	0.71	3.98	4.88	0.37	99
UA5831-6	74.46	0.09	13.01	1.55	0.13	0.00	0.78	3.67	4.99	0.31	99
UA5831-7	74.51	0.12	13.14	1.69	0.07	0.05	0.71	3.94	5.12	0.34	100
UA5831-8	74.24	0.08	13.05	1.61	0.10	0.06	0.72	4.07	4.96	0.36	99
UA5831-9	74.34	0.01	13.15	1.56	0.07	0.08	0.72	4.02	5.02	0.32	99
UA5831-10	74.51	0.03	13.09	1.64	0.06	0.07	0.72	4.41	5.03	0.35	100
Mean	74.49	0.06	13.13	1.61	0.08	0.05	0.72	3.97	5.01	0.34	99
StDev	0.14	0.04	0.13	0.05	0.02	0.03	0.03	0.20	0.09	0.04	0
UA 5831-11	73.66	0.03	13.17	1.73	0.07	0.04	0.75	4.00	4.98	0.36	99
UA 5831-12	73.48	0.10	13.17	1.70	0.06	0.07	0.74	4.16	5.11	0.39	99
UA 5831-13	74.03	0.07	13.12	1.71	0.02	0.04	0.79	4.09	5.07	0.36	99
UA 5831-14	73.76	0.10	12.73	1.67	0.05	0.05	0.79	3.90	5.02	0.38	98
UA 5831-15	73.89	0.04	13.15	1.65	0.08	0.05	0.74	4.03	5.06	0.39	99
UA 5831-16	73.77	0.10	13.18	1.84	0.06	0.04	0.84	3.95	4.86	0.33	99
Mean	73.76	0.07	13.09	1.71	0.06	0.05	0.78	4.02	5.02	0.37	99
StDev	0.19	0.03	0.18	0.07	0.02	0.01	0.04	0.09	0.09	0.03	0
UA 5831-17	74.67	0.00	13.05	1.54	0.08	0.05	0.73	4.09	5.22	0.35	100
UA 5831-18	74.47	0.14	13.18	1.60	0.11	0.08	0.74	4.00	5.03	0.36	100
UA 5831-19	74.37	0.02	13.00	1.81	0.04	0.08	0.71	4.13	4.90	0.39	99
UA 5831-20	74.34	0.08	13.16	1.75	0.07	0.06	0.75	4.13	4.82	0.45	100
UA 5831-21	74.64	0.05	13.03	1.71	0.05	0.04	0.69	3.87	4.95	0.32	99
UA 5831-22	74.62	0.10	13.17	1.69	0.10	0.03	0.74	3.91	4.90	0.39	100
UA 5831-23	74.17	0.12	13.40	1.66	0.05	0.04	0.80	4.11	5.08	0.34	100
Mean	74.47	0.07	13.14	1.68	0.07	0.05	0.74	4.04	4.99	0.37	100
StDev	0.19	0.05	0.14	0.09	0.03	0.02	0.04	0.11	0.13	0.04	0

UA 5831 - 24	73.91	0.06	13.02	1.47	0.06	0.04	0.73	3.94	5.12	0.26	99
UA 5831 - 25	73.84	0.06	13.10	1.50	0.03	0.05	0.74	4.22	4.95	0.31	99
UA 5831 - 26	74.28	0.03	13.11	1.51	0.08	0.06	0.73	4.06	5.23	0.35	99
UA 5831 - 27	73.96	0.09	13.03	1.57	0.08	0.04	0.69	4.11	5.07	0.33	99
UA 5831 - 28	74.16	0.17	13.05	1.49	0.06	0.07	0.74	3.78	5.14	0.30	99
UA 5831 - 29	74.25	0.05	12.79	1.55	0.07	0.03	0.71	3.93	5.04	0.30	99
UA 5831 - 30	74.78	0.04	13.35	1.48	0.04	0.07	0.71	3.94	4.93	0.33	100
UA 5831 - 31	74.30	0.05	13.15	1.45	0.03	0.03	0.75	4.03	5.13	0.40	99
Mean	74.18	0.07	13.08	1.50	0.06	0.05	0.72	4.00	5.08	0.32	99
StDev	0.30	0.04	0.16	0.04	0.02	0.02	0.02	0.13	0.10	0.04	0

UA5831-32	73.31	0.07	12.94	1.60	0.05	0.05	0.73	3.95	5.08	0.26	98
UA5831-33	73.23	0.03	12.86	1.50	0.05	0.07	0.73	4.17	5.10	0.34	98
UA5831-32	73.31	0.07	12.94	1.60	0.05	0.05	0.73	3.95	5.08	0.26	98
UA5831-33	73.23	0.03	12.86	1.50	0.05	0.07	0.73	4.17	5.10	0.34	98
UA5831-35	73.84	0.08	13.11	1.53	0.08	0.05	0.75	3.90	5.05	0.34	99
UA5831-36	73.70	0.06	13.19	1.60	0.06	0.05	0.72	4.14	5.01	0.34	99
UA5831-37	73.56	0.11	13.13	1.50	0.06	0.07	0.72	4.25	5.05	0.32	99
UA5831-38	74.13	0.10	13.12	1.56	0.09	0.03	0.70	4.08	5.00	0.29	99
UA5831-39	74.12	0.03	13.08	1.63	0.04	0.03	0.71	3.98	4.96	0.41	99
UA5831-40	74.07	0.05	13.13	1.61	0.09	0.07	0.75	4.10	5.09	0.38	99
UA5831-41	73.87	0.08	13.07	1.55	0.04	0.07	0.67	4.17	4.97	0.38	99
Mean	73.67	0.06	13.04	1.56	0.06	0.05	0.72	4.08	5.04	0.33	99
StDev	0.36	0.03	0.11	0.05	0.02	0.01	0.02	0.12	0.05	0.05	0

Mean (all)	74.11	0.07	13.09	1.60	0.07	0.05	0.73	4.02	5.03	0.34	99
StDev	0.43	0.04	0.14	0.09	0.02	0.02	0.03	0.14	0.09	0.04	1

ID3506-1	74.46	0.14	13.26	1.55	0.08	0.08	0.71	4.16	5.02	0.36	100
ID3506-2	74.36	0.04	13.29	1.59	0.04	0.05	0.67	4.13	4.86	0.31	99
ID3506-3	73.98	0.06	13.16	1.54	0.07	0.02	0.73	4.10	4.82	0.34	99
ID3506-4	74.32	0.03	13.27	1.60	0.02	0.05	0.66	3.99	4.87	0.30	99
ID3506-5	74.34	0.11	13.20	1.52	0.11	0.07	0.72	4.01	4.84	0.33	99
ID3506-6	74.68	0.00	13.41	1.46	0.08	0.04	0.67	4.03	4.99	0.24	100
ID3506-7	74.91	0.07	13.42	1.56	0.10	0.07	0.72	3.85	5.08	0.28	100
ID3506-8	74.37	0.07	13.14	1.63	0.02	0.04	0.71	4.08	4.91	0.28	99
Mean	74.43	0.07	13.27	1.55	0.07	0.05	0.70	4.04	4.92	0.30	99
StDev	0.28	0.04	0.10	0.05	0.03	0.02	0.03	0.10	0.10	0.04	0

ID3506-9	73.63	0.07	13.25	1.44	0.07	0.05	0.69	3.92	4.88	0.32	98
ID3506-10	73.54	0.08	13.40	1.63	0.10	0.06	0.69	4.16	5.14	0.35	99
ID3506-11	73.48	0.07	13.13	1.55	0.07	0.05	0.77	3.92	5.11	0.37	98
ID3506-12	72.85	0.04	13.10	1.52	0.09	0.06	0.69	4.12	4.92	0.34	98
ID3506-13	73.18	0.03	13.01	1.62	0.13	0.02	0.72	4.09	4.76	0.31	98
ID3506-14	73.11	0.13	13.10	1.49	0.01	0.05	0.69	4.15	4.96	0.34	98
ID3506-15	73.56	0.06	12.98	1.65	0.09	0.05	0.65	4.04	4.85	0.37	98
Mean	73.33	0.07	13.14	1.56	0.08	0.05	0.70	4.06	4.95	0.34	98
StDev	0.29	0.03	0.14	0.08	0.04	0.02	0.04	0.10	0.14	0.02	0

ID3506-16	74.02	0.07	13.23	1.70	0.05	0.04	0.72	4.07	4.77	0.37	99
ID3506-17	73.74	0.10	13.18	1.61	0.10	0.05	0.75	4.14	4.96	0.34	99
ID3506-18	74.34	0.12	13.34	1.55	0.04	0.03	0.67	4.06	4.99	0.31	99
ID3506-19	73.53	0.01	13.16	1.64	0.08	0.06	0.68	3.91	4.91	0.32	98

	ID3506-20	73.57	0.07	13.03	1.70	0.10	0.04	0.67	3.94	4.90	0.37	98
	ID3506-21	74.14	0.07	13.12	1.60	0.08	0.04	0.72	3.91	4.88	0.34	99
	Mean	73.89	0.07	13.17	1.63	0.08	0.04	0.70	4.01	4.90	0.34	99
	StDev	0.33	0.04	0.10	0.06	0.03	0.01	0.03	0.10	0.08	0.02	0
	ID3506-22	74.28	0.12	13.52	1.60	0.11	0.05	0.70	4.02	4.95	0.33	100
	ID3506-23	73.87	0.11	13.26	1.56	0.07	0.09	0.69	4.05	4.95	0.32	99
	ID3506-24	75.18	0.03	13.23	1.59	0.09	0.08	0.72	3.88	5.05	0.33	100
	ID3506-25	74.15	0.04	13.43	1.57	0.09	0.05	0.72	4.15	4.93	0.33	99
	ID3506-26	74.22	0.06	13.45	1.57	0.05	0.07	0.71	3.96	5.19	0.36	100
	ID3506-27	73.79	0.10	13.51	1.72	0.04	0.06	0.74	4.04	5.02	0.35	99
	ID3506-28	75.19	0.04	13.23	1.57	0.10	0.05	0.69	3.93	4.99	0.30	100
	ID3506-29	74.92	0.09	13.56	1.62	0.00	0.06	0.77	4.03	4.91	0.33	100
	Mean	74.45	0.07	13.40	1.60	0.07	0.06	0.72	4.01	5.00	0.33	100
	StDev	0.57	0.04	0.14	0.05	0.04	0.01	0.03	0.08	0.09	0.02	0
	Mean (all)	74.06	0.07	13.25	1.58	0.07	0.05	0.71	4.03	4.94	0.33	99
	StDev	0.60	0.04	0.16	0.07	0.03	0.02	0.03	0.09	0.10	0.03	1
(Kuehn	**ID 3506**	**74.10**	**0.07**	**13.10**	**1.55**	**0.07**	**0.04**	**0.74**	**4.06**	**5.13**	**0.34**	**99**
2011)	**official**	0.96	0.03	0.34	0.06	0.03	0.02	0.05	0.28	0.26	0.03	

Paleomagnetic data for Chapter 2

ChRM of samples from Alyeska Pipline viewing area (AP)

Position relative to tephra (cm)	**Sample**	**Inclination**	**Declination**
0.35	AP-646	64.1	99.2
0.30	AP-647	58.3	95.9
0.10	AP-648	64.3	89.3
Alyeska Pipeline tephra			
-0.15	AP-649	74.1	110
-0.20	AP-650	68.3	96
-0.25	AP-651	68.9	89.7

ChRM of samples from Hollis Mine (HM)

Position relative to tephra (cm)	**Sample**	**Inclination**	**Declination**
15	HM-439	53.5	119
10	HM-440	70.6	57.8
5	HM-441	49.6	111
0	HM-442	60.2	108
Valley Creek tephra			
0	HM-443	58.1	93.7
-5	HM-444	76.2	96.9
-10	HM-445	65.7	62.9
-15	HM-446	60.3	105

-275	HM-498	85.8	137
-280	HM-499	57	105
unknown tephra bed			
-285	HM-500	62.8	114
-290	HM-501	72.1	211
-295	HM-502	59.8	107
-300	HM-503	75.2	80.9
-305	HM-504	67.4	73.3
-310	HM-505	64.1	61.5

ChRM of samples from Palisades, Site B1

Meters above riverl level	Sample	Inclination	Declination
29.8	1	46.2	65.5
29.6	2	32.1	62.7
29.4	3	-26.1	63.8
29.2	4	36.2	65.0
29.0			
28.8	5	67.9	73.2
28.6	6	41.8	56.9
28.4			
28.2	7	9.3	60.8
28.0			
27.8			
27.6			
27.4			
27.2			
27.0	8	21.8	71.9
26.8	9	217.3	-70.8
26.6	10	174.1	-69.7
26.4	11	250.3	-69.5
26.2	12	175.1	-71.6
26.0	13	66.1	73.4
25.8	14	89.2	71.8
25.6	15	96.8	74.9
25.4	16	101.0	67.2
25.2	17	82.2	78.5
25.0	18&25	31.9	70.2
24.8	19&26	28.3	69.3
24.6	20&27	108.9	73.8
24.4	21&28	51.4	71.6
24.2	22&29	48.0	70.1
24.0	23&30	36.9	72.4
23.8	24&31	15.8	62.2
23.4	32	30.6	61.1
23.2	33	32.4	64.2
23.0	34	18.9	70.1
22.8	35	45.9	68.9
22.6	36	54.4	58.7
22.4	37	31.0	63.1
22.2	38	34.2	37.6
22.0	39	51.8	63.9

21.8	40	32.3	62.4
21.6	41	46.9	63.4
21.4	42	77.0	65.8
21.2	43	60.1	66.3
21.0	44	57.6	64.3
20.8	45	44.9	69.6
20.6	46	49.5	67.6
20.4	47	35.2	71.6
20.2	48	80.6	82.4
20.0	49	46.0	67.7
19.8	50	59.3	81.8
19.6	51	12.3	71.8
19.4	52	-32.1	61.0
19.2	53	54.8	73.2
19.0	54	51.6	63.4
18.8	55	59.1	71.9
18.6	56	45.6	56.5
18.4	57	51.3	63.2
18.2	58	53.0	39.1
18.0	59	50.8	29.8
17.8	60	64.7	85.9
17.6	61	61.6	83.8
17.4	62	poor MAD	
17.2	63	94.8	81.0
17.0	64	73.4	79.6
16.8	65	49.6	75.6
16.6	66	72.8	79.5
16.4	67	67.9	79.4
16.2	68	85.7	75.8
16.0	69	118.5	81.2
15.8	70	62.2	77.8
15.6	71	87.8	79.7
15.4	72	133.3	79.8
15.2	73	124.3	73.1
15.0	74	41.1	84.7
14.8	75	113.2	86.2
14.6	76	6.1	67.8
14.4	77	82.9	71.6
14.2	78	108.6	75.6
14.0	79	107.2	76.0
13.8	80	116.2	63.7
13.6	81	107.6	77.4
13.4	82	53.0	81.4
13.2	83	100.0	65.8
13.0	84	83.8	60.4
12.8	85	83.3	57.4
12.6	86	94.7	72.0
12.4	87	89.6	70.6
12.2	88	90.3	60.5
12.0	89	74.6	50.5
11.8	90	151.5	80.4
11.6	91	60.9	50.7
11.4	92	-6.6	51.2

11.2	93	94.6	71.2
11.0	94	87.1	79.7
10.8	95	26.9	83.4
10.6			
10.4	96	oor MAD	
10.3	97	22.7	83.4
10.2	98	159.4	80.2
10.1	99	-47.3	52.4
10.0	100	125.7	74.1
9.8	101	140.9	79.9
9.6	102	#####	78.5
9.4	103	131.4	87.5
9.2	104	oor MAD	
9.0	105	oor MAD	
8.9	106	89.3	58.9
8.8	107	66.4	41.6
8.7	108	46.3	71.5
8.6	109	61.3	57.0
8.5	110	84.3	62.5
8.4	111	62.0	70.1
8.3	112	141.2	80.9
8.2	113	99.1	81.9
8.1	114	40.4	58.6
8.0	115	65.3	65.2
7.9	117	46.4	65.9
7.8	118	76.4	53.9
7.7	119	59.8	72.9
7.6	120	46.5	73.4
7.5	121	79.3	58.2
7.4	122	61.1	69.1
7.3			
7.2			
7.1			
7.0	130	-6.4	84.6
6.9	131	-60.7	74.6
6.8	132	8.3	82.8
6.7	133	15.6	79.5
6.6	134	29.4	79.6
6.5	135	-61.6	81.2
6.4	136	-45.2	74.3
6.3	137	73.0	79.9
6.2	138	17.1	71.7
6.1	139	5.9	81.8
6.0	140	31.5	79.2
5.9	141	#####	69.6
5.8	142	89.0	80.5
5.7	143	7.6	82.7
5.6	144	55.5	82.2
5.5	145	153.1	85.5
5.4	146	199.2	78.3
5.3	147	168.2	72.7
5.2	148	11.9	77.3
5.1	149	55.7	88.6

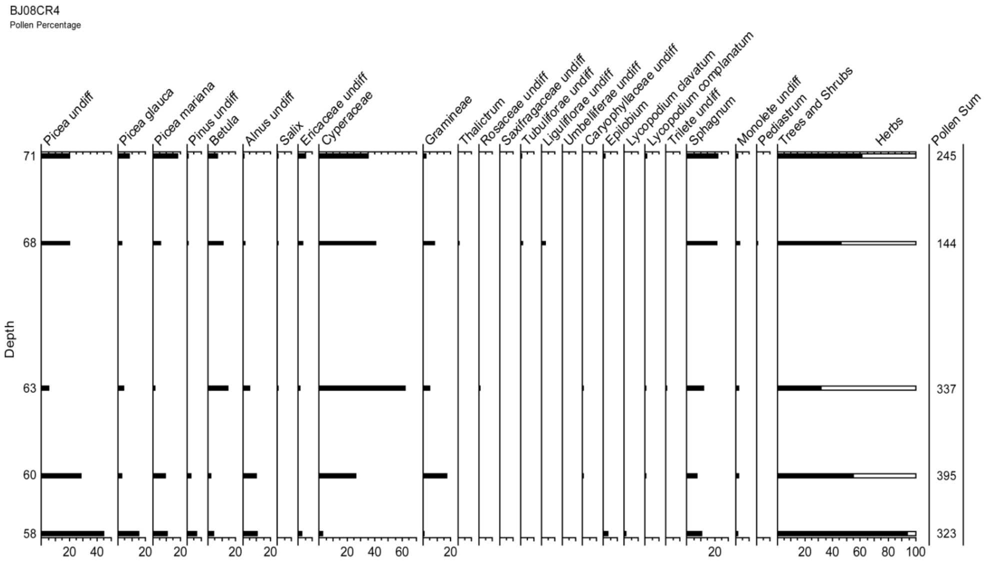
5.0	150	2.0	86.7
4.8	151	155.3	80.5
4.6	152	78.3	84.0
4.4	153	-52.0	70.0
4.2	154	24.1	72.4
4.0	155	124.7	86.4
3.8	156	-21.0	77.0
3.6	157	-6.6	67.6
3.4	158	67.6	83.1
3.2	159	11.7	84.9
3.0	160	-59.2	75.8
2.8	161	-19.9	75.4

ChRM of samples from Palisades, Site B1

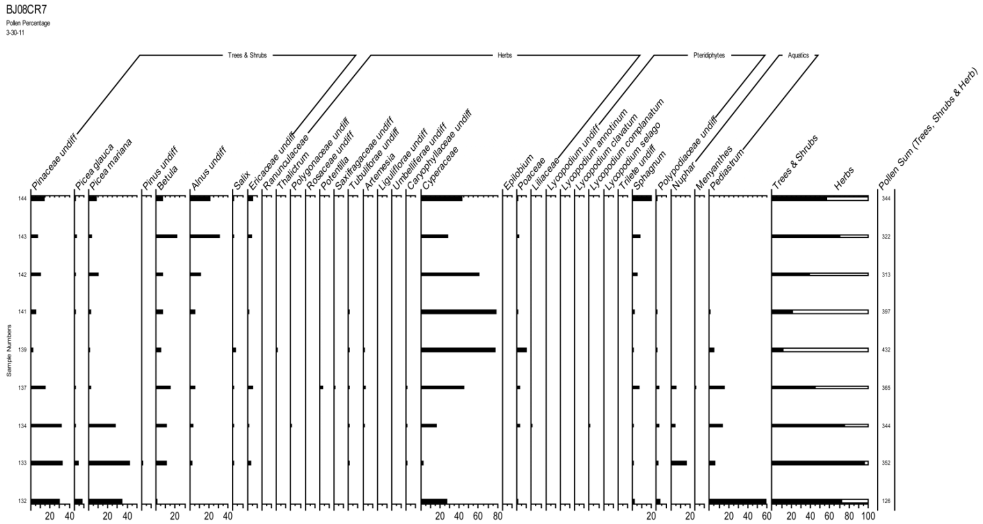
Meters above riverl level	Sample	Inclination	Declination
17.02	27	-8.7	64.0
16.92	26		
16.72	25	-48.3	72.4
16.52	24	-27.3	76.1
16.32	23	43.1	80.0
16.12	22	13.8	59.1
15.92	21	poor MAD	
15.72	20	poor MAD	
15.52	19	-23.0	77.4
15.37	18	poor MAD	
15.22	17	poor MAD	
15.07	16	-43.9	80.6
15.02	15	56.4	62.6
15.00	13&14	5.75	79.2
14.85	12	-23.4	84.3
14.70	11	poor MAD	
14.55	10	39.2	68.5
14.30	9	73.1	84.4
14.10	8	28.5	65.9
13.90	7	-30.7	60.6
13.70	6&5	-12.4	62.5
13.55	4	10.2	52.8
13.40	3	-0.6	40.2
13.25	2	6.7	51.7
13.10	1	poor MAD	

Pollen data disussed in Chapter 2

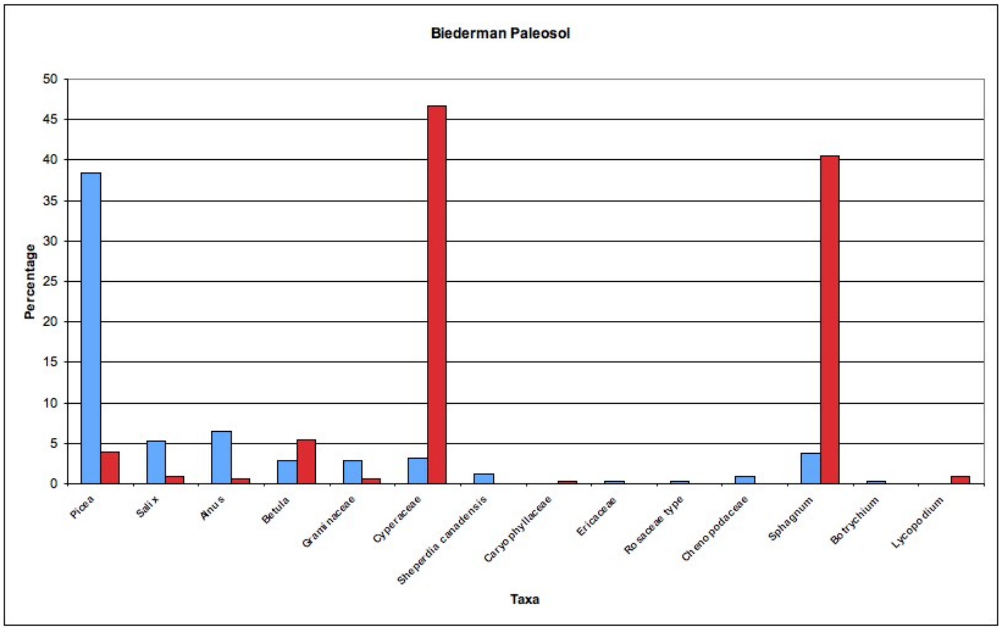
BJ08CR4 = Chester Bluff, Site 4, pollen profile through large paleosol above PrH



BJ08CR7=Chester Bluff, Site 7. Pollen profile through paleosol complex below CBt



Pollen counts from Chester Bluff, Site 2, paleosol directly below Beiderman tephra. One sample from in paleosol (blue), the other from around the tephra (red)



APPENDIX 2: CHAPTER 3

MAJOR-ELEMENT GEOCHEMISTRY OF VT SAMPLES

Tephra ID	Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Cl	Total	H_2O_{diff}	n	Notes
	UA 1579-4	65.63	0.70	15.53	5.15	0.18	1.44	4.44	4.51	2.26	0.15	100	1.39		Hunker
	UA 1579-6	65.91	0.69	15.85	4.83	0.15	1.34	4.28	4.57	2.25	0.12	100	1.28		Creek
	UA 1579-1	67.92	0.58	15.25	4.02	0.12	1.03	3.41	4.80	2.69	0.18	100	1.33		
	UA 1579-18	68.93	0.68	15.13	3.66	0.08	0.94	3.19	4.66	2.58	0.15	100	1.28		
	UA 1579-19	69.60	0.61	15.07	3.51	0.10	0.79	2.93	4.64	2.62	0.13	100	3.62		
	UA 1579-26	69.77	0.65	14.97	3.43	0.12	0.74	2.85	4.58	2.74	0.15	100	1.27		
	UA 1579-23	69.92	0.67	14.93	3.31	0.16	0.72	2.64	4.58	2.89	0.19	100	2.93		
	UA 1579-21	70.28	0.57	14.86	3.31	0.08	0.74	2.63	4.55	2.86	0.14	100	1.61		
	UA 1579-11	70.42	0.60	14.76	3.13	0.13	0.69	2.66	4.48	2.91	0.22	100	4.51		
	UA 1579-10	70.46	0.57	14.87	3.06	0.13	0.57	2.61	4.67	2.88	0.18	100	1.30		
	UA 1579-22	70.59	0.57	14.65	3.04	0.11	0.63	2.67	4.68	2.86	0.21	100	1.65		
	UA 1579-28	70.59	0.59	14.81	3.20	0.13	0.72	2.42	4.38	3.02	0.14	100	2.09		
	UA 1579-14	70.66	0.60	14.58	3.40	0.03	0.77	2.69	4.50	2.57	0.20	100	1.46		
	UA 1579-30	70.73	0.55	14.77	3.08	0.13	0.62	2.40	4.66	2.90	0.16	100	1.72		
	UA 1579-16	70.74	0.59	14.66	3.25	0.08	0.62	2.47	4.45	2.99	0.16	100	2.68		
	UA 1579-24	70.74	0.51	14.61	3.10	0.07	0.59	2.62	4.46	3.14	0.16	100	1.44		
	UA 1579-29	70.77	0.54	14.68	3.08	0.07	0.64	2.48	4.66	2.90	0.20	100	1.69		
	UA 1579-2	70.81	0.57	14.60	3.09	0.10	0.62	2.55	4.43	3.00	0.22	100	3.19		
	UA 1579-5	70.88	0.62	14.80	3.02	0.10	0.66	2.53	4.38	2.85	0.16	100	3.26		
	UA 1579-7	70.89	0.64	14.88	3.09	0.06	0.60	2.39	4.55	2.76	0.15	100	0.94		
	UA 1579-3	70.92	0.60	14.51	3.21	0.06	0.65	2.46	4.51	2.92	0.16	100	3.95		
	UA 1579-15	70.99	0.63	14.80	3.05	0.10	0.66	2.47	4.26	2.84	0.21	100	1.73		
	UA 1579-27	71.18	0.59	14.41	3.09	0.10	0.64	2.41	4.58	2.87	0.14	100	2.01		
	UA 1579-17	71.22	0.52	14.51	2.90	0.13	0.55	2.38	4.55	3.04	0.20	100	0.51		
	UA 1579-13	71.27	0.51	14.67	3.07	0.09	0.65	2.29	4.26	3.00	0.21	100	5.68		
	UA 1579-12	71.35	0.57	14.49	3.03	0.09	0.64	2.36	4.39	2.94	0.13	100	1.42		
	UA 1579-20	71.46	0.46	14.55	2.81	0.10	0.61	2.23	4.65	2.98	0.16	100	1.49		
	AVERAGE	70.17	0.59	14.82	3.33	0.10	0.73	2.72	4.53	2.83	0.17	100	2.13		
	STDEV	1.48	0.06	0.33	0.54	0.03	0.22	0.54	0.13	0.21	0.03	0	1.21	n = 27	
	UA 1579-9	73.34	0.32	14.05	2.32	0.06	0.36	1.86	4.47	3.07	0.15	100	3.34		
	UA 1580-18	66.98	0.72	15.57	4.42	0.15	1.26	3.74	4.60	2.36	0.20	100	1.72		Jackson Hill
	UA 1580-15	69.61	0.66	14.73	3.51	0.12	0.80	2.91	4.72	2.78	0.17	100	2.07		
	UA 1580-20	70.27	0.61	14.63	3.14	0.09	0.70	2.58	4.82	2.96	0.19	100	4.09		
	UA 1580-8	70.46	0.52	14.73	3.25	0.12	0.62	2.44	4.70	2.93	0.22	100	7.15		
	UA 1580-1	70.53	0.60	14.70	3.12	0.09	0.69	2.60	4.57	2.88	0.21	100	0.70		
	UA 1580-22	70.55	0.55	14.60	3.01	0.08	0.58	2.50	4.83	3.13	0.17	100	3.00		
	UA 1580-21	70.56	0.54	14.82	3.10	0.08	0.69	2.54	4.48	2.98	0.21	100	1.68		
	UA 1580-9	70.57	0.62	14.61	3.05	0.09	0.62	2.62	4.57	3.03	0.20	100	2.39		
	UA 1580-3	70.57	0.56	14.83	3.17	0.11	0.64	2.54	4.51	2.92	0.14	100	2.33		
	UA 1580-25	70.57	0.59	14.66	3.08	0.11	0.62	2.56	4.59	3.05	0.18	100	5.76		
	UA 1580-6	70.65	0.53	14.75	3.03	0.08	0.64	2.27	4.73	3.08	0.23	100	1.82		
	UA 1580-17	70.68	0.59	14.67	3.05	0.08	0.65	2.49	4.63	3.02	0.14	100	1.46		
	UA 1580-13	70.68	0.61	14.73	3.00	0.10	0.66	2.57	4.46	3.04	0.15	100	2.25		
	UA 1580-11	70.71	0.54	14.67	3.16	0.09	0.58	2.45	4.61	2.97	0.22	100	1.60		
	UA 1580-16	70.75	0.59	14.58	3.27	0.09	0.63	2.51	4.48	2.87	0.23	100	4.59		
	UA 1580-24	70.87	0.56	14.77	3.00	0.10	0.59	2.47	4.48	3.01	0.14	100	2.83		

UA 1580-4	70.89	0.48	14.63	3.16	0.14	0.72	2.50	4.30	2.99	0.18	100	4.13
UA 1580-14	70.90	0.57	14.61	3.15	0.04	0.68	2.63	4.30	2.95	0.18	100	3.80
UA 1580-2	70.91	0.61	14.60	3.10	0.07	0.61	2.57	4.40	3.00	0.13	100	2.40
UA 1580-5	70.94	0.62	14.60	3.23	0.09	0.65	2.40	4.45	2.93	0.09	100	3.72
UA 1580-10	71.00	0.52	14.62	3.15	0.08	0.65	2.51	4.28	2.97	0.22	100	8.26
UA 1580-7	71.03	0.55	14.63	3.12	0.06	0.63	2.40	4.37	3.01	0.20	100	2.66
UA 1580-12	71.10	0.51	14.77	3.00	0.09	0.59	2.34	4.40	3.10	0.08	100	1.66
UA 1580-23	71.33	0.54	14.56	2.91	0.08	0.65	2.42	4.32	3.05	0.14	100	3.75
UT 1637-15	68.83	0.60	15.18	3.91	0.10	0.91	3.03	4.55	2.77	0.12	100	2.81
UT 1637-10	68.87	0.61	15.14	3.82	0.11	0.94	3.01	4.62	2.68	0.21	100	2.52
UT 1637-8	69.88	0.65	14.80	3.41	0.10	0.73	2.49	4.92	2.88	0.16	100	1.57
UT 1637-24	70.29	0.62	14.78	3.27	0.15	0.69	2.40	4.64	2.96	0.19	100	2.49
UT 1637-14	70.47	0.62	14.58	3.08	0.11	0.63	2.51	4.81	3.02	0.17	100	2.79
UT 1637-23	70.52	0.62	14.77	3.37	0.14	0.71	2.61	4.28	2.85	0.14	100	2.01
UT 1637-1	70.52	0.66	14.94	3.18	0.05	0.60	2.46	4.53	2.87	0.18	100	3.19
UT 1637-26	70.67	0.59	14.80	3.06	0.04	0.65	2.43	4.49	3.07	0.20	100	4.19
UT 1637-4	70.79	0.62	14.83	3.02	0.18	0.61	2.31	4.45	3.02	0.17	100	3.50
UT 1637-20	70.84	0.58	14.53	3.11	0.14	0.64	2.45	4.49	3.03	0.19	100	1.71
UT 1637-16	70.89	0.62	14.43	2.83	0.17	0.63	2.37	4.66	3.19	0.20	100	1.99
UT 1637-3	71.00	0.60	14.57	3.13	0.09	0.63	2.30	4.45	3.03	0.20	100	3.47
UT 1637-13	71.00	0.55	14.60	3.10	0.06	0.67	2.43	4.46	2.95	0.18	100	1.20
UT 1637-7	71.01	0.59	14.48	3.26	0.05	0.71	2.33	4.59	2.81	0.17	100	1.86
UT 1637-25	71.01	0.56	14.73	3.06	0.07	0.62	2.38	4.53	2.87	0.17	100	1.96
UT 1637-5	71.06	0.58	14.51	2.88	0.08	0.65	2.35	4.64	3.09	0.18	100	2.23
UT 1637-6	71.07	0.57	14.51	3.16	0.05	0.64	2.31	4.50	2.97	0.21	100	1.13
UT 1637-18	71.21	0.55	14.55	3.04	0.12	0.56	2.25	4.59	2.94	0.20	100	2.39
UT 1637-19	71.21	0.58	14.57	2.97	0.10	0.60	2.30	4.49	3.03	0.14	100	2.55
UT 1637-21	71.41	0.66	14.76	2.98	0.12	0.57	2.34	4.01	3.01	0.13	100	2.04
UT 1637-2	71.44	0.56	14.44	3.18	0.03	0.65	2.50	4.22	2.81	0.17	100	1.61
UT 1637-8	65.79	0.81	15.83	5.05	0.14	1.47	3.87	4.71	2.20	0.15	100	2.14
UT 1637-30	67.02	0.71	15.63	4.58	0.16	1.33	3.52	4.41	2.50	0.14	100	0.73
UT 1637-22	68.72	0.69	15.40	3.78	0.12	0.92	3.04	4.73	2.47	0.12	100	2.10
UT 1637-13	68.98	0.60	14.94	3.99	0.09	1.03	3.02	4.72	2.50	0.12	100	1.83
UT 1637-7	69.42	0.67	15.22	3.65	0.11	0.75	2.64	4.65	2.76	0.13	100	2.46
UT 1637-3	69.64	0.63	15.24	3.37	0.09	0.78	2.75	4.52	2.78	0.20	100	4.62
UT 1637-6	70.16	0.64	14.85	3.15	0.09	0.70	2.33	4.98	2.96	0.14	100	3.49
UT 1637-11	70.41	0.60	14.63	3.28	0.13	0.66	2.45	4.71	2.91	0.21	100	1.35
UT 1637-18	70.45	0.58	14.78	3.16	0.13	0.59	2.27	4.86	3.00	0.18	100	2.77
UT 1637-9	70.53	0.59	14.63	3.22	0.09	0.72	2.50	4.69	2.86	0.17	100	1.74
UT 1637-24	70.57	0.60	14.70	3.14	0.16	0.70	2.52	4.55	2.91	0.17	100	2.58
UT 1637-4	70.58	0.53	14.62	3.14	0.11	0.63	2.41	4.90	2.89	0.19	100	2.27
UT 1637-23	70.66	0.60	14.72	3.06	0.17	0.70	2.35	4.70	2.89	0.16	100	2.83
UT 1637-2	70.69	0.61	15.03	2.92	0.11	0.66	2.22	4.58	2.99	0.18	100	4.83
UT 1637-5	70.77	0.62	14.61	3.01	0.06	0.68	2.29	4.75	3.05	0.16	100	3.60
UT 1637-12	70.80	0.59	14.70	3.08	0.09	0.57	2.41	4.78	2.80	0.17	100	1.72
UT 1637-10	70.86	0.58	14.68	3.12	0.12	0.60	2.52	4.48	2.90	0.14	100	2.02
UT 1637-17	70.92	0.50	14.58	3.02	0.09	0.63	2.33	4.71	3.03	0.19	100	0.83
UT 1637-25	70.93	0.56	14.72	2.98	0.11	0.68	2.29	4.79	2.76	0.15	100	3.49
UT 1637-16	70.96	0.57	14.56	3.12	0.14	0.64	2.34	4.67	2.85	0.16	100	1.25
UT 1637-29	70.99	0.58	14.60	2.97	0.12	0.59	2.32	4.77	2.91	0.15	100	3.10
UT 1637-20	71.03	0.60	14.54	3.12	0.11	0.63	2.28	4.76	2.81	0.12	100	1.55
UT 1637-1	71.05	0.50	14.79	2.96	0.10	0.59	2.25	4.74	2.87	0.15	100	4.53
UT 1637-15	71.06	0.57	14.53	2.90	0.10	0.66	2.32	4.83	2.86	0.16	100	2.24

	UT 1637-14	71.10	0.49	14.54	3.13	0.11	0.64	2.28	4.63	2.82	0.26	100	1.13	
	UT 1637-28	71.61	0.58	14.54	3.07	0.14	0.67	2.44	3.80	2.94	0.21	100	2.36	
	UT 1637-26	71.71	0.55	14.65	2.97	0.10	0.60	2.34	4.01	2.91	0.15	100	2.05	
	AVERAGE	70.48	0.59	14.75	3.22	0.10	0.70	2.52	4.57	2.90	0.17	100	2.65	
n = 72	**STDEV**	1.02	0.05	0.27	0.38	0.03	0.16	0.31	0.21	0.17	0.03	0	1.36	n = 72
	UA 1100-5	66.09	0.77	15.79	4.86	0.16	1.36	4.12	4.52	2.20	0.13	100	1.95	Montauk
	UA 1100-9	67.82	0.67	15.44	4.23	0.14	1.11	3.44	4.38	2.61	0.17	100	3.99	
	UA 1100-3	68.19	0.62	15.25	4.14	0.21	1.07	3.25	4.40	2.72	0.16	100	6.09	
	UA 1100-18	68.49	0.62	15.59	3.56	0.13	0.84	3.33	4.78	2.51	0.15	100	1.47	
	UA 1100-16	69.13	0.64	15.17	3.67	0.05	0.86	2.96	4.61	2.77	0.14	100	2.18	
	UA 1100-12	69.25	0.59	15.18	3.76	0.10	0.84	2.86	4.60	2.67	0.16	100	2.39	
	UA 1100-10	70.20	0.53	14.62	3.38	0.07	0.71	2.79	4.64	2.88	0.20	100	6.02	
	UA 1100-2	70.58	0.64	14.61	3.05	0.13	0.65	2.45	4.78	2.93	0.19	100	2.99	
	UA 1100-6	70.60	0.52	14.88	3.02	0.09	0.62	2.44	4.60	2.98	0.23	100	3.92	
	UA 1100-11	70.65	0.57	14.69	3.24	0.12	0.63	2.55	4.49	2.90	0.16	100	2.04	
	UA 1100-1	70.65	0.54	14.55	3.27	0.13	0.62	2.47	4.53	3.09	0.16	100	3.36	
	UA 1100-13	70.71	0.59	14.53	3.02	0.13	0.63	2.38	4.91	2.98	0.11	100	2.46	
	UA 1100-8	70.76	0.59	14.47	3.10	0.16	0.64	2.50	4.62	2.97	0.19	100	7.77	
	UA 1100-17	70.78	0.56	14.71	2.98	0.12	0.64	2.49	4.39	3.07	0.25	100	4.10	
	UA 1100-4	70.80	0.54	14.65	3.20	0.05	0.66	2.41	4.48	2.99	0.22	100	1.71	
	UA 1100-7	70.97	0.56	14.49	3.09	0.11	0.64	2.38	4.56	3.01	0.19	100	4.46	
	UA 1100-14	71.12	0.56	14.63	3.04	0.09	0.60	2.52	4.24	2.99	0.21	100	3.32	
	UA 1100-20	65.73	0.77	16.11	4.94	0.14	1.42	3.87	4.51	2.41	0.10	100	2.52	
	UA 1100-23	67.27	0.70	15.70	4.36	0.11	1.29	3.55	4.46	2.47	0.09	100	2.48	
	UA 1100-6	68.99	0.72	14.93	3.86	0.12	0.98	2.92	4.59	2.74	0.15	100	2.78	
	UA 1100-12	69.02	0.65	15.13	3.73	0.14	0.87	2.91	4.60	2.79	0.15	100	3.50	
	UA 1100-7	69.05	0.62	15.11	3.84	0.12	0.86	3.10	4.36	2.78	0.15	100	4.40	
	UA 1100-13	69.08	0.67	15.39	3.71	0.08	0.73	2.77	4.57	2.87	0.14	100	3.36	
	UA 1100-8	70.46	0.65	14.95	3.29	0.08	0.71	2.50	4.32	2.88	0.15	100	2.66	
	UA 1100-17	70.71	0.54	14.80	3.23	0.15	0.65	2.79	3.98	2.97	0.18	100	7.26	
	UA 1100-18	70.89	0.56	14.69	3.01	0.08	0.64	2.38	4.41	3.15	0.18	100	2.71	
	UA 1100-1	70.90	0.52	14.63	2.98	0.07	0.64	2.43	4.58	3.07	0.18	100	3.21	
	UA 1100-5	70.94	0.63	14.73	3.04	0.10	0.55	2.35	4.59	2.92	0.15	100	3.19	
	UA 1100-15	71.00	0.65	14.73	3.12	0.08	0.53	2.39	4.36	3.02	0.12	100	2.59	
	UA 1100-11	71.03	0.55	14.72	3.08	0.06	0.61	2.32	4.33	3.16	0.16	100	1.06	
	UA 1100-4	71.05	0.56	14.63	2.89	0.12	0.61	2.26	4.65	3.03	0.19	100	1.93	
	UA 1100-10	71.06	0.57	14.64	2.94	0.13	0.65	2.35	4.52	2.94	0.22	100	0.89	
	UA 1100-16	71.07	0.58	14.53	3.00	0.12	0.63	2.35	4.49	3.08	0.14	100	2.49	
	UA 1100-19	71.22	0.55	14.49	3.07	0.10	0.64	2.40	4.41	2.94	0.17	100	3.06	
	UA 1100-2	71.49	0.70	14.50	2.98	0.09	0.59	2.20	4.21	3.09	0.14	100	2.14	
	UA 1100-9	71.69	0.44	14.48	2.98	0.09	0.51	2.06	4.46	3.06	0.22	100	2.03	
	UT 1100-28	66.50	0.71	15.64	4.51	0.12	1.31	3.56	5.10	2.42	0.11	100	0.90	
	UT 1100-4	68.79	0.66	15.18	3.81	0.14	0.98	3.06	4.68	2.57	0.12	100	4.80	
	UT 1100-6	69.00	0.64	15.14	3.78	0.14	0.95	2.96	4.66	2.59	0.13	100	1.49	
	UT 1100-20	69.09	0.60	15.13	3.78	0.12	0.89	2.87	4.72	2.67	0.12	100	1.28	
	UT 1100-3	69.11	0.62	14.94	3.75	0.11	0.88	2.91	4.70	2.81	0.17	100	6.27	
	UT 1100-5	69.20	0.64	15.01	3.65	0.15	0.93	2.82	4.69	2.76	0.15	100	2.89	
	UT 1100-9	69.74	0.55	15.38	3.11	0.12	0.67	2.84	4.62	2.81	0.16	100	0.46	
	UT 1100-1	70.11	0.58	14.62	3.22	0.13	0.66	2.54	4.85	3.05	0.23	100	3.87	
	UT 1100-22	70.24	0.59	14.67	3.43	0.12	0.85	2.55	4.55	2.85	0.15	100	6.93	
	UT 1100-30	70.39	0.55	14.81	3.23	0.08	0.64	2.39	4.71	3.03	0.16	100	1.82	

UT 1100-19	70.46	0.57	14.74	3.24	0.11	0.66	2.53	4.69	2.86	0.14	100	5.80	
UT 1100-2	70.50	0.55	14.64	3.27	0.08	0.73	2.46	4.74	2.86	0.16	100	1.35	
UT 1100-15	70.52	0.59	15.07	3.14	0.15	0.57	2.36	4.45	2.97	0.19	100	1.29	
UT 1100-10	70.60	0.58	14.78	3.13	0.08	0.63	2.58	4.56	2.95	0.12	100	2.89	
UT 1100-16	70.61	0.59	14.83	3.24	0.08	0.69	2.37	4.58	2.88	0.12	100	0.06	
UT 1100-18	70.70	0.58	14.78	3.13	0.11	0.63	2.40	4.57	2.96	0.14	100	1.13	
UT 1100-8	70.75	0.55	15.01	3.13	0.08	0.60	2.24	4.53	2.92	0.19	100	1.36	
UT 1100-24	70.77	0.54	14.59	3.05	0.09	0.67	2.38	4.79	3.02	0.11	100	2.04	
UT 1100-12	70.78	0.61	14.66	2.94	0.09	0.64	2.29	4.77	3.04	0.17	100	1.51	
UT 1100-7	70.78	0.56	14.76	3.09	0.08	0.68	2.45	4.70	2.77	0.13	100	1.13	
UT 1100-23	70.87	0.57	14.67	2.97	0.07	0.64	2.36	4.67	3.04	0.13	100	2.75	
UT 1100-26	70.93	0.62	14.66	2.94	0.10	0.69	2.38	4.54	3.00	0.14	100	1.29	
UT 1100-17	70.99	0.58	14.66	3.04	0.08	0.60	2.37	4.65	2.85	0.18	100	1.97	
UT 1100-29	71.26	0.52	14.66	3.04	0.07	0.60	2.36	4.38	2.98	0.12	100	0.70	
UT 1100-21	71.29	0.54	14.54	2.88	0.04	0.58	2.20	4.65	3.15	0.15	100	1.89	
UT 1100-27	71.40	0.53	14.42	2.90	0.12	0.51	2.20	4.65	3.04	0.23	100	0.52	
UT 1100-13	71.96	0.44	14.77	2.45	0.07	0.48	1.87	4.86	2.94	0.15	100	1.76	
AVERAGE	70.11	0.59	14.87	3.34	0.11	0.74	2.63	4.57	2.88	0.16	100	2.77	
STDEV	1.33	0.06	0.36	0.49	0.03	0.21	0.43	0.18	0.20	0.04	0	1.72	n = 63
UA 1100-24	74.52	0.27	13.90	2.04	0.08	0.27	1.34	4.20	3.14	0.23	100	5.65	
UA 1100-25	74.99	0.32	13.06	1.90	0.09	0.25	1.59	3.68	3.82	0.29	100	5.04	
UT 1100-25	75.31	0.39	12.88	1.81	0.06	0.28	1.45	3.92	3.62	0.28	100	3.28	

UT 870-20	66.18	0.79	15.81	4.74	0.14	1.40	3.92	4.68	2.23	0.12	100	2.32	John W.'s reference
UT 870-1	68.67	0.63	14.98	3.88	0.10	1.03	3.15	4.66	2.74	0.15	100	0.96	1
UT 870-11	70.41	0.53	14.69	3.10	0.08	0.66	2.41	5.00	2.94	0.18	100	1.89	
UT 870-4	70.73	0.53	14.59	3.27	0.12	0.63	2.37	4.64	2.94	0.17	100	2.22	
UT 870-12	70.73	0.62	14.63	3.17	0.11	0.65	2.28	4.70	2.96	0.15	100	0.38	
UT 870-5	70.73	0.58	14.35	3.18	0.08	0.73	2.50	4.57	3.08	0.19	100	2.38	
UT 870-3	70.81	0.50	15.20	3.07	0.08	0.58	2.29	4.45	2.89	0.14	100	2.02	
UT 870-19	70.88	0.60	14.63	3.28	0.08	0.68	2.33	4.54	2.83	0.14	100	2.42	
UT 870-13	71.06	0.51	14.60	3.10	0.14	0.66	2.28	4.52	2.99	0.15	100	2.02	
UT 870-6	71.06	0.48	14.64	3.01	0.14	0.65	2.31	4.50	3.06	0.16	100	5.85	
UT 870-10	71.11	0.51	14.43	3.19	0.07	0.63	2.46	4.51	2.99	0.11	100	2.79	
UT 870-8	71.13	0.49	14.46	3.08	0.10	0.65	2.40	4.63	2.92	0.16	100	2.49	
UT 870-16	71.28	0.54	14.44	3.18	0.13	0.61	2.41	4.25	2.99	0.17	100	4.76	
UT 870-9	71.28	0.59	14.50	3.04	0.11	0.68	2.33	4.36	2.98	0.13	100	2.49	
UT 870-17	71.31	0.52	14.40	3.02	0.08	0.66	2.33	4.40	3.10	0.17	100	2.26	
UT 870-2	71.34	0.49	14.57	3.07	0.07	0.66	2.36	4.29	2.99	0.16	100	4.40	
UT 870-15	71.37	0.56	14.42	2.99	0.10	0.61	2.37	4.56	2.80	0.21	100	2.25	
UT 870-18	71.46	0.55	14.50	2.92	0.12	0.62	2.37	4.37	2.91	0.18	100	4.27	
AVERAGE	70.64	0.56	14.66	3.24	0.10	0.71	2.49	4.54	2.91	0.16	100	2.68	
STDEV	1.28	0.07	0.36	0.43	0.02	0.20	0.41	0.18	0.19	0.03	0	1.34	n = 18

UA 1097-24	66.14	0.73	16.13	4.69	0.13	1.31	3.66	4.63	2.41	0.17	100	6.24	Chester
UA 1097-12	68.51	0.72	15.46	3.81	0.14	0.88	2.98	4.64	2.73	0.14	100	5.18	Bluff
UA 1097-3	70.13	0.55	14.82	3.18	0.16	0.65	2.58	4.83	2.91	0.19	100	3.99	
UA 1097-26	70.15	0.61	15.05	3.15	0.08	0.59	2.55	4.68	2.98	0.16	100	6.11	
UA 1097-5	70.19	0.61	14.86	3.29	0.10	0.79	2.44	4.66	2.89	0.17	100	3.13	
UA 1097-23	70.33	0.58	14.89	3.19	0.10	0.56	2.43	4.61	3.15	0.16	100	5.12	
UA 1097-10	70.49	0.59	14.81	3.13	0.13	0.63	2.49	4.52	3.03	0.17	100	2.38	
UA 1097-8	70.52	0.58	14.78	3.05	0.13	0.73	2.32	4.78	2.95	0.16	100	2.95	
UA 1097-9	70.67	0.63	14.93	3.24	0.09	0.75	2.58	4.11	2.87	0.12	100	2.66	

UA 1097-18	70.68	0.60	14.91	3.27	0.07	0.66	2.39	4.32	2.94	0.17	100	3.57	
UA 1097-22	70.76	0.57	14.71	2.99	0.11	0.70	2.42	4.49	3.08	0.18	100	1.43	
UA 1097-21	70.77	0.54	14.59	3.19	0.12	0.69	2.40	4.57	2.96	0.18	100	5.63	
UA 1097-1	70.77	0.60	14.80	3.04	0.13	0.66	2.41	4.38	3.09	0.10	100	2.54	
UA 1097-11	70.86	0.58	14.65	3.10	0.14	0.60	2.34	4.52	3.08	0.12	100	2.82	
UA 1097-14	70.89	0.50	14.89	3.17	0.08	0.62	2.36	4.51	2.84	0.15	100	2.93	
UA 1097-17	70.99	0.55	14.58	2.98	0.14	0.65	2.30	4.60	3.02	0.19	100	3.02	
UA 1097-25	71.05	0.55	14.61	3.04	0.03	0.61	2.37	4.55	3.03	0.16	100	2.69	
UA 1097-15	71.08	0.54	14.68	2.89	0.05	0.68	2.32	4.62	3.01	0.13	100	2.43	
UA 1097-13	71.14	0.57	14.40	3.08	0.14	0.67	2.41	4.58	2.84	0.16	100	4.88	
UA 1097-20	71.34	0.57	14.60	3.04	0.12	0.58	2.32	4.18	3.14	0.11	100	2.52	
UA 1097-6	71.37	0.62	14.73	2.99	0.09	0.65	2.22	4.22	2.98	0.12	100	1.82	
UA 1097-7	71.42	0.59	14.74	3.00	0.10	0.55	2.06	4.50	2.90	0.14	100	1.45	
UA 1097-19	71.51	0.58	14.53	3.01	0.09	0.64	2.26	4.31	2.95	0.14	100	2.54	
UT 1097-5	66.91	0.77	15.84	4.72	0.19	1.30	3.37	4.31	2.45	0.14	100	1.74	
UT 1097-6	67.86	0.67	15.86	3.84	0.16	1.01	3.10	4.80	2.57	0.13	100	4.09	
UT 1097-25	68.09	0.64	15.71	3.94	0.13	1.04	3.11	4.52	2.69	0.14	100	1.91	
UT 1097-18	69.55	0.58	15.18	3.57	0.04	0.83	2.78	4.55	2.74	0.17	100	0.67	
UT 1097-7	69.67	0.69	15.02	3.65	0.11	0.83	2.82	4.28	2.79	0.14	100	7.64	
UT 1097-11	69.89	0.65	14.83	3.27	0.10	0.69	2.61	5.00	2.81	0.15	100	3.05	
UT 1097-10	70.28	0.47	15.15	3.13	0.08	0.73	2.49	4.55	2.93	0.18	100	2.82	
UT 1097-14	70.30	0.62	15.42	3.03	0.09	0.65	2.26	4.58	2.87	0.16	100	2.96	
UT 1097-3	70.42	0.58	14.68	2.97	0.17	0.71	2.38	4.93	2.98	0.17	100	5.11	
UT 1097-27	70.49	0.63	14.73	3.04	0.16	0.69	2.54	4.59	2.96	0.17	100	1.56	
UT 1097-2	70.50	0.63	14.82	2.92	0.10	0.66	2.45	4.71	3.03	0.18	100	2.24	
UT 1097-19	70.53	0.47	14.76	3.15	0.13	0.66	2.55	4.65	2.95	0.16	100	2.67	
UT 1097-16	70.68	0.54	14.49	3.25	0.14	0.64	2.39	4.69	3.01	0.17	100	8.40	
UT 1097-17	70.69	0.56	14.86	3.09	0.11	0.62	2.36	4.63	2.92	0.16	100	2.63	
UT 1097-13	70.83	0.57	14.55	3.01	0.12	0.55	2.50	4.78	2.91	0.18	100	3.06	
UT 1097-20	70.85	0.60	14.70	2.94	0.09	0.71	2.20	4.90	2.83	0.17	100	0.97	
UT 1097-4	70.85	0.50	14.72	3.15	0.09	0.68	2.29	4.63	2.93	0.15	100	3.16	
UT 1097-8	70.93	0.58	14.85	3.12	0.12	0.59	2.31	4.32	3.02	0.15	100	1.18	
UT 1097-21	71.00	0.63	14.74	2.87	0.13	0.69	2.20	4.52	3.11	0.11	100	4.60	
UT 1097-12	71.07	0.56	14.73	3.19	0.08	0.67	2.36	4.27	2.93	0.14	100	3.06	
UT 1097-30	71.16	0.51	14.63	2.80	0.11	0.65	2.19	4.98	2.78	0.18	100	7.63	
UT 1097-23	71.21	0.63	14.46	3.08	0.01	0.66	2.19	4.48	3.12	0.15	100	3.89	
UT 1097-26	71.25	0.54	14.67	2.97	0.18	0.59	2.30	4.44	2.92	0.14	100	3.75	
UT 1097-15	71.27	0.57	14.48	3.01	0.13	0.60	2.33	4.55	2.90	0.16	100	2.71	
UT 1097-1	71.29	0.63	14.50	3.10	0.12	0.60	2.36	4.39	2.88	0.14	100	1.64	
UT 1097-24	71.37	0.53	14.43	2.81	0.08	0.59	2.24	4.71	3.10	0.14	100	0.98	
AVERAGE	70.42	0.59	14.86	3.21	0.11	0.70	2.48	4.56	2.92	0.15	100	3.31	
STDEV	1.12	0.06	0.38	0.39	0.04	0.16	0.31	0.20	0.16	0.02	0	1.77	n = 49
UA1344-1	71.00	0.48	14.65	2.95	0.16	0.64	2.31	4.66	2.96	0.20	100	4.73	Gold Hill 4
UA1344-2	70.59	0.63	14.79	3.26	0.05	0.69	2.47	4.39	2.93	0.18	100	3.41	
UA1344-3	70.74	0.52	14.85	3.18	0.09	0.67	2.44	4.49	2.85	0.18	100	3.18	
UA1344-4	71.03	0.49	14.71	3.10	0.07	0.64	2.36	4.46	2.99	0.15	100	3.21	
UA1344-5	70.86	0.63	14.95	2.95	0.09	0.65	2.40	4.33	3.01	0.14	100	2.08	
UA1344-6	71.42	0.58	14.44	3.10	0.19	0.55	2.33	4.24	2.95	0.20	100	2.91	
UA1344-7	70.92	0.66	14.53	2.89	0.10	0.57	2.36	4.69	3.11	0.16	100	3.17	
UA1344-8	70.45	0.59	14.85	3.22	0.13	0.69	2.47	4.47	2.96	0.17	100	3.29	
UA1344-9	71.09	0.69	14.76	2.98	0.10	0.56	2.42	4.33	2.93	0.14	100	3.26	
UA1344-10	71.21	0.59	14.54	3.05	0.08	0.62	2.31	4.54	2.90	0.16	100	1.66	

UA1344-11	71.09	0.57	14.55	3.02	0.10	0.65	2.36	4.52	3.00	0.13	100	3.25
UA1344-12	71.24	0.65	14.60	3.07	0.09	0.56	2.28	4.37	2.99	0.15	100	1.48
UA1344-15	70.83	0.49	14.73	3.20	0.06	0.60	2.39	4.64	2.91	0.15	100	1.48
UA1344-16	70.74	0.58	14.74	3.03	0.08	0.59	2.39	4.66	2.99	0.20	100	1.30
UA1344-17	70.86	0.63	14.83	3.06	0.10	0.55	2.29	4.59	2.96	0.13	100	3.93
UA1344-18	70.35	0.52	14.81	3.30	0.12	0.67	2.66	4.38	2.92	0.27	100	1.46
UA1344-19	70.67	0.60	14.77	3.37	0.05	0.66	2.26	4.57	2.85	0.20	100	3.01
UA1344-20	70.67	0.60	14.64	2.93	0.11	0.68	2.51	4.53	3.12	0.19	100	1.69
UA1344-21	71.13	0.63	14.65	3.07	0.08	0.62	2.35	4.38	2.98	0.11	100	2.75
UA1344-22	70.59	0.53	14.73	3.11	0.08	0.64	2.34	4.71	3.06	0.20	100	3.04
UA1344-23	75.37	0.32	13.23	1.89	0.01	0.29	1.42	3.40	3.77	0.29	100	7.23
UA1344-24	71.23	0.51	14.56	3.14	0.06	0.57	2.33	4.52	2.93	0.16	100	3.00
UA1344-25	70.97	0.59	14.61	3.09	0.07	0.62	2.33	4.63	2.94	0.16	100	3.35
UA1344-26	70.45	0.57	14.86	3.21	0.09	0.63	2.45	4.60	2.96	0.16	100	3.31
UA 1344-13	69.39	0.67	15.01	3.76	0.10	0.79	2.89	4.51	2.73	0.15	100	0.83
UA 1344-6	69.96	0.62	15.33	3.17	0.10	0.64	2.42	4.47	3.14	0.15	100	9.27
UA 1344-19	70.17	0.62	15.20	3.13	0.08	0.68	2.39	4.61	2.92	0.20	100	7.33
UA 1344-7	70.17	0.63	14.63	3.23	0.11	0.71	2.53	4.94	2.91	0.15	100	1.40
UA 1344-2	70.34	0.68	14.64	3.28	0.11	0.68	2.48	4.79	2.84	0.16	100	6.24
UA 1344-9	70.41	0.51	14.71	3.38	0.08	0.61	2.51	4.81	2.84	0.13	100	2.79
UA 1344-10	70.42	0.56	14.47	3.40	0.27	0.63	2.37	4.74	2.98	0.16	100	6.37
UA 1344-1	70.44	0.62	14.71	3.33	0.17	0.71	2.46	4.59	2.85	0.11	100	2.22
UA 1344-11	70.67	0.54	14.81	3.20	0.06	0.66	2.37	4.67	2.86	0.16	100	1.64
UA 1344-20	70.70	0.61	14.70	2.92	0.07	0.67	2.41	4.77	3.02	0.13	100	6.98
UA 1344-3	70.72	0.55	14.71	3.08	0.10	0.57	2.50	4.65	2.95	0.16	100	2.51
UA 1344-30	70.81	0.59	14.67	3.07	0.11	0.65	2.27	4.82	2.86	0.16	100	7.62
UA 1344-16	70.84	0.57	14.60	3.14	0.04	0.68	2.53	4.63	2.86	0.11	100	1.53
UA 1344-5	70.90	0.54	14.49	3.15	0.10	0.71	2.34	4.77	2.82	0.19	100	1.29
UA 1344-27	70.91	0.63	14.63	3.06	0.10	0.65	2.29	4.94	2.66	0.13	100	1.91
UA 1344-8	70.98	0.56	14.48	3.12	0.11	0.65	2.32	4.64	2.99	0.15	100	1.53
UA 1344-25	71.05	0.58	14.34	3.21	0.12	0.64	2.35	4.65	2.90	0.16	100	1.70
UA 1344-4	71.06	0.56	14.64	2.97	0.11	0.68	2.36	4.59	2.92	0.13	100	2.11
UA 1344-12	71.12	0.62	14.35	3.04	0.11	0.61	2.35	4.66	2.96	0.17	100	1.00
UA 1344-29	71.14	0.59	14.46	2.99	0.12	0.68	2.35	4.75	2.79	0.13	100	0.76
UA 1344-26	71.18	0.62	14.59	3.11	0.12	0.61	2.39	4.43	2.80	0.15	100	1.62
UA 1344-28	71.24	0.59	14.38	3.06	0.09	0.62	2.36	4.52	2.96	0.19	100	1.44
UA 1344-23	71.30	0.60	14.71	2.96	0.06	0.60	2.37	4.37	2.88	0.15	100	2.00
UA 1344-18	71.31	0.46	14.83	3.14	0.04	0.56	2.23	4.32	2.94	0.17	100	3.31
UA 1344-22	71.72	0.61	14.49	2.73	0.03	0.50	1.84	4.45	3.52	0.12	100	1.02
UA 1344-26	66.29	0.57	16.23	4.38	0.08	1.37	3.80	4.87	2.27	0.14	100	3.35
UA 1344-19	68.74	0.61	15.35	3.85	0.11	0.98	3.10	4.40	2.66	0.19	100	1.53
UA 1344-2	69.43	0.52	14.93	3.63	0.16	0.71	2.88	4.83	2.80	0.13	100	0.03
UA 1344-16	70.31	0.59	14.86	3.09	0.10	0.72	2.53	4.69	2.88	0.21	100	0.34
UA 1344-10	70.34	0.49	15.01	3.25	0.11	0.64	2.41	4.61	3.01	0.13	100	2.05
UA 1344-30	70.35	0.54	14.89	3.17	0.09	0.71	2.46	4.63	2.98	0.19	100	1.79
UA 1344-29	70.49	0.50	15.05	3.04	0.05	0.60	2.38	4.79	2.91	0.18	100	1.67
UA 1344-12	70.49	0.58	15.08	3.09	0.11	0.66	2.41	4.57	2.81	0.20	100	3.45
UA 1344-9	70.61	0.58	14.69	3.14	0.07	0.69	2.45	4.75	2.91	0.12	100	3.73
UA 1344-1	70.64	0.53	14.97	3.12	0.16	0.63	2.39	4.44	2.99	0.15	100	3.60
UA 1344-31	70.71	0.63	14.77	3.21	0.07	0.67	2.28	4.52	3.00	0.12	100	0.94
UA 1344-27	70.72	0.54	14.72	3.08	0.14	0.63	2.40	4.65	2.89	0.24	100	1.91
UA 1344-24	70.78	0.63	14.69	2.98	0.14	0.71	2.36	4.69	2.78	0.24	100	3.06
UA 1344-17	70.84	0.56	14.69	3.09	0.04	0.63	2.50	4.61	2.88	0.17	100	0.84

UA 1344-23	70.85	0.50	14.74	2.98	0.10	0.60	2.48	4.55	3.01	0.19	100	1.31	
UA 1344-5	70.87	0.54	14.77	2.90	0.07	0.57	2.25	4.78	3.06	0.18	100	1.12	
UA 1344-13	70.89	0.52	14.71	3.11	0.13	0.62	2.53	4.46	2.91	0.13	100	1.30	
UA 1344-14	71.15	0.51	14.54	2.95	0.13	0.61	2.47	4.56	2.92	0.18	100	0.99	
UA 1344-20	71.28	0.60	14.67	2.92	0.10	0.63	2.35	4.33	2.93	0.20	100	2.92	
UA 1344-28	71.45	0.60	14.49	2.90	0.02	0.55	1.97	4.32	3.60	0.10	100	0.45	
UA 1344-15	71.73	0.54	14.53	2.24	0.10	0.66	2.06	5.39	2.58	0.17	100	6.96	
AVERAGE	70.76	0.57	14.72	3.11	0.10	0.65	2.41	4.58	2.94	0.16	100	2.73	
STDEV	0.92	0.06	0.33	0.30	0.04	0.12	0.27	0.23	0.20	0.04	0	1.93	n = 70

UA1425-1	70.68	0.56	15.11	3.02	0.16	0.67	2.33	4.36	2.96	0.14	100	4.60	Halfway
UA1425-2	71.74	0.52	14.60	2.73	0.07	0.54	2.14	4.35	3.08	0.23	100	2.55	House
UA1425-3	70.64	0.54	14.90	3.15	0.12	0.64	2.33	4.43	3.11	0.15	100	3.02	
UA1425-4	70.44	0.54	14.77	3.11	0.06	0.59	2.40	4.82	3.10	0.17	100	3.03	
UA1425-6	71.12	0.57	14.42	3.06	0.07	0.68	2.30	4.68	2.96	0.14	100	1.41	
UA1425-8	70.91	0.63	14.58	3.01	0.14	0.68	2.38	4.50	2.98	0.21	100	1.67	
UA1425-9	71.83	0.61	14.26	2.98	0.10	0.58	2.28	4.20	3.02	0.15	100	1.76	
UA1425-10	71.07	0.59	14.65	2.91	0.08	0.64	2.22	4.70	2.99	0.15	100	1.11	
UA1425-11	70.51	0.56	15.01	3.19	0.14	0.67	2.44	4.31	2.98	0.17	100	2.65	
UA1425-12	70.90	0.54	14.83	3.02	0.09	0.64	2.33	4.61	2.91	0.13	100	2.51	
UA1425-13	70.80	0.59	14.91	3.03	0.10	0.70	2.37	4.36	2.99	0.15	100	3.51	
UA1425-14	69.62	0.48	15.18	3.60	0.10	0.84	2.80	4.35	2.93	0.12	100	3.67	
UA1425-15	70.74	0.55	15.12	3.12	0.09	0.59	2.47	4.22	2.97	0.13	100	3.51	
UA1425-16	70.91	0.57	14.84	3.08	0.11	0.60	2.30	4.44	3.02	0.14	100	4.22	
UA1425-17	70.09	0.59	15.02	3.19	0.10	0.68	2.36	4.96	2.83	0.18	100	3.52	
UA1425-18	71.46	0.53	14.62	3.01	0.10	0.64	2.26	4.33	2.91	0.15	100	4.43	
UA1425-19	74.95	0.40	13.20	1.78	0.08	0.26	1.51	3.85	3.66	0.31	100	5.05	
UA1425-20	70.71	0.58	15.13	3.03	0.10	0.67	2.31	4.44	2.92	0.10	100	2.10	
UA1425-21	70.78	0.55	14.83	3.06	0.08	0.56	2.39	4.57	2.95	0.21	100	3.96	
UA1425-22	70.65	0.60	14.88	3.17	0.13	0.62	2.48	4.23	3.07	0.18	100	3.72	
UA1425-23	71.18	0.50	14.46	3.15	0.07	0.65	2.42	4.43	2.98	0.15	100	3.24	
UA1425-24	70.58	0.62	14.68	3.14	0.08	0.63	2.42	4.46	3.15	0.24	100	5.17	
UA1425-25	70.48	0.54	14.68	3.08	0.09	0.66	2.46	4.77	3.12	0.12	100	2.84	
UA 1425-12	70.40	0.60	14.60	3.26	0.10	0.65	2.48	4.66	3.08	0.17	100	9.07	
UA 1425-26	70.40	0.73	14.50	3.13	0.09	0.65	2.56	4.73	3.08	0.13	100	2.91	
UA 1425-21	70.43	0.62	14.85	3.21	0.11	0.77	2.72	4.55	2.63	0.12	100	2.57	
UA 1425-9	70.44	0.60	14.88	3.21	0.07	0.59	2.33	4.76	2.97	0.14	100	2.52	
UA 1425-29	70.55	0.64	14.69	3.02	0.11	0.66	2.45	4.68	3.02	0.18	100	3.41	
UA 1425-17	70.55	0.56	14.64	3.16	0.11	0.61	2.39	4.96	2.84	0.19	100	3.12	
UA 1425-19	70.64	0.56	14.54	3.28	0.06	0.69	2.43	4.61	3.02	0.17	100	0.48	
UA 1425-20	70.66	0.59	14.70	3.06	0.12	0.69	2.38	4.66	3.01	0.14	100	1.54	
UA 1425-5	70.67	0.57	14.69	3.04	0.07	0.61	2.31	4.87	3.03	0.14	100	5.76	
UA 1425-13	70.71	0.55	14.57	3.39	0.08	0.63	2.28	4.63	2.97	0.19	100	6.27	
UA 1425-27	70.79	0.56	14.80	2.99	0.12	0.64	2.42	4.56	2.96	0.16	100	2.07	
UA 1425-3	70.84	0.55	14.80	3.05	0.11	0.66	2.38	4.47	3.00	0.14	100	2.00	
UA 1425-6	70.85	0.54	14.60	3.07	0.10	0.63	2.35	4.78	2.95	0.13	100	4.72	
UA 1425-4	70.91	0.58	14.62	3.08	0.14	0.61	2.31	4.49	3.08	0.18	100	6.12	
UA 1425-8	70.92	0.56	14.75	3.09	0.07	0.62	2.37	4.50	2.98	0.15	100	1.31	
UA 1425-10	70.92	0.61	14.56	3.06	0.15	0.57	2.27	4.75	2.92	0.18	100	1.94	
UA 1425-24	70.96	0.55	14.71	3.06	0.09	0.64	2.31	4.69	2.85	0.13	100	2.38	
UA 1425-7	70.98	0.62	14.67	3.06	0.08	0.64	2.31	4.57	2.95	0.12	100	1.28	
UA 1425-1	71.00	0.46	15.00	2.79	0.08	0.68	2.43	4.52	2.87	0.17	100	1.80	
UA 1425-14	71.03	0.53	14.67	2.97	0.09	0.62	2.39	4.64	2.86	0.20	100	0.69	

UA 1425-22	71.04	0.54	14.58	3.03	0.08	0.52	2.32	4.73	3.05	0.11	100	3.73	
UA 1425-16	71.09	0.51	14.47	2.96	0.13	0.63	2.39	4.69	3.00	0.14	100	1.80	
UA 1425-28	71.10	0.56	14.51	3.09	0.10	0.72	2.29	4.50	2.96	0.17	100	4.15	
UA 1425-15	71.11	0.59	14.54	3.04	0.11	0.60	2.35	4.66	2.88	0.12	100	1.21	
UA 1425-18	71.18	0.58	14.61	2.97	0.08	0.58	2.21	4.63	3.03	0.15	100	1.54	
UA 1425-30	71.25	0.52	14.66	2.95	0.10	0.59	2.24	4.59	2.98	0.12	100	2.33	
UA 1425-11	71.29	0.51	14.65	3.01	0.11	0.64	2.35	4.32	2.92	0.20	100	2.54	
UA 1425-24	65.25	0.73	16.43	5.01	0.19	1.49	4.15	4.46	2.15	0.13	100	0.73	
UA 1425-30	65.44	0.95	16.16	4.86	0.18	1.49	4.08	4.53	2.19	0.12	100	0.90	
UA 1425-7	65.75	0.81	16.17	4.81	0.13	1.39	4.13	4.46	2.24	0.09	100	0.66	
UA 1425-15	66.36	0.64	15.77	4.87	0.15	1.31	3.89	4.68	2.23	0.10	100	1.02	
UA 1425-33	67.38	0.69	15.57	4.44	0.16	1.03	3.22	4.77	2.55	0.19	100	0.85	
UA 1425-32	68.05	0.91	15.12	4.17	0.05	1.05	3.21	4.30	3.08	0.08	100	0.61	
UA 1425-2	69.61	0.60	14.96	3.52	0.10	0.84	2.76	4.75	2.72	0.13	100	1.01	
UA 1425-1	70.16	0.59	14.97	2.99	0.06	0.71	2.46	4.89	2.93	0.23	100	2.43	
UA 1425-11	70.19	0.56	15.07	3.11	0.07	0.58	2.39	4.98	2.88	0.16	100	2.89	
UA 1425-5	70.33	0.61	14.84	3.41	0.06	0.72	2.52	4.48	2.83	0.19	100	0.10	
UA 1425-27	70.42	0.58	14.75	3.17	0.13	0.62	2.34	4.81	2.98	0.19	100	4.63	
UA 1425-6	70.51	0.47	14.92	2.93	0.03	0.68	2.34	5.12	2.86	0.14	100	5.29	
UA 1425-29	70.56	0.61	14.72	3.02	0.11	0.63	2.44	4.73	2.94	0.24	100	1.52	
UA 1425-20	70.58	0.55	15.03	3.01	0.07	0.64	2.31	4.66	2.99	0.16	100	1.16	
UA 1425-13	70.65	0.51	14.87	3.04	0.05	0.62	2.51	4.72	2.85	0.19	100	0.35	
UA 1425-23	70.78	0.50	14.87	2.90	0.08	0.69	2.23	4.68	3.07	0.20	100	2.95	
UA 1425-9	70.82	0.52	15.11	2.95	0.10	0.64	2.37	4.37	2.94	0.20	100	0.44	
UA 1425-8	70.85	0.53	14.95	3.06	0.08	0.69	2.40	4.29	2.94	0.19	100	2.28	
UA 1425-16	70.94	0.57	14.99	3.10	0.04	0.69	2.32	4.43	2.77	0.15	100	2.34	
UA 1425-21	70.95	0.54	14.88	2.91	0.13	0.65	2.25	4.57	2.98	0.14	100	3.67	
UA 1425-14	70.95	0.60	14.65	3.17	0.06	0.60	2.37	4.61	2.82	0.17	100	0.44	
UA 1425-17	70.96	0.55	14.62	3.05	0.05	0.69	2.41	4.64	2.85	0.17	100	1.90	
UA 1425-28	70.99	0.53	14.73	2.92	0.08	0.54	2.32	4.81	2.89	0.18	100	2.59	
UA 1425-12	71.04	0.52	14.66	2.99	0.09	0.70	2.52	4.35	2.97	0.17	100	0.63	
UA 1425-25	71.05	0.49	14.84	2.92	0.11	0.63	2.42	4.42	2.94	0.18	100	1.56	
UA 1425-10	71.06	0.53	14.84	3.00	0.10	0.61	2.31	4.41	2.98	0.16	100	0.94	
UA 1425-4	71.06	0.55	14.75	3.04	0.13	0.69	2.25	4.56	2.84	0.12	100	0.32	
UA 1425-22	71.10	0.57	14.86	2.90	0.06	0.58	2.06	4.58	3.13	0.16	100	1.41	
UA 1425-31	71.32	0.59	14.63	2.92	0.09	0.60	2.26	4.53	2.97	0.10	100	1.31	
AVERAGE	70.51	0.58	14.83	3.17	0.10	0.69	2.47	4.57	2.92	0.16	100	2.52	
STDEV	1.36	0.08	0.41	0.49	0.03	0.20	0.42	0.21	0.21	0.04	0	1.66	n =79

UT 1435-28	70.32	0.56	14.82	3.19	0.14	0.77	2.57	4.65	2.88	0.10	100	3.14	Aeolis Mtn.
UT 1435-22	70.52	0.68	14.85	3.13	0.11	0.62	2.33	4.58	2.97	0.21	100	3.51	
UT 1435-27	70.60	0.62	14.77	3.08	0.11	0.64	2.39	4.60	3.03	0.16	100	4.20	
UT 1435-8	70.68	0.56	14.93	3.14	0.12	0.62	2.28	4.64	2.87	0.17	100	2.04	
UT 1435-20	70.73	0.61	14.80	3.07	0.11	0.59	2.36	4.64	2.93	0.17	100	3.91	
UT 1435-13	70.77	0.65	14.72	2.96	0.11	0.63	2.29	4.79	2.92	0.14	100	5.86	
UT 1435-18	70.78	0.56	14.87	3.13	0.15	0.60	2.31	4.49	2.92	0.19	100	3.67	
UT 1435-25	70.79	0.53	14.66	3.04	0.07	0.65	2.46	4.67	3.00	0.13	100	5.58	
UT 1435-12	70.82	0.56	14.79	3.13	0.12	0.55	2.35	4.72	2.79	0.18	100	8.66	
UT 1435-15	70.83	0.57	14.79	3.13	0.17	0.60	2.27	4.47	3.00	0.17	100	2.08	
UT 1435-7	70.84	0.52	14.86	2.98	0.10	0.65	2.31	4.70	2.94	0.12	100	2.75	
UT 1435-9	70.84	0.54	14.98	2.93	0.12	0.57	2.30	4.60	2.99	0.12	100	3.99	
UT 1435-10	70.87	0.54	14.65	3.16	0.10	0.66	2.32	4.65	2.93	0.14	100	5.42	
UT 1435-30	70.88	0.58	14.75	2.95	0.09	0.59	2.38	4.63	3.02	0.13	100	5.74	

UT 1435-23	70.91	0.54	14.83	3.12	0.11	0.61	2.30	4.42	2.98	0.16	100	2.55	
UT 1435-5	70.95	0.57	14.51	3.14	0.09	0.63	2.41	4.63	2.95	0.14	100	2.29	
UT 1435-21	70.96	0.64	14.86	3.04	0.10	0.62	2.22	4.47	2.93	0.16	100	4.05	
UT 1435-16	70.97	0.47	14.85	2.94	0.13	0.56	2.29	4.65	2.95	0.18	100	3.39	
UT 1435-6	70.99	0.54	14.72	2.95	0.11	0.59	2.39	4.57	2.98	0.16	100	4.27	
UT 1435-29	70.99	0.54	14.82	3.04	0.08	0.61	2.36	4.45	2.98	0.12	100	5.36	
UT 1435-24	71.04	0.53	14.33	3.07	0.09	0.62	2.32	4.89	2.95	0.16	100	4.19	
UT 1435-19	71.07	0.59	14.34	3.01	0.13	0.59	2.23	4.99	2.87	0.19	100	3.77	
UT 1435-11	71.07	0.57	14.75	3.01	0.08	0.62	2.32	4.52	2.87	0.17	100	2.86	
UT 1435-2	71.09	0.54	14.49	3.06	0.15	0.64	2.44	4.47	2.97	0.15	100	2.79	
UT 1435-26	71.11	0.54	14.58	2.99	0.11	0.61	2.37	4.50	3.01	0.18	100	2.87	
UT 1435-17	71.20	0.57	14.86	2.95	0.09	0.59	2.35	4.25	3.00	0.15	100	2.07	
UT 1435-3	71.23	0.58	14.70	3.00	0.09	0.58	2.43	4.24	2.96	0.20	100	8.04	
UT 1435-4	71.28	0.54	14.52	2.91	0.17	0.65	2.32	4.59	2.83	0.19	100	1.29	
AVERAGE	70.90	0.57	14.73	3.04	0.11	0.62	2.35	4.59	2.94	0.16	100	3.94	
STDEV	0.21	0.04	0.17	0.08	0.03	0.04	0.07	0.16	0.06	0.03	0	1.74	n = 28
UT 1813-7	64.86	0.72	16.84	4.95	0.13	1.28	4.12	4.75	2.26	0.10	100	3.83	Thistle Creek
UT 1813-21	66.45	0.65	15.64	4.58	0.14	1.24	4.01	4.85	2.26	0.18	100	0.98	
UT 1813-14	67.54	0.68	15.52	4.31	0.12	1.18	3.67	4.46	2.40	0.13	100	2.45	
UT 1813-1	69.17	0.70	15.43	3.53	0.07	0.79	2.77	4.73	2.73	0.08	100	6.74	
UT 1813-27	70.15	0.66	14.72	3.37	0.10	0.76	2.62	4.58	2.88	0.16	100	4.62	
UT 1813-29	70.18	0.63	14.90	3.39	0.08	0.73	2.57	4.55	2.81	0.17	100	3.02	
UT 1813-26	70.28	0.50	14.87	3.13	0.12	0.66	2.48	4.84	2.93	0.19	100	4.11	
UT 1813-6	70.37	0.59	14.73	3.35	0.04	0.67	2.46	4.81	2.81	0.16	100	1.77	
UT 1813-20	70.48	0.68	14.55	3.23	0.04	0.65	2.35	4.75	3.13	0.13	100	7.14	
UT 1813-10	70.77	0.64	14.65	3.08	0.04	0.65	2.28	4.70	3.02	0.16	100	4.75	
UT 1813-17	70.79	0.57	14.51	3.21	0.09	0.65	2.41	4.63	3.02	0.11	100	1.52	
UT 1813-15	70.87	0.61	14.42	3.18	0.08	0.56	2.48	4.60	3.01	0.18	100	2.19	
UT 1813-25	70.88	0.64	14.71	3.10	0.03	0.61	2.30	4.61	2.97	0.14	100	3.54	
UT 1813-13	70.88	0.58	14.47	3.08	0.11	0.57	2.38	4.69	3.05	0.18	100	2.69	
UT 1813-5	70.90	0.56	14.17	3.19	0.12	0.63	2.50	4.82	2.94	0.16	100	4.29	
UT 1813-9	70.93	0.60	14.65	3.13	0.13	0.65	2.30	4.53	2.96	0.12	100	1.52	
UT 1813-4	71.01	0.61	14.48	3.11	0.10	0.61	2.32	4.71	2.91	0.15	100	1.18	
UT 1813-2	71.02	0.44	14.56	3.06	0.02	0.61	2.44	4.63	3.02	0.19	100	5.42	
UT 1813-18	71.03	0.55	14.51	3.06	0.11	0.61	2.20	4.72	3.02	0.20	100	1.60	
UT 1813-30	71.14	0.56	14.66	3.08	0.11	0.50	2.20	4.65	2.93	0.18	100	2.43	
UT 1813-16	71.17	0.52	14.51	3.16	0.07	0.63	2.25	4.52	2.99	0.20	100	1.47	
UT 1813-8	71.24	0.44	14.82	2.86	0.11	0.67	2.38	4.43	2.93	0.12	100	3.78	
UT 1813-3	71.41	0.57	14.47	2.99	0.04	0.61	2.29	4.52	2.91	0.18	100	2.87	
AVERAGE	70.15	0.60	14.82	3.35	0.09	0.72	2.60	4.66	2.86	0.16	100	3.21	
STDEV	1.65	0.08	0.57	0.53	0.04	0.21	0.55	0.12	0.24	0.03	0	1.72	n = 23
UT 1409-24	69.97	0.58	15.11	3.37	0.05	0.79	2.71	4.41	2.85	0.15	100	1.35	Togiak VT
UT 1409-19	69.99	0.61	15.30	3.26	0.08	0.72	2.37	4.51	2.97	0.20	100	3.18	
UT 1409-21	70.06	0.57	15.20	3.05	0.12	0.67	2.53	4.69	2.96	0.16	100	2.55	
UT 1409-31	70.11	0.62	15.24	2.90	0.09	0.71	2.64	4.60	2.93	0.16	100	1.80	
UT 1409-4	70.16	0.56	15.09	3.17	0.09	0.67	2.51	4.68	2.93	0.14	100	2.92	
UT 1409-12	70.27	0.55	15.18	3.17	0.11	0.63	2.41	4.59	2.89	0.19	100	3.21	
UT 1409-1	70.33	0.47	15.05	3.00	0.04	0.61	2.56	4.60	3.09	0.25	100	4.37	
UT 1409-10	70.39	0.55	15.20	3.10	0.12	0.63	2.40	4.47	3.01	0.13	100	2.55	
UT 1409-26	70.45	0.51	15.06	3.12	0.11	0.71	2.42	4.48	2.90	0.23	100	2.49	
UT 1409-3	70.47	0.57	14.99	3.07	0.14	0.61	2.45	4.50	3.02	0.18	100	2.38	

UT 1409-14	70.53	0.58	15.07	3.10	0.14	0.60	2.36	4.35	3.10	0.16	100	2.27	
UT 1409-9	70.58	0.58	14.84	3.03	0.09	0.53	2.38	4.78	3.06	0.13	100	3.91	
UT 1409-29	70.60	0.54	15.00	3.08	0.09	0.62	2.28	4.54	3.08	0.16	100	3.43	
UT 1409-13	70.62	0.63	15.06	3.04	0.11	0.62	2.38	4.52	2.93	0.09	100	3.04	
UT 1409-23	70.68	0.49	15.14	2.91	0.11	0.59	2.43	4.58	2.90	0.17	100	1.91	
UT 1409-27	70.70	0.61	14.86	3.08	0.13	0.65	2.40	4.55	2.87	0.17	100	0.75	
UT 1409-18	70.71	0.58	14.87	3.02	0.09	0.66	2.41	4.40	3.09	0.18	100	2.79	
UT 1409-8	70.75	0.56	14.97	3.08	0.12	0.59	2.38	4.36	3.02	0.17	100	1.96	
UT 1409-16	70.84	0.55	14.59	2.95	0.14	0.62	2.57	4.55	3.01	0.18	100	1.96	
UT 1409-28	70.84	0.56	15.00	3.06	0.07	0.65	2.24	4.46	2.93	0.19	100	1.05	
UT 1409-30	70.87	0.53	14.95	2.85	0.10	0.62	2.41	4.66	2.91	0.11	100	2.34	
UT 1409-22	70.90	0.47	14.88	3.05	0.09	0.65	2.41	4.39	3.02	0.14	100	2.05	
UT 1409-6	70.91	0.57	14.97	2.82	0.11	0.66	2.38	4.49	2.90	0.20	100	1.09	
UT 1409-5	70.93	0.56	14.92	2.93	0.12	0.67	2.33	4.48	2.92	0.13	100	2.90	
UT 1409-11	70.97	0.52	14.83	2.92	0.13	0.55	2.30	4.43	3.16	0.20	100	2.33	
UT 1409-20	71.00	0.51	14.95	2.96	0.11	0.58	2.37	4.39	2.96	0.18	100	1.61	
UT 1409-17	71.03	0.55	14.69	3.03	0.05	0.63	2.24	4.72	2.91	0.15	100	0.94	
UT 1409-7	71.04	0.56	14.88	3.07	0.14	0.67	2.33	4.29	2.85	0.16	100	2.09	
UT 1409-15	71.25	0.57	14.71	2.50	0.07	0.70	2.17	5.08	2.77	0.17	100	9.19	
UA 1409-H-5	70.05	0.63	14.91	3.52	0.10	0.81	2.64	4.44	2.80	0.09	100	0.84	
UA 1409-I-10	70.34	0.58	14.72	3.30	0.11	0.74	2.48	4.57	2.99	0.18	100	-0.32	
UA 1409-H-8	70.42	0.58	14.52	3.37	0.11	0.63	2.43	4.86	2.88	0.19	100	3.82	
UA 1409-H-2	70.45	0.64	14.92	3.29	0.11	0.53	2.32	4.65	2.93	0.16	100	5.97	
UA 1409-H-1	70.69	0.54	14.40	3.34	0.13	0.63	2.42	4.69	3.03	0.13	100	7.03	
UA 1409-H-1	70.70	0.64	14.71	3.17	0.12	0.59	2.23	4.63	3.06	0.16	100	2.65	
UA 1409-H-7	70.77	0.59	14.64	3.17	0.10	0.62	2.47	4.60	2.84	0.21	100	1.55	
UA 1409-H-1	70.79	0.54	14.63	3.09	0.11	0.62	2.56	4.58	2.94	0.14	100	1.90	
UA 1409-I-12	70.82	0.61	14.62	3.33	0.09	0.70	2.36	4.56	2.79	0.11	100	0.57	
UA 1409-H-1	70.83	0.48	14.60	3.29	0.09	0.67	2.42	4.57	2.89	0.15	100	1.71	
UA 1409-H-1	70.84	0.57	14.52	2.91	0.10	0.54	2.47	4.90	2.97	0.18	100	4.28	
UA 1409-H-1	70.84	0.51	14.57	3.09	0.10	0.64	2.30	4.75	3.03	0.17	100	6.93	
UA 1409-H-1	70.87	0.58	14.53	3.09	0.15	0.63	2.47	4.63	2.93	0.12	100	2.84	
UA 1409-H-2	70.90	0.56	14.49	3.17	0.07	0.67	2.36	4.70	2.93	0.15	100	4.08	
UA 1409-I-4	70.90	0.54	14.61	3.21	0.08	0.64	2.45	4.54	2.90	0.14	100	0.85	
UA 1409-H-1	71.00	0.58	14.62	2.98	0.10	0.62	2.48	4.42	3.01	0.17	100	1.03	
UA 1409-I-13	71.15	0.58	14.45	3.11	0.09	0.65	2.38	4.41	2.99	0.18	100	1.07	
UA 1409-I-15	71.19	0.51	14.52	3.03	0.11	0.61	2.27	4.54	3.05	0.17	100	1.14	
UA 1409-I-9	71.20	0.73	14.19	3.29	0.13	0.56	2.22	4.60	2.88	0.18	100	-0.37	
UA 1409-H-9	71.25	0.59	14.28	3.44	0.13	0.47	2.04	4.57	3.03	0.20	100	0.19	
UA 1409-I-6	71.28	0.55	14.63	3.11	0.10	0.60	2.19	4.50	2.89	0.14	100	1.63	
UA 1409-I-3	71.35	0.56	14.42	3.00	0.08	0.57	2.42	4.40	3.02	0.18	100	1.23	
UA 1409-I-1	71.40	0.58	14.42	3.15	0.08	0.55	2.31	4.48	2.88	0.14	100	2.18	
UA 1409-I-7	71.77	0.60	14.00	3.28	0.08	0.63	2.21	4.37	2.86	0.18	100	0.88	
MEAN	70.75	0.57	14.78	3.10	0.10	0.63	2.39	4.56	2.95	0.16	100	2.42	
STDEV	0.39	0.05	0.29	0.17	0.02	0.06	0.12	0.15	0.08	0.03	0	1.81	n = 53
UA 1409-H-6	75.40	0.12	13.05	1.93	0.05	0.14	0.94	4.29	3.78	0.30	100	5.39	

	Si02	**Ti02**	**Al203**	**Fe203**	**MnO**	**MgO**	**CaO**	**Na20**	**K20**	**Cl**		
96TOK-1-5	69.4	0.87	15.1	3.52		0.89	2.53	4.62	2.93	0.14	100	Tok
96TOK-1-5	69.7	0.66	14.8	3.48		0.81	2.52	4.72	3.1	0.21	100	
96TOK-1-5	69.8	0.4	14.9	3.46		0.76	2.4	4.85	3.2	0.21	100	
96TOK-1-5	70	0.81	15	3.38		0.65	2.43	4.63	2.95	0.15	100	
96TOK-1-5	70	0.81	14.8	3.21		0.76	2.38	4.88	2.96	0.2	100	

96TOK-1-5	70.1	0.53	15.1	3.25		0.75	2.28	4.82	2.98	0.17	100	
96TOK-1-5	70.2	0.59	14.6	3.64		0.77	2.3	4.96	2.79	0.15	100	
96TOK-1-5	70.2	0.58	15	3.4		0.71	2.33	4.58	3.04	0.14	100	
96TOK-1-5	70.2	0.75	15	3		0.73	2.18	4.96	3.02	0.17	100	
96TOK-1-5	70.3	0.62	14.8	3.34		0.73	2.27	4.84	2.98	0.16	100	
96TOK-1-5	70.3	0.6	15	3.25		0.82	2.39	4.72	2.84	0.1	100	
96TOK-1-5	70.6	0.58	14.8	2.98		0.66	2.14	5.01	3.06	0.19	100	
96TOK-1-5	70.7	0.52	14.7	3.21		0.73	2.13	4.63	3.18	0.15	100	
96TOK-1-5	70.8	0.56	14.8	3.06		0.64	2.24	4.67	3.07	0.2	100	
AVG	70.16	0.63	14.89	3.30		0.74	2.32	4.78	3.01	0.17	100	
STDDEV	0.39	0.13	0.15	0.20		0.07	0.13	0.14	0.11	0.03	0	n=16

Fe-Ti oxide data for VT tephra

Tephra ID	Sample	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	V_2O_3	Fe_2O_3	FeO	MgO	MnO	CaO	Total	FeOt	n	Notes
	UT 1409-27	0.26	11.95	2.71	0.05	0.37	42.53	37.76	2.72	0.61	0.09	99	76.04		Togiak Bay
	UT 1409-30	1.45	12.16	2.45	0.00	0.38	38.82	39.45	2.49	0.67	0.09	98	74.39		
	UT 1409-II-9	0.17	12.60	2.39	0.00	0.30	41.57	38.12	2.60	0.65	0.13	99	75.53		
	UT 1409-II-3	0.17	13.04	2.27	0.03	0.40	41.04	39.04	2.41	0.69	0.04	99	75.97		
	UT 1409-1	0.14	13.15	2.29	0.00	0.37	41.38	39.29	2.43	0.67	0.06	100	76.53		
	UT 1409-20	0.12	13.21	2.35	0.02	0.39	41.78	39.44	2.46	0.68	0.10	101	77.04		
	UT 1409-34	0.22	13.25	2.18	0.05	0.37	40.30	39.17	2.40	0.67	0.05	99	75.43		
	UT 1409-2	0.15	13.29	2.28	0.00	0.39	41.65	39.72	2.38	0.66	0.10	101	77.20		
	UT 1409-21	0.12	13.30	2.38	0.01	0.42	42.39	39.95	2.51	0.67	0.01	102	78.09		
	UT 1409-29	0.16	13.34	2.23	0.04	0.41	41.50	39.72	2.47	0.66	0.02	101	77.07		
	UT 1409-8	0.08	13.35	2.27	0.03	0.42	41.39	39.44	2.48	0.66	0.05	100	76.68		
	UT 1409-15	0.10	13.37	2.30	0.05	0.42	41.76	39.74	2.49	0.67	0.02	101	77.32		
	UT 1409-31	0.12	13.38	2.38	0.03	0.43	41.76	40.00	2.42	0.65	0.00	101	77.58		
	UT 1409-3	0.14	13.40	2.31	0.05	0.41	41.55	39.86	2.45	0.66	0.03	101	77.25		
	UT 1409-17	0.12	13.41	2.32	0.00	0.40	41.73	39.87	2.45	0.69	0.02	101	77.42		
	UT 1409-23	0.12	13.42	2.26	0.02	0.38	40.88	39.58	2.40	0.66	0.02	100	76.37		
	UT 1409-7	0.13	13.44	2.29	0.07	0.40	42.13	39.98	2.51	0.65	0.09	102	77.89		
	UT 1409-4	0.13	13.45	2.31	0.01	0.40	41.38	39.81	2.47	0.68	0.01	101	77.04		
	UT 1409-22	0.11	13.46	2.29	0.03	0.40	41.51	39.75	2.51	0.67	0.02	101	77.10		
	UT 1409-11	0.19	13.47	2.26	0.03	0.39	41.94	39.99	2.39	0.69	0.27	102	77.73		
	UT 1409-24	0.11	13.47	2.26	0.01	0.40	41.22	39.81	2.40	0.65	0.03	100	76.90		
	UT 1409-13	0.13	13.48	2.30	0.03	0.41	41.80	39.86	2.51	0.69	0.06	101	77.47		
	UT 1409-25	0.13	13.50	2.31	0.02	0.40	40.92	39.81	2.39	0.68	0.02	100	76.64		
	UT 1409-9	0.15	13.51	2.27	0.03	0.39	41.47	40.08	2.38	0.72	0.01	101	77.39		
	UT 1409-19	0.13	13.53	2.24	0.01	0.41	41.63	40.32	2.29	0.68	0.02	101	77.77		
	UT 1409-35	0.09	13.56	2.26	0.02	0.43	41.26	39.96	2.41	0.67	0.01	101	77.08		
	UT 1409-5	0.13	13.63	2.29	0.02	0.39	41.41	40.09	2.47	0.69	0.03	101	77.36		
	UT 1409-12	0.13	13.63	2.26	0.05	0.39	40.98	40.07	2.39	0.68	0.00	101	76.95		
	UT 1409-18	0.11	13.64	2.27	0.05	0.39	41.57	40.50	2.30	0.68	0.01	102	77.90		
	UT 1409-28	0.08	13.71	2.25	0.03	0.42	40.89	40.12	2.34	0.67	0.03	101	76.92		
	UT 1409-27	0.09	11.95	2.71	0.05	0.37	41.52	38.68	2.72	0.61	0.26	99	76.04		
	UT 1409-30	0.09	12.16	2.45	0.00	0.38	36.73	41.33	2.49	0.67	1.45	98	74.39		
	UT 1409-II-9	0.13	12.60	2.39	0.00	0.30	40.72	38.89	2.60	0.65	0.17	98	75.53		
	UT 1409-II-3	0.04	13.04	2.27	0.03	0.40	39.92	40.05	2.41	0.69	0.17	99	75.97		
	UT 1409-1	0.06	13.15	2.29	0.00	0.37	40.72	39.88	2.43	0.67	0.14	100	76.53		
	UT 1409-20	0.10	13.21	2.35	0.02	0.39	40.72	40.39	2.46	0.68	0.12	100	77.04		
	UT 1409-34	0.05	13.25	2.18	0.05	0.37	39.92	39.51	2.40	0.67	0.22	99	75.43		
	UT 1409-2	0.10	13.29	2.28	0.00	0.39	40.72	40.55	2.38	0.66	0.15	101	77.20		

UT 1409-21	0.01	13.30	2.38	0.01	0.42	41.52	40.73	2.51	0.67	0.12	102	78.09	
UT 1409-29	0.02	13.34	2.23	0.04	0.41	40.72	40.42	2.47	0.66	0.16	100	77.07	
UT 1409-8	0.05	13.35	2.27	0.03	0.42	40.72	40.04	2.48	0.66	0.08	100	76.68	
UT 1409-15	0.02	13.37	2.30	0.05	0.42	41.52	39.96	2.49	0.67	0.10	101	77.32	
UT 1409-31	0.00	13.38	2.38	0.03	0.43	41.52	40.22	2.42	0.65	0.12	101	77.58	
UT 1409-3	0.03	13.40	2.31	0.05	0.41	40.72	40.60	2.45	0.66	0.14	101	77.25	
UT 1409-17	0.02	13.41	2.32	0.00	0.40	40.72	40.78	2.45	0.69	0.12	101	77.42	
UT 1409-23	0.02	13.42	2.26	0.02	0.38	39.92	40.44	2.40	0.66	0.12	100	76.37	
UT 1409-7	0.09	13.44	2.29	0.07	0.40	41.52	40.53	2.51	0.65	0.13	102	77.89	
UT 1409-4	0.01	13.45	2.31	0.01	0.40	40.72	40.40	2.47	0.68	0.13	101	77.04	
UT 1409-22	0.02	13.46	2.29	0.03	0.40	40.72	40.46	2.51	0.67	0.11	101	77.10	
UT 1409-11	0.27	13.47	2.26	0.03	0.39	39.92	41.81	2.39	0.69	0.19	101	77.73	
UT 1409-24	0.03	13.47	2.26	0.01	0.40	40.72	40.26	2.40	0.65	0.11	100	76.90	
UT 1409-13	0.06	13.48	2.30	0.03	0.41	40.72	40.83	2.51	0.69	0.13	101	77.47	
UT 1409-25	0.02	13.50	2.31	0.02	0.40	40.72	39.99	2.39	0.68	0.13	100	76.64	
UT 1409-9	0.01	13.51	2.27	0.03	0.39	40.72	40.75	2.38	0.72	0.15	101	77.39	
UT 1409-19	0.02	13.53	2.24	0.01	0.41	40.72	41.13	2.29	0.68	0.13	101	77.77	
UT 1409-35	0.01	13.56	2.26	0.02	0.43	40.72	40.44	2.41	0.67	0.09	101	77.08	
UT 1409-5	0.03	13.63	2.29	0.02	0.39	40.72	40.71	2.47	0.69	0.13	101	77.36	
UT 1409-12	0.00	13.63	2.26	0.05	0.39	40.72	40.31	2.39	0.68	0.13	101	76.95	
UT 1409-18	0.01	13.64	2.27	0.05	0.39	40.72	41.26	2.30	0.68	0.11	101	77.90	
UT 1409-28	0.03	13.71	2.25	0.03	0.42	40.72	40.28	2.34	0.67	0.08	101	76.92	
AVERAGE	0.11	13.30	2.31	0.03	0.40	41.01	40.03	2.44	0.67	0.11	100	76.94	60
STDEV	0.19	0.40	0.09	0.02	0.02	0.86	0.70	0.08	0.02	0.19	1	0.81	
UT 1409-16	0.12	10.44	2.92	0.04	0.46	46.08	36.38	2.84	0.55	0.02	100	77.84	
UT 1409-14	0.17	10.91	2.68	0.03	0.55	45.26	38.88	1.75	0.47	0.02	101	79.60	
UT 1409-26	0.14	11.58	2.75	0.06	0.47	45.38	37.97	2.87	0.61	0.01	102	78.81	
UT 1409-16	0.02	10.44	2.92	0.04	0.46	45.51	36.89	2.84	0.55	0.12	100	77.84	
UT 1409-26	0.01	11.58	2.75	0.06	0.47	44.71	38.57	2.87	0.61	0.14	102	78.81	
UT 1409-14	0.02	10.91	2.68	0.03	0.55	44.71	39.37	1.75	0.47	0.17	101	78.81	
AVERAGE	0.08	10.97	2.78	0.04	0.49	45.28	38.01	2.49	0.54	0.08	101	78.62	6
STDEV	0.07	0.51	0.11	0.01	0.05	0.52	1.17	0.57	0.06	0.07	1	0.68	
AVERAGE	0.11	13.09	2.35	0.03	0.40	41.40	39.85	2.45	0.66	0.11	100	77.09	66
STDEV	0.18	0.79	0.17	0.02	0.04	1.49	0.95	0.18	0.04	0.18	1	0.93	

UA 1425-22	0.22	11.72	2.29	0.07	0.68	43.51	38.54	2.14	0.62	0.09	100	77.69	Halfway
UA 1425-11	0.18	12.67	2.38	0.05	0.38	41.83	38.56	2.58	0.65	0.05	99	76.20	House
UA 1425-12	0.16	12.68	2.33	0.03	0.38	41.73	38.69	2.42	0.68	0.06	99	76.24	
UA 1425-5	0.20	12.72	2.23	0.03	0.41	41.30	38.67	2.39	0.66	0.06	99	75.83	
UA 1425-1	0.17	12.73	2.25	0.02	0.38	41.68	38.69	2.39	0.63	0.14	99	76.20	
UA 1425-3	0.22	12.74	2.35	0.02	0.40	40.92	38.59	2.45	0.65	0.05	98	75.41	
UA 1425-19	0.16	12.77	2.37	0.05	0.38	41.36	38.50	2.54	0.67	0.06	99	75.72	
UA 1425-30	0.16	12.83	2.33	0.04	0.41	41.80	38.50	2.48	0.64	0.39	100	76.12	
UA 1425-6	0.21	12.91	2.27	0.05	0.39	41.38	39.12	2.41	0.66	0.04	99	76.35	
UA 1425-2	0.11	12.98	2.31	0.03	0.39	41.48	38.90	2.48	0.66	0.05	99	76.22	
UA 1425-4	0.13	13.05	2.24	0.03	0.41	41.04	38.74	2.53	0.66	0.06	99	75.67	
UA 1425-24	0.16	13.10	2.39	0.05	0.39	41.37	39.22	2.49	0.66	0.05	100	76.44	
UA 1425-14	0.14	13.10	2.19	0.05	0.38	41.25	39.17	2.39	0.66	0.05	99	76.29	
UA 1425-28	0.16	13.16	2.31	0.02	0.41	41.63	39.48	2.46	0.67	0.03	100	76.95	
UA 1425-18	0.13	13.17	2.27	0.05	0.36	41.57	39.36	2.47	0.67	0.03	100	76.77	
UA 1425-7	0.19	13.19	2.33	0.07	0.40	39.49	38.55	2.50	0.69	0.05	97	74.08	
UA 1425-15	0.14	13.19	2.28	0.05	0.43	41.29	39.32	2.48	0.66	0.01	100	76.47	
UA 1425-25	0.18	13.25	2.27	0.04	0.39	40.74	39.32	2.43	0.66	0.04	99	75.98	

UA 1425-17	0.09	13.31	2.32	0.04	0.40	41.38	39.59	2.41	0.68	0.01	100	76.83	
UA 1425-27	0.10	13.38	2.32	0.00	0.41	41.05	39.53	2.44	0.64	0.03	100	76.47	
UA 1425-26	0.13	13.42	2.29	0.02	0.38	41.20	39.80	2.39	0.65	0.03	100	76.88	
UA 1425-29	0.17	13.46	2.32	0.05	0.40	41.08	39.85	2.41	0.67	0.07	100	76.82	
UA 1425-8	0.11	13.48	2.46	0.03	0.41	39.74	39.19	2.45	0.69	0.02	99	74.95	
UA 1425-10	0.14	13.51	2.28	0.02	0.39	40.69	39.71	2.40	0.71	0.02	100	76.32	
UA 1425-22	0.09	11.72	2.29	0.07	0.68	42.32	39.61	2.14	0.62	0.22	100	77.69	
UA 1425-11	0.05	12.67	2.38	0.05	0.38	40.72	39.56	2.58	0.65	0.18	99	76.20	
UA 1425-12	0.06	12.68	2.33	0.03	0.38	40.72	39.60	2.42	0.68	0.16	99	76.24	
UA 1425-5	0.06	12.72	2.23	0.03	0.41	40.72	39.19	2.39	0.66	0.20	99	75.83	
UA 1425-1	0.14	12.73	2.25	0.02	0.38	40.72	39.55	2.39	0.63	0.17	99	76.20	
UA 1425-3	0.05	12.74	2.35	0.02	0.40	39.92	39.49	2.45	0.65	0.22	98	75.41	
UA 1425-19	0.06	12.77	2.37	0.05	0.38	40.72	39.08	2.54	0.67	0.16	99	75.72	
UA 1425-30	0.39	12.83	2.33	0.04	0.41	39.12	40.91	2.48	0.64	0.16	99	76.12	
UA 1425-6	0.04	12.91	2.27	0.05	0.39	40.72	39.71	2.41	0.66	0.21	99	76.35	
UA 1425-2	0.05	12.98	2.31	0.03	0.39	40.72	39.58	2.48	0.66	0.11	99	76.22	
UA 1425-4	0.06	13.05	2.24	0.03	0.41	39.92	39.75	2.53	0.66	0.13	99	75.67	
UA 1425-24	0.05	13.10	2.39	0.05	0.39	40.72	39.79	2.49	0.66	0.16	100	76.44	
UA 1425-14	0.05	13.10	2.19	0.05	0.38	40.72	39.65	2.39	0.66	0.14	99	76.29	
UA 1425-28	0.03	13.16	2.31	0.02	0.41	40.72	40.31	2.46	0.67	0.16	100	76.95	
UA 1425-18	0.03	13.17	2.27	0.05	0.36	40.72	40.13	2.47	0.67	0.13	100	76.77	
UA 1425-7	0.05	13.19	2.33	0.07	0.40	38.33	39.59	2.50	0.69	0.19	97	74.08	
UA 1425-15	0.01	13.19	2.28	0.05	0.43	40.72	39.83	2.48	0.66	0.14	100	76.47	
UA 1425-25	0.04	13.25	2.27	0.04	0.39	39.92	40.06	2.43	0.66	0.18	99	75.98	
UA 1425-17	0.01	13.31	2.32	0.04	0.40	40.72	40.18	2.41	0.68	0.09	100	76.83	
UA 1425-27	0.03	13.38	2.32	0.00	0.41	40.72	39.82	2.44	0.64	0.10	100	76.47	
UA 1425-26	0.03	13.42	2.29	0.02	0.38	40.72	40.23	2.39	0.65	0.13	100	76.88	
UA 1425-29	0.07	13.46	2.32	0.05	0.40	39.92	40.90	2.41	0.67	0.17	100	76.82	
UA 1425-8	0.02	13.48	2.46	0.03	0.41	39.12	39.75	2.45	0.69	0.11	99	74.95	
UA 1425-10	0.02	13.51	2.28	0.02	0.39	39.92	40.39	2.40	0.71	0.14	100	76.32	
AVERAGE	0.11	13.02	2.31	0.04	0.41	40.83	39.46	2.44	0.66	0.11	99	76.20	48
STDEV	0.08	0.39	0.06	0.02	0.06	0.87	0.60	0.08	0.02	0.08	1	0.71	
UA 1425-16	0.16	7.86	3.19	0.04	0.35	46.31	36.90	2.15	0.46	0.48	98	78.58	
UA 1425-13	0.00	9.41	3.76	0.07	0.57	46.31	34.80	3.61	0.43	0.17	99	76.48	
UA 1425-21	0.05	9.81	3.22	0.08	0.52	47.11	35.75	3.36	0.49	0.16	101	78.14	
UA 1425-23	0.04	10.76	2.89	0.05	0.45	43.91	37.12	3.04	0.53	0.16	99	76.64	
UA 1425-16	0.48	7.86	3.19	0.04	0.35	48.44	34.98	2.15	0.46	0.16	98	78.58	
UA 1425-13	0.17	9.41	3.76	0.07	0.57	46.76	34.40	3.61	0.43	0.00	99	76.48	
UA 1425-21	0.16	9.81	3.22	0.08	0.52	47.52	35.38	3.36	0.49	0.05	101	78.14	
UA 1425-23	0.16	10.76	2.89	0.05	0.45	44.98	36.16	3.04	0.53	0.04	99	76.64	
AVERAGE	0.15	9.46	3.27	0.06	0.47	46.42	35.69	3.04	0.48	0.15	99	77.46	4
STDEV	0.15	1.12	0.34	0.02	0.09	1.43	0.98	0.59	0.04	0.15	1	0.98	
AVERAGE	0.12	12.51	2.44	0.04	0.42	41.63	38.92	2.52	0.64	0.12	99	76.38	52
STDEV	0.09	1.37	0.36	0.02	0.07	2.19	1.49	0.31	0.07	0.09	1	0.87	
UA 1344-16	0.35	12.34	2.37	0.02	0.35	42.26	38.69	2.48	0.66	0.06	100	76.71	Gold Hill
UA 1344-18	0.18	12.77	2.33	0.02	0.41	42.00	38.77	2.58	0.66	0.03	100	76.56	
UA 1344-33	0.15	12.78	2.27	0.02	0.37	41.54	38.58	2.51	0.68	0.03	99	75.96	
UA 1344-35	0.18	12.81	2.31	0.02	0.38	41.80	39.00	2.44	0.66	0.05	100	76.61	
UA 1344-32	0.11	12.86	2.39	0.02	0.41	41.92	38.77	2.55	0.65	0.09	100	76.49	
UA 1344-17	0.10	12.91	2.30	0.05	0.40	42.01	39.00	2.47	0.67	0.07	100	76.81	
UA 1344-31	0.16	12.92	2.31	0.00	0.38	41.58	38.08	2.51	0.64	0.70	99	75.50	
UA 1344-26	0.18	12.92	2.32	0.03	0.41	41.13	38.62	2.60	0.65	0.07	99	75.63	

UA 1344-14	0.14	12.99	2.35	0.03	0.40	41.47	39.05	2.49	0.65	0.02	100	76.37	
UA 1344-11	0.17	13.00	2.27	0.03	0.42	41.09	39.04	2.41	0.67	0.03	99	76.01	
UA 1344-27	0.15	13.13	2.34	0.08	0.41	41.38	39.37	2.45	0.66	0.03	100	76.60	
UA 1344-25	0.11	13.16	2.34	0.03	0.40	40.90	39.02	2.47	0.67	0.04	99	75.82	
UA 1344-5	0.16	13.18	2.34	0.04	0.43	41.10	39.31	2.48	0.65	0.01	100	76.29	
UA 1344-7	0.10	13.30	2.31	0.04	0.43	41.65	39.59	2.49	0.65	0.02	101	77.07	
UA 1344-10	0.14	13.31	2.36	0.05	0.44	40.50	39.31	2.44	0.66	0.00	99	75.76	
UA 1344-3	0.11	13.34	2.29	0.05	0.43	41.29	39.41	2.52	0.66	0.02	100	76.57	
UA 1344-29	0.13	13.35	2.36	0.04	0.40	41.12	39.60	2.45	0.65	0.01	100	76.60	
UA 1344-6	0.18	13.36	2.38	0.06	0.43	39.95	39.22	2.46	0.65	0.03	99	75.17	
UA 1344-30	0.14	13.38	2.41	0.02	0.41	40.14	39.07	2.48	0.69	0.10	99	75.19	
UA 1344-1	0.12	13.41	2.28	0.05	0.41	41.11	39.78	2.37	0.64	0.02	100	76.78	
UA 1344-34	0.13	13.50	2.40	0.04	0.41	41.76	40.20	2.44	0.65	0.02	102	77.78	
UA 1344-20	0.21	13.57	2.51	0.15	1.06	39.95	38.69	3.33	0.37	0.05	100	74.64	
UA 1344-13	0.10	13.66	2.31	0.04	0.39	40.66	39.85	2.44	0.67	0.02	100	76.44	
UA 1344-28	0.50	13.69	2.40	0.04	0.42	39.66	39.51	2.99	0.63	0.04	100	75.20	
UA 1344-23	0.13	13.71	2.24	0.05	0.41	39.16	39.15	2.44	0.68	0.12	98	74.39	
UA 1344-19	1.04	11.31	2.22	0.05	0.56	36.73	43.53	2.10	0.57	0.17	98	76.58	
UA 1344-16	0.06	12.34	2.37	0.02	0.35	41.52	39.35	2.48	0.66	0.35	100	76.71	
UA 1344-18	0.03	12.77	2.33	0.02	0.41	41.52	39.20	2.58	0.66	0.18	100	76.56	
UA 1344-33	0.03	12.78	2.27	0.02	0.37	40.72	39.31	2.51	0.68	0.15	99	75.96	
UA 1344-35	0.05	12.81	2.31	0.02	0.38	40.72	39.96	2.44	0.66	0.18	100	76.61	
UA 1344-32	0.09	12.86	2.39	0.02	0.41	40.72	39.85	2.55	0.65	0.11	100	76.49	
UA 1344-17	0.07	12.91	2.30	0.05	0.40	40.72	40.16	2.47	0.67	0.10	100	76.81	
UA 1344-31	0.70	12.92	2.31	0.00	0.38	36.73	42.45	2.51	0.64	0.16	99	75.50	
UA 1344-26	0.07	12.92	2.32	0.03	0.41	39.92	39.70	2.60	0.65	0.18	99	75.63	
UA 1344-14	0.02	12.99	2.35	0.03	0.40	40.72	39.72	2.49	0.65	0.14	100	76.37	
UA 1344-11	0.03	13.00	2.27	0.03	0.42	40.72	39.37	2.41	0.67	0.17	99	76.01	
UA 1344-27	0.03	13.13	2.34	0.08	0.41	40.72	39.96	2.45	0.66	0.15	100	76.60	
UA 1344-25	0.04	13.16	2.34	0.03	0.40	39.92	39.90	2.47	0.67	0.11	99	75.82	
UA 1344-5	0.01	13.18	2.34	0.04	0.43	40.72	39.65	2.48	0.65	0.16	100	76.29	
UA 1344-7	0.02	13.30	2.31	0.04	0.43	40.72	40.43	2.49	0.65	0.10	100	77.07	
UA 1344-10	0.00	13.31	2.36	0.05	0.44	39.92	39.83	2.44	0.66	0.14	99	75.76	
UA 1344-3	0.02	13.34	2.29	0.05	0.43	40.72	39.92	2.52	0.66	0.11	100	76.57	
UA 1344-29	0.01	13.35	2.36	0.04	0.40	40.72	39.95	2.45	0.65	0.13	100	76.60	
UA 1344-6	0.03	13.36	2.38	0.06	0.43	39.12	39.96	2.46	0.65	0.18	99	75.17	
UA 1344-30	0.10	13.38	2.41	0.02	0.41	39.12	39.98	2.48	0.69	0.14	99	75.19	
UA 1344-1	0.02	13.41	2.28	0.05	0.41	40.72	40.13	2.37	0.64	0.12	100	76.78	
UA 1344-34	0.02	13.50	2.40	0.04	0.41	41.52	40.41	2.44	0.65	0.13	102	77.78	
UA 1344-20	0.05	13.57	2.51	0.15	1.06	38.33	40.15	3.33	0.37	0.21	100	74.64	
UA 1344-13	0.02	13.66	2.31	0.04	0.39	39.92	40.51	2.44	0.67	0.10	100	76.44	
UA 1344-28	0.04	13.69	2.40	0.04	0.42	38.33	40.71	2.99	0.63	0.50	100	75.20	
UA 1344-23	0.12	13.71	2.24	0.05	0.41	38.33	39.91	2.44	0.68	0.13	98	74.39	
AVERAGE	0.13	13.14	2.34	0.04	0.43	40.52	39.66	2.52	0.64	0.12	100	76.13	51
STDEV	0.18	0.42	0.06	0.03	0.13	1.23	0.89	0.21	0.06	0.12	1	0.78	
UA 1344-12	0.15	8.27	3.51	0.02	0.51	48.96	33.87	3.13	0.45	0.03	99	77.93	
UA 1344-22	0.15	8.93	3.83	0.11	0.59	48.38	34.41	3.50	0.45	0.05	100	77.95	
UA 1344-24	0.16	9.31	3.54	0.06	0.49	47.74	34.72	3.42	0.45	0.04	100	77.68	
UA 1344-21	0.13	9.60	3.42	0.05	0.56	47.68	35.03	3.46	0.47	0.02	100	77.93	
UA 1344-2	0.10	10.07	3.21	0.06	0.48	46.73	35.46	3.26	0.51	0.05	100	77.51	
UA 1344-15	0.16	10.63	2.93	0.03	0.40	45.34	36.19	2.96	0.56	0.08	99	76.99	
UA 1344-19	0.17	11.31	2.22	0.05	0.56	44.21	36.80	2.10	0.57	1.04	99	76.58	
UA 1344-8	0.18	11.34	2.83	0.05	0.36	43.30	36.97	2.71	0.59	0.06	98	75.93	

UA 1344-12	0.03	8.27	3.51	0.02	0.51	47.91	34.82	3.13	0.45	0.15	99	77.93		
UA 1344-22	0.05	8.93	3.83	0.11	0.59	47.91	34.84	3.50	0.45	0.15	100	77.95		
UA 1344-24	0.04	9.31	3.54	0.06	0.49	47.11	35.29	3.42	0.45	0.16	100	77.68		
UA 1344-21	0.02	9.60	3.42	0.05	0.56	47.11	35.54	3.46	0.47	0.13	100	77.93		
UA 1344-2	0.05	10.07	3.21	0.06	0.48	45.51	36.56	3.26	0.51	0.10	100	77.51		
UA 1344-15	0.08	10.63	2.93	0.03	0.40	43.91	37.47	2.96	0.56	0.16	99	76.99		
UA 1344-8	0.06	11.34	2.83	0.05	0.36	42.32	37.85	2.71	0.59	0.18	98	75.93		
AVERAGE	0.10	9.84	3.25	0.05	0.49	46.27	35.72	3.13	0.50	0.16	100	77.36	15	
STDEV	0.06	1.05	0.44	0.03	0.08	2.04	1.19	0.39	0.06	0.25	1	0.72		
AVERAGE	0.13	12.39	2.54	0.04	0.45	41.83	38.76	2.66	0.61	0.13	100	76.41	66	
STDEV	0.16	1.52	0.44	0.03	0.12	2.82	1.92	0.36	0.08	0.16	1	0.92		
UA 1580-22	0.18	12.80	2.24	0.05	0.38	42.16	38.84	2.60	0.65	0.04	100	76.78		Jackson Hill
UA 1580-3	0.20	12.81	2.33	0.02	0.40	42.19	39.21	2.47	0.65	0.04	100	77.17		
UA 1580-19	0.15	12.84	2.34	0.03	0.41	41.34	38.58	2.52	0.66	0.09	99	75.78		
UA 1580-20	0.14	13.00	2.34	0.03	0.41	39.64	38.32	2.44	0.66	0.05	97	73.99		
UA 1580-21	0.15	13.02	2.38	0.02	0.41	41.88	39.13	2.56	0.65	0.09	100	76.82		
UA 1580-16	0.20	13.03	2.23	0.03	0.38	41.37	39.17	2.44	0.67	0.04	100	76.39		
UA 1580-4	0.15	13.14	2.28	0.03	0.39	41.84	39.49	2.45	0.67	0.02	100	77.14		
UA 1580-30	0.13	13.14	2.37	0.06	0.40	41.48	39.31	2.50	0.65	0.03	100	76.63		
UA 1580-29	0.15	13.15	2.30	0.07	0.40	41.90	39.19	2.68	0.66	0.04	101	76.90		
UA 1580-5	0.15	13.17	2.31	0.06	0.40	40.71	38.99	2.49	0.65	0.06	99	75.62		
UA 1580-6	0.12	13.27	2.31	0.04	0.39	40.68	39.26	2.40	0.65	0.03	99	75.86		
UA 1580-33	0.15	13.27	2.31	0.01	0.42	41.51	39.48	2.51	0.68	0.03	100	76.84		
UA 1580-7	0.15	13.28	2.28	0.02	0.38	41.23	39.48	2.41	0.65	0.10	100	76.58		
UA 1580-28	0.15	13.29	2.33	0.05	0.39	41.64	39.72	2.47	0.65	0.04	101	77.19		
UA 1580-24	0.13	13.30	2.33	0.03	0.41	41.88	39.80	2.46	0.67	0.01	101	77.49		
UA 1580-9	0.17	13.31	2.29	0.06	0.41	41.33	39.76	2.42	0.66	0.02	100	76.94		
UA 1580-14	0.13	13.31	2.32	0.07	0.41	41.37	39.70	2.42	0.64	0.02	100	76.92		
UA 1580-25	0.15	13.35	2.28	0.04	0.40	41.22	39.44	2.53	0.68	0.05	100	76.53		
UA 1580-2	0.14	13.38	2.22	0.04	0.40	40.79	39.46	2.37	0.66	0.10	100	76.17		
UA 1580-23	0.14	13.39	2.25	0.02	0.41	41.83	39.94	2.43	0.66	0.05	101	77.58		
UA 1580-11	0.14	13.40	2.24	0.03	0.42	41.44	39.91	2.36	0.66	0.03	101	77.20		
UA 1580-13	0.19	13.45	2.35	0.01	0.39	39.93	39.31	2.46	0.66	0.05	99	75.24		
UA 1580-32	0.14	13.48	2.37	0.03	0.42	40.71	39.71	2.43	0.66	0.01	100	76.34		
UA 1580-12	0.17	13.49	2.37	0.02	0.43	40.99	39.79	2.50	0.64	0.04	100	76.68		
UA 1580-10	0.13	13.51	2.33	0.04	0.39	40.57	39.84	2.34	0.65	0.01	100	76.35		
UA 1580-22	0.04	12.80	2.24	0.05	0.38	41.52	39.42	2.60	0.65	0.18	100	76.78		
UA 1580-3	0.04	12.81	2.33	0.02	0.40	41.52	39.80	2.47	0.65	0.20	100	77.17		
UA 1580-19	0.09	12.84	2.34	0.03	0.41	39.92	39.85	2.52	0.66	0.15	99	75.78		
UA 1580-21	0.09	13.02	2.38	0.02	0.41	40.72	40.18	2.56	0.65	0.15	100	76.82		
UA 1580-16	0.04	13.03	2.23	0.03	0.38	40.72	39.75	2.44	0.67	0.20	100	76.39		
UA 1580-4	0.02	13.14	2.28	0.03	0.39	41.52	39.78	2.45	0.67	0.15	100	77.14		
UA 1580-30	0.03	13.14	2.37	0.06	0.40	40.72	39.99	2.50	0.65	0.13	100	76.63		
UA 1580-29	0.04	13.15	2.30	0.07	0.40	41.52	39.54	2.68	0.66	0.15	100	76.90		
UA 1580-5	0.06	13.17	2.31	0.06	0.40	39.92	39.69	2.49	0.65	0.15	99	75.62		
UA 1580-6	0.03	13.27	2.31	0.04	0.39	39.92	39.94	2.40	0.65	0.12	99	75.86		
UA 1580-33	0.03	13.27	2.31	0.01	0.42	40.72	40.20	2.51	0.68	0.15	100	76.84		
UA 1580-7	0.10	13.28	2.28	0.02	0.38	39.92	40.65	2.41	0.65	0.15	100	76.58		
UA 1580-28	0.04	13.29	2.33	0.05	0.39	40.72	40.55	2.47	0.65	0.15	101	77.19		
UA 1580-24	0.01	13.30	2.33	0.03	0.41	41.52	40.13	2.46	0.67	0.13	101	77.49		
UA 1580-14	0.02	13.31	2.32	0.07	0.41	40.72	40.28	2.42	0.64	0.13	100	76.94		
UA 1580-9	0.02	13.31	2.29	0.06	0.41	40.72	40.30	2.42	0.66	0.17	100	76.92		

UA 1580-25	0.05	13.35	2.28	0.04	0.40	40.72	39.89	2.53	0.68	0.15	100	76.53		
UA 1580-2	0.10	13.38	2.22	0.04	0.40	39.92	40.24	2.37	0.66	0.14	99	76.17		
UA 1580-23	0.05	13.39	2.25	0.02	0.41	40.72	40.94	2.43	0.66	0.14	101	77.58		
UA 1580-11	0.03	13.40	2.24	0.03	0.42	40.72	40.56	2.36	0.66	0.14	101	77.20		
UA 1580-13	0.05	13.45	2.35	0.01	0.39	39.12	40.03	2.46	0.66	0.19	99	75.24		
UA 1580-32	0.01	13.48	2.37	0.03	0.42	39.92	40.42	2.43	0.66	0.14	100	76.34		
UA 1580-12	0.04	13.49	2.37	0.02	0.43	40.72	40.03	2.50	0.64	0.17	100	76.68		
UA 1580-10	0.01	13.51	2.33	0.04	0.39	39.92	40.42	2.34	0.65	0.13	100	76.35		
AVERAGE	0.10	13.23	2.31	0.04	0.40	40.93	39.74	2.47	0.66	0.10	100	76.58	49	
STDEV	0.06	0.21	0.04	0.02	0.01	0.73	0.53	0.08	0.01	0.06	1	0.69		
UA 1580-26	0.12	9.52	3.61	0.02	0.54	47.56	35.07	3.34	0.48	0.03	100	77.87		
UA 1580-8	0.18	9.74	3.14	0.03	0.60	47.51	35.97	2.94	0.48	0.07	101	78.73		
UA 1580-31	0.16	10.27	3.35	0.02	0.53	45.56	35.65	3.21	0.49	0.03	99	76.65		
UA 1580-34	0.14	10.31	3.08	0.04	0.49	47.00	36.16	3.17	0.53	0.05	101	78.46		
UA 1580-18	0.18	10.40	3.24	0.07	0.50	44.90	35.97	2.95	0.54	0.04	99	76.37		
UA 1580-15	0.15	10.54	2.91	0.04	0.40	45.52	36.60	2.68	0.58	0.04	99	77.56		
UA 1580-17	0.14	10.61	2.97	0.03	0.49	45.67	35.71	3.30	0.54	0.09	100	76.81		
UA 1580-1	0.14	10.97	2.94	0.07	0.44	45.19	37.02	2.83	0.56	0.04	100	77.68		
UA 1580-27	0.13	11.22	2.88	0.04	0.44	45.67	37.44	2.92	0.59	0.01	101	78.53		
UA 1580-35	0.12	10.70	3.28	0.04	0.51	44.32	35.87	3.11	0.52	0.05	99	75.75		
UA 1580-26	0.03	9.52	3.61	0.02	0.54	46.31	36.19	3.34	0.48	0.12	100	77.87		
UA 1580-8	0.07	9.74	3.14	0.03	0.60	46.31	37.05	2.94	0.48	0.18	101	78.73		
UA 1580-31	0.03	10.27	3.35	0.02	0.53	44.71	36.42	3.21	0.49	0.16	99	76.65		
UA 1580-34	0.05	10.31	3.08	0.04	0.49	46.31	36.78	3.17	0.53	0.14	101	78.46		
UA 1580-18	0.04	10.40	3.24	0.07	0.50	43.91	36.86	2.95	0.54	0.18	99	76.37		
UA 1580-15	0.04	10.54	2.91	0.04	0.40	44.71	37.33	2.68	0.58	0.15	99	77.56		
UA 1580-17	0.09	10.61	2.97	0.03	0.49	44.71	36.57	3.30	0.54	0.14	99	76.81		
UA 1580-35	0.05	10.70	3.28	0.04	0.51	43.91	36.24	3.11	0.52	0.12	98	75.75		
UA 1580-1	0.04	10.97	2.94	0.07	0.44	44.71	37.44	2.83	0.56	0.14	100	77.68		
UA 1580-27	0.01	11.22	2.88	0.04	0.44	44.71	38.30	2.92	0.59	0.13	101	78.53		
AVERAGE	0.09	10.43	3.14	0.04	0.49	45.46	36.53	3.04	0.53	0.09	100	77.44	20	
STDEV	0.06	0.50	0.23	0.02	0.06	1.09	0.76	0.21	0.04	0.06	1	0.98		
AVERAGE	0.10	12.42	2.55	0.04	0.43	42.25	38.81	2.63	0.62	0.10	100	76.83	69	
STDEV	0.06	1.32	0.40	0.02	0.05	2.23	1.59	0.29	0.06	0.06	1	0.87		
UT 1813-19	0.21	12.02	2.30	0.06	0.42	43.57	38.27	2.53	0.64	0.08	100	77.47		Thistle
UT 1813-24	0.18	12.46	2.29	0.04	0.36	42.04	38.44	2.32	0.65	0.22	99	76.26		Creek
UT 1813-33	0.18	12.51	2.41	0.03	0.38	43.74	38.60	2.78	0.63	0.21	101	77.96		
UT 1813-35	0.19	12.93	2.28	0.03	0.35	41.54	39.03	2.42	0.67	0.09	100	76.41		
UT 1813-12	0.12	12.93	2.44	0.07	0.41	42.09	39.06	2.59	0.66	0.04	100	76.93		
UT 1813-26	0.14	12.97	2.29	0.03	0.41	42.31	39.28	2.49	0.69	0.04	101	77.36		
UT 1813-20	0.15	12.97	2.31	0.02	0.38	41.28	38.91	2.48	0.67	0.04	99	76.05		
UT 1813-3	0.14	13.00	2.30	0.00	0.39	42.10	39.07	2.57	0.63	0.09	100	76.95		
UT 1813-10	0.16	13.14	2.29	0.01	0.37	40.87	39.04	2.42	0.70	0.09	99	75.82		
UT 1813-17	0.16	13.15	2.27	0.03	0.38	41.57	39.44	2.42	0.68	0.06	100	76.85		
UT 1813-21	0.20	13.16	2.27	0.03	0.38	41.42	39.25	2.48	0.70	0.13	100	76.53		
UT 1813-9	0.15	13.16	2.29	0.03	0.44	40.40	38.69	2.58	0.62	0.06	98	75.05		
UT 1813-15	0.17	13.17	2.26	0.03	0.40	41.16	39.29	2.44	0.66	0.06	100	76.33		
UT 1813-34	0.14	13.21	2.39	0.02	0.38	40.69	38.89	2.55	0.68	0.11	99	75.50		
UT 1813-29	0.15	13.22	2.29	0.02	0.40	41.19	39.26	2.51	0.66	0.03	100	76.32		
UT 1813-28	0.14	13.24	2.43	0.06	0.40	41.74	39.59	2.55	0.64	0.05	101	77.15		
UT 1813-25	0.18	13.27	2.36	0.05	0.40	40.48	39.31	2.42	0.65	0.04	99	75.74		
UT 1813-5	0.14	13.33	2.30	0.02	0.41	41.48	39.25	2.66	0.67	0.08	100	76.57		

UT 1813-16	0.16	13.34	2.29	0.02	0.40	40.06	38.95	2.52	0.65	0.05	98	75.00	
UT 1813-7	0.14	13.34	2.27	0.03	0.39	41.45	39.68	2.43	0.67	0.03	100	76.98	
UT 1813-23	0.14	13.36	2.28	0.07	0.40	40.90	39.49	2.41	0.66	0.07	100	76.29	
UT 1813-31	0.13	13.40	2.43	0.03	0.44	40.55	39.55	2.40	0.67	0.04	100	76.04	
UT 1813-14	0.13	13.60	2.32	0.06	0.41	41.28	39.86	2.58	0.66	0.04	101	77.01	
UT 1813-30	0.21	13.76	2.34	0.05	0.43	39.74	39.52	2.62	0.69	0.06	99	75.28	
UT 1813-19	0.08	12.02	2.30	0.06	0.42	42.32	39.39	2.53	0.64	0.21	100	77.47	
UT 1813-24	0.22	12.46	2.29	0.04	0.36	39.92	40.34	2.32	0.65	0.18	99	76.26	
UT 1813-33	0.21	12.51	2.41	0.03	0.38	42.32	39.88	2.78	0.63	0.18	101	77.96	
UT 1813-35	0.09	12.93	2.28	0.03	0.35	40.72	39.77	2.42	0.67	0.19	99	76.41	
UT 1813-12	0.04	12.93	2.44	0.07	0.41	41.52	39.57	2.59	0.66	0.12	100	76.93	
UT 1813-26	0.04	12.97	2.29	0.03	0.41	41.52	39.99	2.49	0.69	0.14	101	77.36	
UT 1813-20	0.04	12.97	2.31	0.02	0.38	40.72	39.41	2.48	0.67	0.15	99	76.05	
UT 1813-3	0.09	13.00	2.30	0.00	0.39	40.72	40.31	2.57	0.63	0.14	100	76.95	
UT 1813-10	0.09	13.14	2.29	0.01	0.37	39.92	39.89	2.42	0.70	0.16	99	75.82	
UT 1813-17	0.06	13.15	2.27	0.03	0.38	40.72	40.20	2.42	0.68	0.16	100	76.85	
UT 1813-21	0.13	13.16	2.27	0.03	0.38	39.92	40.60	2.48	0.70	0.20	100	76.53	
UT 1813-9	0.06	13.16	2.29	0.03	0.44	39.92	39.12	2.58	0.62	0.15	98	75.05	
UT 1813-15	0.06	13.17	2.26	0.03	0.40	40.72	39.69	2.44	0.66	0.17	100	76.33	
UT 1813-34	0.11	13.21	2.39	0.02	0.38	39.12	40.30	2.55	0.68	0.14	99	75.50	
UT 1813-29	0.03	13.22	2.29	0.02	0.40	40.72	39.68	2.51	0.66	0.15	100	76.32	
UT 1813-28	0.05	13.24	2.43	0.06	0.40	40.72	40.51	2.55	0.64	0.14	101	77.15	
UT 1813-25	0.04	13.27	2.36	0.05	0.40	39.92	39.82	2.42	0.65	0.18	99	75.74	
UT 1813-5	0.08	13.33	2.30	0.02	0.41	40.72	39.93	2.66	0.67	0.14	100	76.57	
UT 1813-16	0.05	13.34	2.29	0.02	0.40	39.12	39.79	2.52	0.65	0.16	98	75.00	
UT 1813-7	0.03	13.34	2.27	0.03	0.39	40.72	40.33	2.43	0.67	0.14	100	76.98	
UT 1813-23	0.07	13.36	2.28	0.07	0.40	39.92	40.37	2.41	0.66	0.14	100	76.29	
UT 1813-31	0.04	13.40	2.43	0.03	0.44	39.92	40.11	2.40	0.67	0.13	100	76.04	
UT 1813-14	0.04	13.60	2.32	0.06	0.41	40.72	40.37	2.58	0.66	0.13	101	77.01	
UT 1813-30	0.06	13.76	2.34	0.05	0.43	39.12	40.07	2.62	0.69	0.21	99	75.28	
AVERAGE	0.12	13.11	2.32	0.04	0.40	40.94	39.57	2.51	0.66	0.12	100	76.41	48
STDEV	0.06	0.36	0.06	0.02	0.02	1.01	0.57	0.10	0.02	0.06	1	0.76	
UT 1813-8	0.21	5.87	3.47	0.02	0.16	51.10	35.23	1.85	0.43	0.22	99	81.22	
UT 1813-22	0.07	7.54	2.84	0.03	0.24	50.30	35.52	2.18	0.48	0.19	99	80.79	
UT 1813-18	0.06	8.46	3.56	0.18	0.77	47.11	36.48	2.76	0.37	0.19	100	78.87	
UT 1813-6	0.06	9.87	3.62	0.04	0.56	44.71	35.40	3.48	0.50	0.15	98	75.64	
UT 1813-27	0.06	10.26	3.25	0.03	0.50	44.71	36.73	3.30	0.50	0.14	99	76.96	
UT 1813-1	0.04	10.47	3.10	0.05	0.49	45.51	37.06	3.03	0.51	0.14	100	78.02	
UT 1813-11	0.06	10.54	3.24	0.03	0.50	43.91	36.76	3.08	0.52	0.13	99	77.03	
UT 1813-4	0.11	10.54	3.04	0.06	0.41	44.71	36.79	3.09	0.57	0.17	99	76.28	
UT 1813-13	0.06	10.75	2.82	0.02	0.45	44.71	36.79	2.93	0.57	0.15	99	77.02	
UT 1813-32	0.13	10.90	2.90	0.04	0.47	43.12	37.98	2.76	0.60	0.16	99	76.78	
UT 1813-2	0.04	11.04	2.89	0.01	0.43	44.71	37.68	2.96	0.52	0.12	100	77.91	
UT 1813-8	0.22	5.87	3.47	0.02	0.16	53.05	33.48	1.85	0.43	0.21	99	81.22	
UT 1813-22	0.19	7.54	2.84	0.03	0.24	51.21	34.70	2.18	0.48	0.07	99	80.79	
UT 1813-18	0.19	8.46	3.56	0.18	0.77	48.65	35.09	2.76	0.37	0.06	100	78.87	
UT 1813-6	0.15	9.87	3.62	0.04	0.56	45.57	34.63	3.48	0.50	0.06	98	75.64	
UT 1813-27	0.14	10.26	3.25	0.03	0.50	46.03	35.54	3.30	0.50	0.06	100	76.96	
UT 1813-1	0.14	10.47	3.10	0.05	0.49	46.24	36.41	3.03	0.51	0.04	100	78.02	
UT 1813-4	0.17	10.54	3.04	0.06	0.41	45.60	36.00	3.09	0.57	0.11	100	77.03	
UT 1813-11	0.13	10.54	3.24	0.03	0.50	44.91	35.87	3.08	0.52	0.06	99	76.28	
UT 1813-13	0.15	10.75	2.82	0.02	0.45	45.23	36.32	2.93	0.57	0.06	99	77.02	
UT 1813-32	0.16	10.90	2.90	0.04	0.47	44.63	36.62	2.76	0.60	0.13	99	76.78	

UT 1813-2	0.12	11.04	2.89	0.01	0.43	45.53	36.94	2.96	0.52	0.04	101	77.91		
AVERAGE	0.12	9.66	3.16	0.05	0.45	46.42	36.09	2.85	0.51	0.12	99	77.86	22	
STDEV	0.06	1.62	0.29	0.04	0.16	2.68	1.07	0.46	0.06	0.06	1	1.74		
AVERAGE	0.12	12.02	2.58	0.04	0.41	42.67	38.47	2.62	0.61	0.12	100	76.87	70	
STDEV	0.06	1.87	0.42	0.03	0.09	3.07	1.79	0.31	0.08	0.06	1	1.33		
UA 1097-2	0.14	12.73	2.29	0.01	0.38	41.68	38.54	2.50	0.62	0.10	99	76.05		Chester
UA 1097-9	0.16	12.73	2.23	0.02	0.41	42.10	38.76	2.44	0.62	0.18	100	76.65		Bluff
UA 1097-10	0.17	12.79	2.32	0.03	0.37	42.29	39.09	2.47	0.66	0.06	100	77.15		
UA 1097-18	0.16	13.00	2.31	0.02	0.39	41.18	39.02	2.43	0.64	0.05	99	76.08		
UA 1097-28	0.16	13.00	2.32	0.07	0.40	41.11	39.05	2.40	0.66	0.06	99	76.04		
UA 1097-22	0.17	13.04	2.31	0.02	0.40	41.54	39.22	2.45	0.63	0.09	100	76.60		
UA 1097-19	0.15	13.11	2.35	0.03	0.37	41.76	39.12	2.58	0.69	0.08	100	76.70		
UA 1097-15	0.18	13.12	2.29	0.00	0.39	41.30	39.13	2.50	0.67	0.06	100	76.30		
UA 1097-27	0.20	13.14	2.30	0.04	0.44	41.22	39.12	2.59	0.65	0.05	100	76.21		
UA 1097-35	0.12	13.15	2.26	0.01	0.42	41.85	39.51	2.43	0.65	0.03	100	77.17		
UA 1097-26	0.19	13.16	2.28	0.05	0.44	41.23	39.31	2.50	0.64	0.04	100	76.41		
UA 1097-4	0.13	13.25	2.30	0.04	0.42	41.51	39.55	2.48	0.63	0.00	100	76.90		
UA 1097-13	0.15	13.27	2.18	0.00	0.38	41.06	39.28	2.40	0.69	0.08	100	76.23		
UA 1097-8	0.13	13.29	2.25	0.04	0.40	41.16	39.31	2.50	0.68	0.03	100	76.35		
UA 1097-24	0.12	13.30	2.32	0.02	0.39	41.22	39.46	2.43	0.66	0.06	100	76.55		
UA 1097-17	0.14	13.32	2.28	0.04	0.37	41.71	39.80	2.43	0.65	0.04	101	77.33		
UA 1097-1	0.13	13.56	2.17	0.03	0.38	40.46	39.45	2.45	0.67	0.05	99	75.86		
UA 1097-2	0.10	12.73	2.29	0.01	0.38	40.72	39.40	2.50	0.62	0.14	99	76.05		
UA 1097-9	0.18	12.73	2.23	0.02	0.41	40.72	40.01	2.44	0.62	0.16	100	76.65		
UA 1097-10	0.06	12.79	2.32	0.03	0.37	41.52	39.78	2.47	0.66	0.17	100	77.15		
UA 1097-18	0.05	13.00	2.31	0.02	0.39	40.72	39.43	2.43	0.64	0.16	99	76.08		
UA 1097-28	0.06	13.00	2.32	0.07	0.40	39.92	40.12	2.40	0.66	0.16	99	76.04		
UA 1097-22	0.09	13.04	2.31	0.02	0.40	40.72	39.96	2.45	0.63	0.17	100	76.60		
UA 1097-19	0.08	13.11	2.35	0.03	0.37	40.72	40.06	2.58	0.69	0.15	100	76.70		
UA 1097-15	0.06	13.12	2.29	0.00	0.39	40.72	39.65	2.50	0.67	0.18	100	76.30		
UA 1097-27	0.05	13.14	2.30	0.04	0.44	40.72	39.57	2.59	0.65	0.20	100	76.21		
UA 1097-35	0.03	13.15	2.26	0.01	0.42	41.52	39.81	2.43	0.65	0.12	100	77.17		
UA 1097-26	0.04	13.16	2.28	0.05	0.44	40.72	39.77	2.50	0.64	0.19	100	76.41		
UA 1097-4	0.00	13.25	2.30	0.04	0.42	40.72	40.26	2.48	0.63	0.13	100	76.90		
UA 1097-13	0.08	13.27	2.18	0.00	0.38	39.92	40.31	2.40	0.69	0.15	99	76.23		
UA 1097-8	0.03	13.29	2.25	0.04	0.40	40.72	39.71	2.50	0.68	0.13	100	76.35		
UA 1097-24	0.06	13.30	2.32	0.02	0.39	40.72	39.91	2.43	0.66	0.12	100	76.55		
UA 1097-17	0.04	13.32	2.28	0.04	0.37	40.72	40.69	2.43	0.65	0.14	101	77.33		
UA 1097-1	0.05	13.56	2.17	0.03	0.38	39.92	39.94	2.45	0.67	0.13	99	75.86		
AVERAGE	0.11	13.11	2.28	0.03	0.40	41.05	39.56	2.47	0.65	0.11	100	76.51	34	
STDEV	0.06	0.22	0.05	0.02	0.02	0.58	0.47	0.05	0.02	0.06	0	0.43		
UA 1097-12	0.14	5.42	3.12	0.10	0.38	54.72	33.32	1.86	0.34	0.06	100	82.56		
UA 1097-29	0.21	7.28	3.21	0.08	0.37	51.71	35.02	2.09	0.49	0.06	101	81.56		
UA 1097-6	2.84	7.37	3.32	0.01	0.25	44.96	37.75	2.45	0.45	0.11	100	78.21		
UA 1097-20	0.19	7.71	3.56	0.17	0.83	50.46	33.76	3.24	0.33	0.06	100	79.17		
UA 1097-32	0.21	8.16	3.18	0.05	0.36	50.03	33.97	3.10	0.48	0.08	100	78.98		
UA 1097-30	0.17	8.27	4.12	0.09	0.64	48.64	34.80	2.85	0.41	0.05	100	78.57		
UA 1097-7	0.17	9.05	3.20	0.05	0.51	47.36	35.73	2.33	0.48	0.08	99	78.34		
UA 1097-5	0.15	10.06	3.39	0.07	0.54	45.69	35.39	3.23	0.47	0.02	99	76.50		
UA 1097-16	0.14	10.11	3.11	0.06	0.47	46.48	35.80	3.08	0.51	0.03	100	77.62		
UA 1097-11	0.16	10.22	3.04	0.07	0.57	45.76	36.00	2.86	0.52	0.10	99	77.18		
UA 1097-31	0.13	10.43	3.13	0.05	0.48	46.99	36.61	3.07	0.52	0.01	101	78.89		

UA 1097-14	0.14	10.47	2.87	0.04	0.42	45.41	35.84	3.00	0.53	0.06	99	76.70	
UA 1097-33	0.17	10.56	2.86	0.02	0.43	46.03	36.46	2.93	0.52	0.07	100	77.88	
UA 1097-23	0.13	10.97	2.68	0.04	0.57	44.36	36.99	2.51	0.60	0.04	99	76.91	
UA 1097-3	0.17	11.05	2.90	0.06	0.43	42.06	35.72	2.83	0.58	0.05	96	73.57	
UA 1097-21	0.15	11.15	2.84	0.01	0.43	44.29	36.75	2.89	0.54	0.05	99	76.60	
UA 1097-12	0.06	5.42	3.12	0.10	0.38	54.29	33.71	1.86	0.34	0.14	99	82.56	
UA 1097-29	0.06	7.28	3.21	0.08	0.37	51.10	35.57	2.09	0.49	0.21	100	81.56	
UA 1097-20	0.06	7.71	3.56	0.17	0.83	49.50	34.62	3.24	0.33	0.19	100	79.17	
UA 1097-32	0.08	8.16	3.18	0.05	0.36	48.71	35.15	3.10	0.48	0.21	99	78.98	
UA 1097-30	0.05	8.27	4.12	0.09	0.64	47.91	35.46	2.85	0.41	0.17	100	78.57	
UA 1097-7	0.08	9.05	3.20	0.05	0.51	46.31	36.67	2.33	0.48	0.17	99	78.34	
UA 1097-5	0.02	10.06	3.39	0.07	0.54	44.71	36.27	3.23	0.47	0.15	99	76.50	
UA 1097-16	0.03	10.11	3.11	0.06	0.47	45.51	36.67	3.08	0.51	0.14	100	77.62	
UA 1097-11	0.10	10.22	3.04	0.07	0.57	44.71	36.94	2.86	0.52	0.16	99	77.18	
UA 1097-31	0.01	10.43	3.13	0.05	0.48	46.31	37.22	3.07	0.52	0.13	101	78.89	
UA 1097-14	0.06	10.47	2.87	0.04	0.42	44.71	36.47	3.00	0.53	0.14	99	76.70	
UA 1097-33	0.07	10.56	2.86	0.02	0.43	44.71	37.64	2.93	0.52	0.17	100	77.88	
UA 1097-23	0.04	10.97	2.68	0.04	0.57	43.91	37.39	2.51	0.60	0.13	99	76.91	
UA 1097-21	0.05	11.15	2.84	0.01	0.43	43.91	37.08	2.89	0.54	0.15	99	76.60	
AVERAGE	0.20	9.27	3.16	0.06	0.49	47.04	35.89	2.78	0.48	0.11	99	78.22	30
STDEV	0.50	1.66	0.34	0.04	0.13	3.10	1.20	0.41	0.07	0.06	1	1.93	
AVERAGE	0.15	11.31	2.69	0.04	0.44	43.86	37.84	2.61	0.57	0.11	100	77.31	64
STDEV	0.35	2.24	0.50	0.03	0.10	3.70	2.05	0.32	0.10	0.06	1	1.60	

UA 1100-9	0.87	12.29	2.39	0.04	0.42	39.68	38.57	2.60	0.60	0.09	98	74.27	Little Montauk
UA 1100-12	0.24	12.48	2.25	0.01	0.37	41.78	37.96	2.52	0.63	0.36	99	75.55	
UA 1100-16	0.19	12.52	2.23	0.00	0.38	41.69	38.33	2.45	0.66	0.07	99	75.84	
UA 1100-14	0.21	12.55	2.22	0.04	0.38	41.01	37.38	2.43	0.63	0.69	98	74.28	
UA 1100-6	0.18	12.66	2.26	0.02	0.40	41.31	38.09	2.35	0.60	0.51	98	75.26	
UA 1100-11	0.24	12.66	2.36	0.01	0.38	40.99	38.26	2.57	0.65	0.06	98	75.15	
UA 1100-27	0.15	12.87	2.30	0.04	0.40	41.87	38.50	2.77	0.64	0.04	100	76.18	
UA 1100-1	0.15	13.02	2.25	0.05	0.38	40.99	38.92	2.45	0.64	0.01	99	75.81	
UA 1100-30	0.19	13.02	2.26	0.02	0.38	41.62	38.58	2.47	0.66	0.54	100	76.03	
UA 1100-21	0.16	13.03	2.24	0.02	0.37	41.08	39.12	2.32	0.69	0.05	99	76.08	
UA 1100-24	0.18	13.04	2.23	0.04	0.39	40.81	38.84	2.46	0.69	0.05	99	75.57	
UA 1100-22	0.16	13.05	2.55	0.06	0.41	38.87	37.63	2.78	0.65	0.05	96	72.61	
UA 1100-32	0.17	13.21	2.35	0.05	0.41	39.38	38.65	2.41	0.69	0.07	97	74.09	
UA 1100-4	0.12	13.22	2.24	0.03	0.37	41.20	39.18	2.43	0.68	0.11	100	76.25	
UA 1100-26	0.14	13.30	2.33	0.06	0.41	41.02	39.44	2.48	0.65	0.02	100	76.36	
UA 1100-7	0.19	13.32	2.27	0.02	0.38	41.38	39.30	2.42	0.68	0.36	100	76.53	
UA 1100-17	0.15	13.35	2.19	0.02	0.40	40.93	39.09	2.59	0.69	0.06	99	75.92	
UA 1100-5	0.13	13.44	2.22	0.04	0.40	41.03	39.84	2.31	0.69	0.02	100	76.77	
UA 1100-19	0.15	13.45	2.32	0.05	0.43	40.14	38.82	2.66	0.69	0.13	99	74.93	
UA 1100-29	0.15	13.62	2.24	0.03	0.39	41.58	39.41	2.91	0.66	0.03	101	76.83	
UA 1100-23	0.09	13.63	2.32	0.05	0.41	39.15	39.30	2.33	0.66	0.03	98	74.54	
UA 1100-8	0.11	12.07	2.53	0.04	0.34	37.53	41.04	2.80	0.65	1.39	98	74.81	
UA 1100-9	0.09	12.29	2.39	0.04	0.42	37.53	40.50	2.60	0.60	0.87	97	74.27	
UA 1100-12	0.36	12.48	2.25	0.01	0.37	39.12	40.35	2.52	0.63	0.24	98	75.55	
UA 1100-16	0.07	12.52	2.23	0.00	0.38	40.72	39.20	2.45	0.66	0.19	98	75.84	
UA 1100-11	0.06	12.66	2.36	0.01	0.38	39.92	39.22	2.57	0.65	0.24	98	75.15	
UA 1100-6	0.51	12.66	2.26	0.02	0.40	37.53	41.49	2.35	0.60	0.18	98	75.26	
UA 1100-27	0.04	12.87	2.30	0.04	0.40	40.72	39.53	2.77	0.64	0.15	99	76.18	
UA 1100-1	0.01	13.02	2.25	0.05	0.38	40.72	39.16	2.45	0.64	0.15	99	75.81	

UA 1100-30	0.54	13.02	2.26	0.02	0.38	37.53	42.26	2.47	0.66	0.19	99	76.03	
UA 1100-21	0.05	13.03	2.24	0.02	0.37	39.92	40.16	2.32	0.69	0.16	99	76.08	
UA 1100-24	0.05	13.04	2.23	0.04	0.39	39.92	39.64	2.46	0.69	0.18	99	75.57	
UA 1100-32	0.07	13.21	2.35	0.05	0.41	38.33	39.60	2.41	0.69	0.17	97	74.09	
UA 1100-4	0.11	13.22	2.24	0.03	0.37	39.92	40.33	2.43	0.68	0.12	99	76.25	
UA 1100-26	0.02	13.30	2.33	0.06	0.41	40.72	39.72	2.48	0.65	0.14	100	76.36	
UA 1100-7	0.36	13.32	2.27	0.02	0.38	38.33	42.04	2.42	0.68	0.19	100	76.53	
UA 1100-17	0.06	13.35	2.19	0.02	0.40	39.92	40.00	2.59	0.69	0.15	99	75.92	
UA 1100-5	0.02	13.44	2.22	0.04	0.40	40.72	40.12	2.31	0.69	0.13	100	76.77	
UA 1100-19	0.13	13.45	2.32	0.05	0.43	39.12	39.73	2.66	0.69	0.15	99	74.93	
UA 1100-29	0.03	13.62	2.24	0.03	0.39	40.72	40.18	2.91	0.66	0.15	101	76.83	
UA 1100-23	0.03	13.63	2.32	0.05	0.41	38.33	40.05	2.33	0.66	0.09	98	74.54	
AVERAGE	0.17	13.02	2.29	0.03	0.39	40.12	39.45	2.51	0.66	0.21	99	75.55	41
STDEV	0.16	0.41	0.08	0.02	0.02	1.29	1.07	0.16	0.03	0.26	1	0.93	
UA 1100-13	0.20	8.45	3.43	0.01	0.47	48.77	33.59	3.39	0.45	0.09	99	77.48	
UA 1100-31	0.17	9.81	3.18	0.05	0.46	46.73	35.36	3.12	0.51	0.05	99	77.41	
UA 1100-10	0.14	9.89	4.15	0.10	0.58	43.58	35.12	2.95	0.50	0.03	97	74.33	
UA 1100-18	0.15	10.08	3.08	0.05	0.50	46.25	35.35	3.23	0.50	0.05	99	76.97	
UA 1100-3	0.23	10.39	2.81	0.04	0.54	45.32	36.15	2.84	0.53	0.07	99	76.93	
UA 1100-35	0.17	10.80	2.82	0.06	0.49	45.12	36.60	2.87	0.56	0.05	100	77.20	
UA 1100-20	0.26	11.31	2.56	0.03	0.37	44.42	37.59	2.52	0.63	0.13	100	77.56	
UA 1100-25	0.16	11.52	3.11	0.04	0.48	42.15	37.16	2.61	0.53	0.10	98	75.09	
UA 1100-15	0.28	11.97	2.46	0.02	0.40	41.36	36.51	2.61	0.60	0.71	97	73.73	
UA 1100-34	0.13	12.01	2.43	0.01	0.42	43.46	38.33	2.42	0.63	0.02	100	77.43	
UA 1100-2	0.14	12.06	2.40	0.02	0.38	43.27	37.61	2.80	0.62	0.05	99	76.56	
UA 1100-13	0.09	8.45	3.43	0.01	0.47	47.91	34.37	3.39	0.45	0.20	99	77.48	
UA 1100-31	0.05	9.81	3.18	0.05	0.46	45.51	36.46	3.12	0.51	0.17	99	77.41	
UA 1100-18	0.05	10.08	3.08	0.05	0.50	45.51	36.02	3.23	0.50	0.15	99	76.97	
UA 1100-3	0.07	10.39	2.81	0.04	0.54	43.91	37.41	2.84	0.53	0.23	99	76.93	
UA 1100-35	0.05	10.80	2.82	0.06	0.49	43.91	37.68	2.87	0.56	0.17	99	77.20	
UA 1100-20	0.13	11.31	2.56	0.03	0.37	43.12	38.76	2.52	0.63	0.26	100	77.56	
UA 1100-25	0.10	11.52	3.11	0.04	0.48	40.72	38.44	2.61	0.53	0.16	98	75.09	
UA 1100-34	0.02	12.01	2.43	0.01	0.42	43.12	38.63	2.42	0.63	0.13	100	77.43	
UA 1100-2	0.05	12.06	2.40	0.02	0.38	42.32	38.48	2.80	0.62	0.14	99	76.56	
AVERAGE	0.13	10.74	2.91	0.04	0.46	44.32	36.78	2.86	0.55	0.15	99	76.66	20
STDEV	0.07	1.13	0.45	0.02	0.06	2.09	1.49	0.31	0.06	0.15	1	1.15	
AVERAGE	0.16	12.27	2.49	0.03	0.41	41.50	38.58	2.63	0.62	0.19	99	75.92	61
STDEV	0.14	1.30	0.39	0.02	0.05	2.54	1.75	0.27	0.07	0.23	1	1.13	

Ilmenite data

UA 1580-II-2	0.08	51.85	0.03	0.21	0.05	0.70	45.57	0.11	0.86	0.07	100	46.19
UA 1580-II-2	0.07	51.85	0.03	0.21	0.05	0.80	45.48	0.11	0.86	0.08	100	46.19
UA 1580-II-4	0.72	47.71	0.13	0.00	0.07	4.79	41.66	2.66	0.86	0.09	99	45.97
UA 1580-II-1	0.02	49.60	0.08	0.00	0.26	6.39	41.64	1.69	0.51	0.05	100	47.39
UA 1580-II-1	0.05	49.60	0.08	0.00	0.26	6.99	41.10	1.69	0.51	0.02	100	47.39
UA 1580-II-4	0.09	47.71	0.13	0.00	0.07	10.57	36.46	2.66	0.86	0.72	99	45.97
UA 1580-II-6	0.05	35.46	0.18	0.05	0.36	31.94	26.33	2.72	0.98	0.08	98	55.07
UA 1580-II-6	0.08	35.46	0.18	0.05	0.36	32.24	26.06	2.72	0.98	0.05	98	55.07
UA 1580-II-9	0.14	44.61	0.30	0.00	0.10	15.97	33.39	3.87	0.75	0.14	99	47.76
UA 1580-II-3	0.09	44.81	0.25	0.00	0.13	15.97	33.80	3.45	0.77	0.09	99	48.17
UA 1580-II-7	0.12	44.81	0.29	0.00	0.12	15.97	33.80	3.80	0.76	0.06	100	48.17
UA 1580-II-8	0.31	44.83	0.33	0.02	0.11	14.37	34.50	3.92	0.75	0.08	99	47.44

UA 1580-II-1	0.05	45.01	0.26	0.01	0.12	15.97	32.89	3.74	0.81	0.11	99	47.26
UA 1580-II-1	0.04	45.41	0.28	0.00	0.12	14.37	34.67	3.63	0.78	0.09	99	47.61
UA 1580-II-9	0.14	44.61	0.30	0.00	0.10	17.02	32.44	3.87	0.75	0.14	99	47.76
UA 1580-II-3	0.09	44.81	0.25	0.00	0.13	16.46	33.36	3.45	0.77	0.09	99	48.17
UA 1580-II-7	0.06	44.81	0.29	0.00	0.12	17.23	32.66	3.80	0.76	0.12	100	48.17
UA 1580-II-8	0.08	44.83	0.33	0.02	0.11	16.88	32.25	3.92	0.75	0.31	99	47.44
UA 1580-II-1	0.11	45.01	0.26	0.01	0.12	15.79	33.04	3.74	0.81	0.05	99	47.26
UA 1580-II-1	0.09	45.41	0.28	0.00	0.12	15.53	33.63	3.63	0.78	0.04	100	47.61
AVERAGE	0.11	44.91	0.29	0.00	0.12	15.96	33.37	3.73	0.77	0.11	99	47.73
STDEV	0.07	0.26	0.03	0.01	0.01	0.91	0.76	0.17	0.02	0.07	0	0.36
AVERAGE	0.12	45.41	0.21	0.03	0.14	14.30	35.24	2.96	0.78	0.12	99	48.10
STDEV	0.15	4.17	0.10	0.06	0.09	8.15	5.34	1.20	0.11	0.15	1	2.49

UA 1425-II-6	0.05	52.64	0.06	0.01	0.03	0.22	44.41	0.23	2.52	0.01	100	44.61
UA 1425-II-4	0.01	52.35	0.06	0.03	0.12	0.80	44.12	1.50	0.58	0.05	100	44.84
UA 1425-II-6	0.01	52.64	0.06	0.01	0.03	0.80	43.90	0.23	2.52	0.05	100	44.61
UA 1425-II-4	0.05	52.35	0.06	0.03	0.12	1.08	43.87	1.50	0.58	0.01	100	44.84
UA 1425-II-5	0.05	50.22	0.07	0.04	0.23	3.19	42.83	1.01	0.71	0.09	98	45.70
UA 1425-II-5	0.09	50.22	0.07	0.04	0.23	3.37	42.67	1.01	0.71	0.05	98	45.70
UA 1425-II-3	0.05	50.05	0.05	0.02	0.07	4.65	43.61	0.07	1.27	0.04	100	47.79
UA 1425-II-3	0.04	50.05	0.05	0.02	0.07	4.79	43.48	0.07	1.27	0.05	100	47.79
UA 1425-II-8	0.02	47.25	0.12	0.09	0.51	7.98	40.93	1.34	0.40	0.09	99	48.12
UA 1425-20	0.06	48.25	0.08	0.02	0.17	7.98	38.45	2.06	2.13	0.08	99	45.63
UA 1425-20	0.08	48.25	0.08	0.02	0.17	8.97	37.57	2.06	2.13	0.06	99	45.63
UA 1425-II-8	0.09	47.25	0.12	0.09	0.51	9.31	39.74	1.34	0.40	0.02	99	48.12
UA 1425-II-1	0.05	47.52	0.10	0.01	0.27	9.58	38.94	2.30	0.53	0.06	99	47.56
UA 1425-II-1	0.06	47.52	0.10	0.01	0.27	10.53	38.09	2.30	0.53	0.05	99	47.56

UA 1425-II-2	0.03	45.03	0.23	0.02	0.20	15.97	35.04	3.30	0.47	0.08	100	49.41
UA 1425-II-2	0.08	45.03	0.23	0.02	0.20	16.93	34.17	3.30	0.47	0.03	100	49.41
UA 1425-9	0.16	41.32	0.20	0.04	0.27	19.16	33.72	2.68	0.49	0.09	98	50.97
UA 1425-II-1	0.06	42.93	0.25	0.01	0.10	20.25	33.13	2.71	0.69	0.01	100	51.35
UA 1425-II-1	0.01	42.93	0.25	0.01	0.10	20.76	32.67	2.71	0.69	0.06	100	51.35
UA 1425-9	0.09	41.32	0.20	0.04	0.27	21.32	31.78	2.68	0.49	0.16	98	50.97
UA 1425-II-7	0.05	41.33	0.27	0.13	0.33	22.36	31.87	3.49	0.30	0.10	100	51.99
UA 1425-II-7	0.10	41.33	0.27	0.13	0.33	23.73	30.64	3.49	0.30	0.05	100	51.99
AVERAGE	0.07	42.65	0.24	0.05	0.22	20.06	32.88	3.04	0.49	0.07	100	50.93
STDEV	0.05	1.62	0.03	0.05	0.09	2.62	1.43	0.38	0.15	0.05	1	1.02
AVERAGE	0.06	47.17	0.14	0.04	0.21	10.62	38.44	1.88	0.92	0.06	100	48.00
STDEV	0.03	3.98	0.08	0.04	0.13	8.02	4.82	1.13	0.73	0.03	1	2.59

UT 1409-II-1	0.03	48.35	0.11	0.00	0.07	9.58	37.51	3.32	0.93	0.05	100	46.13
UT 1409-II-1	0.05	48.35	0.11	0.00	0.07	10.54	36.65	3.32	0.93	0.03	100	46.13

UT 1409-II-1	0.07	45.60	0.26	0.00	0.12	14.37	35.32	3.46	0.76	0.07	100	48.25
UT 1409-II-5	0.02	45.74	0.27	0.00	0.10	14.37	34.59	3.62	0.77	0.05	100	47.53
UT 1409-II-1	0.02	45.83	0.27	0.01	0.14	14.37	35.22	3.52	0.74	0.06	100	48.16
UT 1409-II-11	0.02	45.84	0.26	0.00	0.09	14.37	34.75	3.52	0.76	0.06	100	47.68
UT 1409-II-2	0.02	45.84	0.24	0.02	0.13	14.37	35.02	3.44	0.78	0.06	100	47.95
UT 1409-II-4	0.06	45.91	0.28	0.00	0.10	14.37	34.76	3.75	0.79	0.04	100	47.69
UT 1409-II-11	0.06	45.84	0.26	0.00	0.09	14.96	34.22	3.52	0.76	0.02	100	47.68
UT 1409-II-5	0.05	45.74	0.27	0.00	0.10	15.10	33.94	3.62	0.77	0.02	100	47.53
UT 1409-II-2	0.06	45.84	0.24	0.02	0.13	15.13	34.34	3.44	0.78	0.02	100	47.95

UT 1409-II-4	0.04	45.91	0.28	0.00	0.10	15.46	33.77	3.75	0.79	0.06	100	47.69	
UT 1409-II-1	0.06	45.83	0.27	0.01	0.14	15.48	34.23	3.52	0.74	0.02	100	48.16	
UT 1409-II-1	0.07	45.60	0.26	0.00	0.12	15.77	34.07	3.46	0.76	0.07	100	48.25	
UT 1409-II-1	0.08	45.23	0.27	0.01	0.13	15.92	32.92	3.94	0.73	0.07	99	47.24	
UT 1409-II-1	0.06	45.95	0.27	0.04	0.14	15.93	34.23	3.57	0.76	0.01	101	48.57	
UT 1409-II-8	0.09	44.42	0.29	0.01	0.11	15.97	33.73	3.87	0.74	0.09	99	48.10	
UT 1409-II-1	0.07	45.23	0.27	0.01	0.13	15.97	32.87	3.94	0.73	0.08	99	47.24	
UT 1409-II-1	0.10	45.36	0.28	0.01	0.13	15.97	34.02	3.65	0.74	0.03	100	48.39	
UT 1409-II-7	0.04	45.66	0.27	0.00	0.12	15.97	33.87	3.67	0.76	0.07	100	48.24	
UT 1409-II-6	0.05	45.68	0.24	0.00	0.12	15.97	34.18	3.58	0.77	0.07	101	48.55	
UT 1409-II-1	0.01	45.95	0.27	0.04	0.14	15.97	34.20	3.57	0.76	0.06	101	48.57	
UT 1409-II-7	0.07	45.66	0.27	0.00	0.12	16.08	33.77	3.67	0.76	0.04	100	48.24	
UT 1409-II-6	0.07	45.68	0.24	0.00	0.12	16.25	33.93	3.58	0.77	0.05	101	48.55	
UT 1409-II-1	0.03	45.36	0.28	0.01	0.13	16.61	33.44	3.65	0.74	0.10	100	48.39	
UT 1409-II-8	0.09	44.42	0.29	0.01	0.11	17.58	32.28	3.87	0.74	0.09	99	48.10	
AVERAGE	0.05	45.59	0.27	0.01	0.12	15.51	34.07	3.63	0.76	0.05	100	48.03	13
STDEV	0.02	0.42	0.01	0.01	0.01	0.84	0.72	0.15	0.02	0.02	0	0.41	
AVERAGE	0.05	45.80	0.25	0.01	0.11	15.09	34.30	3.61	0.77	0.05	100	47.88	
STDEV	0.02	0.85	0.05	0.01	0.02	1.69	1.08	0.17	0.05	0.02	0	0.65	

APPENDIX 3: CHAPTER 4

GLASS MAJOR-ELEMENT GEOCHEMISTRY FOR TEPHRA BEDS AT HALFWAY HOUSE

Tephra ID	Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Cl	Total	H_2O_{diff}	n	Notes
Boneyard	**UA 1874-2**	75.87	0.00	14.69	0.59	0.13	0.06	1.21	4.23	3.18	0.06	100	6.64		
	UA 1874-22	75.95	0.05	14.24	0.55	0.20	0.06	1.04	4.20	3.58	0.16	100	6.53		
	UA 1874-18	76.01	0.05	14.33	0.64	0.19	0.09	1.08	3.97	3.61	0.05	100	7.05		
	UA 1874-21	76.05	0.01	14.43	0.55	0.14	0.06	1.06	3.88	3.69	0.15	100	7.00		
	UA 1874-23	76.06	0.03	14.54	0.53	0.16	0.13	1.13	3.92	3.42	0.11	100	7.16		
	UA 1874-19	76.18	0.04	14.32	0.61	0.14	0.13	0.93	3.97	3.59	0.10	100	7.72		
	UA 1874-3	76.31	0.00	14.22	0.63	0.14	0.09	1.08	3.90	3.56	0.09	100	7.66		
	UA 1874-16	76.38	0.08	14.10	0.47	0.14	0.11	0.97	4.18	3.46	0.15	100	6.58		
	UA 1874-5	76.40	0.00	14.47	0.59	0.14	0.09	0.99	3.46	3.78	0.13	100	8.25		
	UA 1874-1	76.43	0.00	14.36	0.50	0.15	0.12	1.09	3.74	3.54	0.08	100	8.22		
	UA 1874-10	76.43	0.06	13.95	0.57	0.13	0.08	1.02	3.83	3.76	0.21	100	7.85		
	UA 1874-20	76.44	0.05	14.29	0.62	0.16	0.12	1.09	3.84	3.37	0.03	100	7.21		
	UA 1874-8	76.45	0.02	14.05	0.59	0.08	0.06	0.99	3.83	3.76	0.20	100	7.97		
	UA 1874-24	76.47	0.00	14.19	0.60	0.13	0.11	0.96	3.85	3.60	0.12	100	7.74		
	UA 1874-12	76.47	0.00	14.29	0.54	0.16	0.07	1.06	3.73	3.61	0.08	100	7.64		
	UA 1874-25	76.48	0.05	14.20	0.56	0.17	0.11	1.10	3.65	3.62	0.07	100	7.70		
	UA 1874-13	76.49	0.01	14.19	0.57	0.16	0.16	1.09	3.85	3.41	0.09	100	7.63		
	UA 1874-9	76.62	0.00	14.26	0.51	0.21	0.09	1.14	3.78	3.33	0.09	100	8.15		
	UA 1874-4	76.66	0.08	14.15	0.57	0.14	0.08	1.06	3.78	3.46	0.04	100	8.19		
	UA1874-8	75.53	0.00	14.28	0.65	0.13	0.08	1.01	1.45	6.72	0.14	100	9.74		
	UA1874-30	75.55	0.02	14.69	0.57	0.14	0.11	1.03	4.23	3.63	0.04	100	5.86		
	UA1874-29	75.77	0.03	14.03	0.48	0.10	0.07	0.74	4.59	3.97	0.21	100	6.18		
	UA1874-26	75.79	0.02	14.40	0.59	0.11	0.11	1.10	4.06	3.75	0.07	100	7.16		
	UA1874-27	75.80	0.02	14.47	0.68	0.12	0.08	1.00	4.14	3.57	0.11	100	6.51		
	UA1874-5	75.83	0.04	14.38	0.48	0.16	0.03	1.06	4.23	3.70	0.10	100	7.39		
	UA1874-25	75.88	0.00	14.24	0.66	0.19	0.07	1.06	4.09	3.73	0.08	100	7.26		
	UA1874-10	75.91	0.13	14.06	0.53	0.18	0.09	1.00	4.30	3.63	0.18	100	6.83		
	UA1874-23	75.91	0.03	14.20	0.60	0.12	0.09	1.04	4.13	3.66	0.23	100	6.70		
	UA1874-6	75.93	0.05	14.29	0.62	0.16	0.17	1.09	4.09	3.50	0.09	100	6.87		
	UA1874-1	75.96	0.01	14.28	0.58	0.14	0.13	1.03	4.27	3.54	0.08	100	6.57		
	UA1874-15	76.00	0.08	14.29	0.54	0.10	0.13	0.96	4.20	3.61	0.10	100	6.86		
	UA1874-7	76.01	0.07	14.26	0.66	0.11	0.10	1.03	4.14	3.61	0.03	100	6.91		
	UA1874-3	76.02	0.14	14.33	0.55	0.19	0.12	1.04	3.88	3.69	0.04	100	8.34		
	UA1874-9	76.03	0.00	14.27	0.60	0.19	0.13	1.06	4.24	3.41	0.06	100	7.29		
	UA1874-2	76.04	0.00	14.41	0.59	0.20	0.13	1.01	4.13	3.45	0.04	100	6.17		
	UA1874-12	76.13	0.09	14.23	0.60	0.12	0.12	0.99	4.16	3.50	0.07	100	7.17		
	UA1874-21	76.13	0.04	14.13	0.61	0.16	0.12	1.13	3.52	4.10	0.07	100	9.79		
	UA1874-19	76.14	0.00	13.97	0.37	0.05	0.13	0.92	4.52	3.70	0.20	100	7.52		
	UA1874-16	76.19	0.02	14.11	0.55	0.20	0.05	1.06	3.86	3.89	0.07	100	8.69		
	UA1874-14	76.23	0.01	14.17	0.51	0.11	0.08	1.04	4.16	3.61	0.09	100	7.44		
	UA1874-28	76.24	0.03	14.16	0.52	0.13	0.11	0.99	4.23	3.54	0.04	100	6.82		
	UA1874-11	76.31	0.04	14.02	0.56	0.16	0.14	1.01	4.11	3.55	0.10	100	7.17		
	UA1874-18	76.39	0.04	14.01	0.55	0.10	0.11	1.03	4.16	3.53	0.09	100	7.91		
	UA1874-13	76.42	0.12	12.55	1.98	0.10	0.02	1.23	3.07	4.39	0.11	100	7.55		
	UA1874-22	76.50	0.08	14.21	0.50	0.15	0.09	0.99	3.71	3.69	0.08	100	7.54		
	Mean	76.15	0.04	14.21	0.60	0.14	0.10	1.04	3.94	3.69	0.10	100	7.40	45	
	StDev	0.28	0.04	0.30	0.22	0.03	0.03	0.08	0.47	0.50	0.05	0	0.81		

	UA 1874-17	75.54	0.00	14.32	0.63	0.13	0.11	1.10	2.43	5.69	0.06	100	7.64	
	UA 1874-14	75.73	0.01	14.32	0.61	0.18	0.06	1.03	2.20	5.77	0.10	100	9.83	
	UA 1874-7	75.87	0.07	14.05	0.60	0.14	0.14	1.05	1.90	6.13	0.07	100	9.49	
Old Crow	**UA 1871-1**	75.45	0.31	12.82	1.71	0.07	0.28	1.43	3.95	3.71	0.27	100	3.77	
	UA 1871-2	75.47	0.35	12.74	1.72	0.09	0.33	1.53	3.84	3.67	0.27	100	0.59	
	UA 1871-3	75.59	0.22	12.81	1.67	0.14	0.27	1.61	3.74	3.66	0.30	100	4.33	
	UA 1871-4	75.79	0.33	12.83	1.79	0.01	0.27	1.55	3.39	3.76	0.28	100	4.56	
	UA 1871-5	75.75	0.34	12.91	1.69	0.10	0.27	1.49	3.49	3.65	0.31	100	5.03	
	UA 1871-6	75.34	0.25	12.94	1.81	0.09	0.28	1.55	3.77	3.66	0.31	100	1.40	
	UA 1871-7	75.29	0.32	12.70	1.83	0.07	0.32	1.50	3.77	3.90	0.30	100	3.55	
	UA 1871-8	75.31	0.29	13.01	1.77	0.07	0.30	1.57	3.66	3.74	0.27	100	3.41	
	UA 1871-9	75.59	0.27	12.89	1.76	0.09	0.32	1.47	3.70	3.67	0.25	100	1.67	
	UA 1871-10	75.38	0.31	13.03	1.69	0.05	0.36	1.43	3.90	3.55	0.30	100	1.95	
	UA 1871-11	75.35	0.36	12.96	1.72	0.04	0.26	1.52	3.93	3.61	0.25	100	1.85	
	UA 1871-12	75.72	0.41	12.73	1.78	0.07	0.35	1.45	3.43	3.80	0.26	100	4.46	
	UA 1871-13	75.20	0.32	12.93	1.85	0.14	0.31	1.51	3.66	3.76	0.32	100	4.42	
	UA 1871-14	75.55	0.29	12.78	1.73	0.06	0.32	1.45	3.75	3.81	0.26	100	3.18	
	UA 1871-15	75.50	0.26	12.87	1.74	0.05	0.31	1.47	3.87	3.66	0.27	100	3.80	
	UA 1871-16	75.69	0.32	12.73	1.69	0.10	0.31	1.48	3.79	3.61	0.27	100	4.30	
	UA 1871-17	75.27	0.29	12.93	1.82	0.04	0.29	1.61	3.67	3.83	0.26	100	4.38	
	UA 1871-18	75.29	0.36	12.76	1.90	0.09	0.34	1.57	3.62	3.81	0.26	100	3.45	
	Mean	75.47	0.31	12.85	1.76	0.08	0.30	1.51	3.72	3.71	0.28	100	3.34	18
	StDev	0.18	0.04	0.10	0.06	0.03	0.03	0.06	0.16	0.09	0.02	0	1.29	
HH1	**UA 1872-12**	64.55	1.28	15.43	5.63	0.09	1.68	4.29	4.39	2.60	0.05	100	1.72	
	UA 1872-11	65.14	1.16	15.39	5.42	0.09	1.66	4.21	4.17	2.71	0.04	100	2.05	
	UA 1872-28	66.47	1.33	14.90	4.85	0.09	1.43	3.73	4.29	2.83	0.08	100	1.54	
	UA 1872-29	67.80	0.96	15.01	4.19	0.08	1.04	3.08	4.58	3.18	0.07	100	3.23	
	UA 1872-9	68.22	1.15	14.65	4.54	0.07	1.05	3.16	3.77	3.33	0.06	100	2.92	
	UA 1872-20	68.36	1.14	14.38	4.39	0.04	1.06	3.28	4.08	3.17	0.10	100	2.78	
	UA 1872-15	68.66	0.96	14.39	4.42	0.01	1.02	3.13	4.00	3.27	0.14	100	3.23	
	UA 1872-10	69.39	0.76	15.02	3.55	0.06	0.80	2.85	4.18	3.30	0.09	100	4.44	
	UA 1872-8	69.58	0.79	15.11	3.41	0.08	0.79	2.49	4.11	3.53	0.11	100	4.61	
	UA 1872-6	69.69	0.75	14.67	3.36	0.08	0.81	2.68	4.39	3.48	0.09	100	3.55	
	UA 1872-2	69.69	0.69	14.91	3.49	0.01	0.79	2.57	4.45	3.31	0.09	100	2.59	
	UA 1872-13	69.87	0.90	13.97	4.01	0.04	0.86	2.49	4.27	3.54	0.04	100	1.84	
	UA 1872-17	71.50	0.48	14.54	2.73	0.09	0.51	1.83	4.36	3.89	0.09	100	5.72	
	UA 1872-18	73.92	0.37	13.71	2.13	0.05	0.31	1.35	4.10	3.98	0.08	100	4.30	
	UA 1872-5	73.92	0.46	13.57	1.90	0.01	0.30	1.24	4.18	4.33	0.09	100	2.90	
	UA 1872-23	74.32	0.31	13.87	1.82	0.03	0.30	1.35	3.71	4.18	0.11	100	7.72	
	UA 1872-30	74.36	0.30	13.62	1.92	0.00	0.25	1.23	3.79	4.42	0.10	100	4.37	
	UA 1872-24	75.64	0.22	13.24	1.24	0.03	0.20	0.96	3.82	4.50	0.15	100	6.75	
	UA 1872-26	75.68	0.24	13.15	1.25	0.06	0.21	0.95	4.00	4.33	0.14	100	6.41	
	UA 1872-21	76.45	0.26	12.69	1.40	0.01	0.14	0.80	3.14	4.95	0.13	100	5.40	
	UA 1872-33	66.93	1.00	15.25	4.20	0.14	1.26	3.77	4.44	2.96	0.05	100	1.79	
	UA 1872-12	68.31	1.14	14.48	4.39	0.06	1.16	3.04	4.23	3.10	0.08	100	1.86	
	UA 1872-22	69.72	0.56	14.62	3.62	0.18	0.85	2.70	4.81	2.78	0.17	100	6.66	
	UA 1872-10	70.23	0.60	14.90	3.08	0.03	0.72	2.25	4.69	3.38	0.12	100	5.04	
	UA 1872-8	71.18	0.62	14.63	3.16	0.04	0.63	2.21	3.99	3.45	0.09	100	3.06	
	UA 1872-30	71.85	0.51	14.22	2.61	0.05	0.52	1.75	4.47	3.92	0.10	100	3.56	
	UA 1872-11	74.20	0.33	13.54	1.88	0.07	0.23	1.25	4.18	4.23	0.10	100	4.98	
	UA 1872-18	74.20	0.28	13.68	1.85	0.06	0.25	1.24	4.12	4.23	0.09	100	5.73	

	UA 1872-4	74.61	0.28	13.46	1.81	0.06	0.25	1.26	3.98	4.17	0.11	100	6.58		
	UA 1872-2	74.99	0.29	13.41	1.62	0.00	0.24	0.98	3.90	4.45	0.12	100	5.98		
	UA 1872-23	75.53	0.20	12.99	1.47	0.00	0.23	0.80	3.99	4.66	0.13	100	5.70		
	UA 1872-14	75.79	0.25	13.09	1.32	0.02	0.18	0.89	3.85	4.50	0.11	100	8.27		
	Mean	71.27	0.64	14.20	3.02	0.05	0.68	2.18	4.14	3.71	0.10	100	4.29	32	Correlates to Snag
	StDev	3.44	0.36	0.78	1.32	0.04	0.45	1.07	0.32	0.65	0.03	0	1.90		
HH2	**UA 1872-22**	74.71	0.20	14.61	1.27	0.03	0.45	1.86	4.00	2.87	0.01	100	1.37		
	UA 1872-4	74.81	0.16	14.92	1.28	0.01	0.50	1.93	3.63	2.73	0.03	100	4.09		
	UA 1872-16	75.56	0.09	14.35	1.27	0.08	0.14	0.83	4.50	3.12	0.05	100	8.08		
	UA 1872-21	74.06	0.18	14.98	1.34	0.05	0.40	2.03	4.15	2.81	0.01	100	2.79		
	UA 1872-15	74.43	0.11	14.60	1.19	0.04	0.39	1.93	4.40	2.85	0.04	100	3.96		
	UA 1872-31	74.50	0.26	14.30	1.37	0.08	0.38	1.90	4.51	2.68	0.02	100	5.09		
	UA 1872-5	74.98	0.17	14.55	1.08	0.02	0.33	1.96	4.10	2.78	0.05	100	7.68		
	UA 1872-24	75.10	0.26	14.30	1.30	0.05	0.38	1.64	3.98	2.93	0.05	100	6.28		
	UA 1872-20	75.33	0.19	14.66	1.06	0.02	0.40	1.88	3.63	2.81	0.02	100	5.06		
	UA 1872-27	75.40	0.29	13.80	1.33	0.06	0.30	1.52	4.12	3.13	0.04	100	5.46		
	UA 1872-19	75.51	0.15	14.10	1.37	0.00	0.38	1.56	4.03	2.83	0.06	100	8.74		
	UA 1872-26	77.20	0.19	13.05	1.03	0.04	0.27	1.06	3.70	3.46	0.00	100	4.01		
	Mean	75.13	0.19	14.35	1.24	0.04	0.36	1.67	4.07	2.92	0.03	100	5.22	12	White River Unknown 5
	StDev	0.80	0.06	0.53	0.12	0.03	0.09	0.38	0.31	0.22	0.02	0	2.19		
HH3	**UA 1872-7**	76.45	0.24	13.23	1.43	0.08	0.36	1.76	4.70	1.58	0.16	100	4.30		
	UA 1872-14	77.64	0.19	12.96	1.40	0.06	0.32	1.61	4.06	1.58	0.18	100	6.11		
	UA 1872-29	76.40	0.23	13.28	1.60	0.14	0.32	1.62	4.72	1.54	0.14	100	6.27		
	UA 1872-28	76.48	0.25	13.28	1.34	0.07	0.27	1.72	4.86	1.59	0.15	100	6.07		
	UA 1872-37	77.17	0.21	12.95	1.34	0.08	0.29	1.56	4.77	1.47	0.15	100	6.46		
	Mean	76.83	0.22	13.14	1.42	0.08	0.31	1.65	4.62	1.55	0.16	100	5.84	5	Potential correlation to Stampede tephra
	StDev	0.55	0.02	0.17	0.11	0.03	0.03	0.08	0.32	0.05	0.01	0	0.88		
	UA 1872-27	75.32	0.31	13.08	1.83	0.04	0.29	1.51	3.72	3.62	0.28	100	5.77		Old Crow
HH3-upper samples	***[incl. topmost beds]***														
	UA 1860-12	76.55	0.31	13.38	1.50	0.17	0.37	1.79	4.43	1.40	0.14	100	5.94		
	UA 1857-5	77.14	0.26	13.17	1.39	0.04	0.31	1.68	4.48	1.41	0.13	100	6.84		
	UA 1862-5	76.38	0.25	13.38	1.53	0.13	0.37	1.77	4.65	1.41	0.17	100	8.08		
	UA 1868-20	76.80	0.23	13.21	1.41	0.10	0.34	1.68	4.68	1.41	0.14	100	6.65		
	UA 1867-22	76.71	0.25	13.25	1.55	0.18	0.35	1.82	4.36	1.41	0.17	100	6.36		
	UA 1867-4	77.51	0.25	13.05	1.50	0.09	0.37	1.54	4.11	1.42	0.20	100	6.51		
	UA 1865-33	76.61	0.29	13.16	1.52	0.06	0.35	1.75	4.63	1.44	0.18	100	7.21		
	UA 1865-6	77.04	0.27	13.04	1.41	0.09	0.30	1.62	4.64	1.44	0.15	100	5.93		
	UA 1857-1	77.11	0.25	13.16	1.41	0.11	0.38	1.67	4.32	1.44	0.19	100	5.61		
	UA 1861-24	76.78	0.30	13.23	1.50	0.07	0.35	1.79	4.43	1.45	0.14	100	8.32		
	UA 1862-16	76.18	0.19	13.49	1.56	0.11	0.38	1.83	4.65	1.45	0.23	100	8.74		
	UA 1865-9	76.05	0.29	13.43	1.65	0.14	0.35	1.76	4.74	1.45	0.14	100	5.35		
	UA 1868-23	76.59	0.28	13.28	1.47	0.05	0.32	1.69	4.75	1.45	0.11	100	5.75		
	UA 1868-25	77.33	0.25	13.14	1.53	0.12	0.32	1.75	3.97	1.45	0.16	100	9.42		
	UA 1863-7	75.86	0.31	13.38	1.57	0.15	0.36	1.74	5.04	1.45	0.14	100	4.19		
	UA 1862-15	76.67	0.29	13.38	1.54	0.09	0.37	1.76	4.34	1.45	0.14	100	9.15		

	UA 1865-21	76.62	0.23	12.98	1.53	0.10	0.30	1.66	4.95	1.45	0.16	100	6.45		
	UA 1868-5	77.44	0.19	13.14	1.54	0.10	0.33	1.72	3.92	1.45	0.21	100	7.34		
	UA 1863-19	77.25	0.24	13.16	1.37	0.09	0.33	1.57	4.44	1.46	0.11	100	7.41		
	UA 1865-17	76.83	0.25	13.03	1.46	0.04	0.35	1.65	4.80	1.46	0.14	100	7.02		
	UA 1863-15	77.20	0.23	13.09	1.44	0.14	0.33	1.56	4.44	1.47	0.14	100	9.41		
	UA 1864-9	76.27	0.28	13.40	1.50	0.04	0.38	1.82	4.73	1.47	0.15	100	9.19		
	UA 1868-4	76.65	0.23	13.31	1.56	0.11	0.38	1.79	4.38	1.48	0.15	100	6.08		
	UA 1868-24	76.87	0.27	13.25	1.50	0.12	0.34	1.76	4.30	1.48	0.15	100	7.08		
	UA 1866-22	76.73	0.26	13.45	1.53	0.09	0.40	1.72	4.20	1.49	0.16	100	7.46		
	UA 1857-19	76.90	0.16	13.22	1.54	0.08	0.33	1.62	4.52	1.49	0.14	100	6.31		
	UA 1858-20	76.83	0.28	13.24	1.54	0.12	0.30	1.73	4.38	1.49	0.13	100	6.37		
	UA 1862-25	76.11	0.20	13.47	1.50	0.13	0.37	1.87	4.65	1.49	0.27	100	9.12		
	UA 1857-14	76.52	0.25	13.28	1.51	0.13	0.32	1.65	4.69	1.49	0.14	100	5.14		
	UA 1863-6	75.99	0.28	13.33	1.60	0.09	0.33	1.73	5.04	1.50	0.13	100	4.91		
	UA 1868-10	77.17	0.19	13.27	1.55	0.09	0.34	1.72	4.10	1.50	0.11	100	6.73		
	UA 1861-6	76.79	0.28	13.32	1.50	0.05	0.41	1.78	4.23	1.50	0.16	100	8.73		
	UA 1857-20	76.64	0.26	13.16	1.48	0.12	0.30	1.69	4.68	1.51	0.16	100	5.64		
	UA 1865-30	76.45	0.21	13.48	1.45	0.06	0.38	1.69	4.62	1.51	0.16	100	7.13		
	UA 1868-13	76.40	0.25	13.19	1.47	0.08	0.30	1.72	4.90	1.51	0.17	100	7.38		
	UA 1868-7	76.84	0.16	13.22	1.56	0.11	0.35	1.76	4.33	1.52	0.20	100	5.53		
	UA 1868-28	76.24	0.19	13.19	1.50	0.10	0.32	1.78	5.01	1.52	0.16	100	6.80		
	UA 1867-24	77.21	0.33	12.87	1.54	0.10	0.32	1.76	4.25	1.52	0.14	100	5.10		
	UA 1864-13	76.47	0.33	13.42	1.54	0.06	0.37	1.82	4.36	1.54	0.10	100	6.65		
	UA 1863-17	76.59	0.27	13.06	1.48	0.07	0.33	1.67	4.86	1.54	0.13	100	8.02		
	UA 1862-1	76.62	0.30	13.21	1.52	0.10	0.43	1.75	4.40	1.54	0.15	100	8.16		
	UA 1860-21	76.89	0.23	13.14	1.49	0.14	0.32	1.74	4.39	1.54	0.15	100	6.69		
	UA 1866-3	77.58	0.16	12.89	1.43	0.11	0.32	1.58	4.27	1.55	0.15	100	6.67		
	UA 1864-2	76.63	0.20	13.36	1.48	0.11	0.35	1.83	4.36	1.56	0.16	100	8.41		
	UA 1860-13	76.64	0.21	13.15	1.41	0.13	0.36	1.82	4.55	1.58	0.18	100	4.78		
	UA 1864-25	77.71	0.21	13.03	1.34	0.08	0.29	1.53	4.10	1.58	0.17	100	5.99		
	UA 1864-24	77.53	0.23	12.94	1.41	0.14	0.32	1.61	4.09	1.60	0.16	100	7.44		
	UA 1863-28	76.60	0.25	13.11	1.45	0.08	0.29	1.61	4.85	1.61	0.14	100	7.47		
	UA 1864-16	76.45	0.29	13.33	1.55	0.11	0.32	1.76	4.43	1.62	0.17	100	6.73		
	UA 1873-11	76.86	0.29	13.43	1.42	0.08	0.35	1.66	4.40	1.38	0.13	100	4.79		
	UA 1873-29	77.15	0.26	13.24	1.40	0.18	0.35	1.66	4.11	1.49	0.15	100	5.92		
	UA 1873-21	76.64	0.20	13.29	1.55	0.07	0.36	1.75	4.40	1.54	0.19	100	0.05		
	UA 1901-16	76.22	0.26	13.44	1.60	0.06	0.37	1.73	4.67	1.50	0.16	100	6.10		
	UA 1901-24	76.53	0.28	13.28	1.53	0.10	0.39	1.76	4.49	1.46	0.17	100	7.25		
	UA 1901-24	77.46	0.21	13.04	1.40	0.07	0.35	1.69	4.22	1.41	0.15	100	0.97		
	UA 1901-29	76.85	0.21	12.88	1.56	0.09	0.27	1.65	4.74	1.61	0.15	100	6.25		
	UA 1901-4	76.91	0.24	13.36	1.46	0.01	0.37	1.82	4.20	1.45	0.18	100	2.04		
	UA 1877-6	76.98	0.25	13.24	1.57	0.02	0.36	1.78	4.24	1.43	0.19	100	5.76		
	UA 1877-23	77.43	0.21	13.07	1.55	0.13	0.35	1.70	3.96	1.43	0.20	100	6.14		
	Mean	76.78	0.25	13.22	1.50	0.10	0.34	1.72	4.47	1.49	0.16	100	6.52	59	Potential correlative to Stampede tephra
	StDev	0.42	0.04	0.16	0.06	0.04	0.03	0.08	0.28	0.06	0.03	0	1.79		
HHt	**UA 1453-1**	74.18	0.44	13.88	2.15	0.17	0.45	1.66	5.08	1.87	0.12	100	0.99		
	UA 1453-2	74.33	0.37	13.71	2.00	0.12	0.46	1.67	5.37	1.84	0.13	100	1.62		
	UA 1453-4	73.48	0.39	14.38	2.17	0.17	0.50	1.84	5.19	1.73	0.15	100	0.46		
	UA 1453-5	73.54	0.46	14.15	2.23	0.12	0.43	1.69	5.27	1.96	0.15	100	1.73		
	UA 1453-6	73.87	0.45	13.93	2.09	0.13	0.42	1.71	5.30	1.95	0.14	100	0.60		

UA 1453-7	73.17	0.45	14.11	2.38	0.15	0.48	2.05	5.16	1.90	0.16	100	2.29
UA 1453-8	73.81	0.43	13.79	2.23	0.19	0.43	1.74	5.46	1.81	0.12	100	1.64
UA 1453-9	73.95	0.38	14.11	2.13	0.15	0.40	1.84	5.04	1.84	0.14	100	1.18
UA 1453-11	73.60	0.43	14.34	1.98	0.19	0.46	1.73	5.28	1.81	0.17	100	0.88
UA 1453-12	73.88	0.37	14.00	2.14	0.10	0.40	1.72	5.23	1.99	0.15	100	0.55
UA 1453-13	72.30	0.43	14.57	2.61	0.19	0.56	2.21	5.20	1.81	0.12	100	1.14
UA 1453-14	73.78	0.43	14.06	2.17	0.15	0.44	1.78	5.09	1.96	0.14	100	1.19
UA 1453-15	74.10	0.42	13.78	2.28	0.11	0.49	1.84	5.07	1.78	0.16	100	-0.13
UA 1453-16	73.53	0.37	14.20	2.27	0.12	0.50	1.84	5.13	1.88	0.16	100	0.98
UA 1453-17	73.38	0.38	14.18	2.18	0.14	0.48	1.76	5.38	1.98	0.14	100	4.11
UA 1453-18	74.08	0.41	14.08	2.08	0.13	0.41	1.59	5.19	1.93	0.11	100	0.63
UA 1453-19	73.43	0.45	14.04	2.26	0.16	0.50	1.92	5.32	1.84	0.08	100	1.71
UA 1453-20	73.48	0.37	14.14	2.08	0.19	0.43	1.80	5.53	1.82	0.17	100	0.83
UA 1453-15	68.66	0.67	15.48	3.74	0.16	0.89	3.52	5.24	1.56	0.10	100	0.38
UA 1453-22	69.63	0.62	14.64	3.79	0.13	0.91	3.22	5.24	1.68	0.16	100	0.54
UA 1453-17	72.13	0.54	14.38	2.63	0.16	0.56	2.17	5.48	1.83	0.12	100	1.57
UA 1453-2	73.07	0.47	14.08	2.31	0.13	0.47	1.87	5.60	1.85	0.16	100	2.60
UA 1453-27	73.23	0.47	13.94	2.37	0.22	0.50	1.82	5.41	1.90	0.15	100	1.87
UA 1453-19	73.30	0.46	13.94	2.37	0.09	0.52	1.86	5.49	1.85	0.12	100	2.76
UA 1453-26	73.50	0.40	13.90	2.28	0.16	0.46	1.83	5.37	1.96	0.13	100	1.57
UA 1453-13	73.53	0.45	14.21	2.17	0.14	0.47	1.77	5.26	1.86	0.14	100	1.35
UA 1453-3	73.53	0.42	13.99	2.12	0.13	0.43	1.70	5.58	1.93	0.17	100	1.53
UA 1453-7	73.55	0.51	13.82	2.09	0.15	0.47	1.72	5.51	2.07	0.12	100	3.19
UA 1453-18	73.56	0.45	13.70	2.24	0.17	0.51	1.73	5.47	2.03	0.13	100	2.39
UA 1453-12	73.60	0.44	14.11	2.23	0.10	0.48	1.77	5.21	1.94	0.11	100	2.34
UA 1453-1	73.70	0.40	14.05	2.10	0.13	0.46	1.66	5.44	1.90	0.15	100	2.73
UA 1453-16	73.75	0.39	13.64	2.36	0.10	0.52	1.72	5.34	2.05	0.14	100	0.96
UA 1453-5	73.77	0.47	14.06	2.28	0.11	0.45	1.73	5.20	1.80	0.13	100	1.17
UA 1453-10	73.84	0.48	13.81	2.11	0.18	0.49	1.65	5.43	1.90	0.11	100	1.18
UA 1453-30	73.86	0.42	13.99	2.23	0.10	0.46	1.67	5.29	1.86	0.13	100	1.27
UA 1453-32	73.91	0.44	13.83	2.05	0.14	0.41	1.59	5.59	1.90	0.14	100	1.96
UA 1453-20	73.91	0.32	13.79	2.25	0.16	0.46	1.68	5.34	1.93	0.15	100	1.14
UA 1453-21	74.07	0.43	13.76	2.22	0.11	0.44	1.63	5.27	1.90	0.16	100	1.42
UA 1453-8	74.10	0.40	13.94	2.18	0.16	0.39	1.59	5.28	1.83	0.14	100	2.64
UA 1453-33	74.12	0.41	13.88	2.33	0.16	0.46	1.68	5.00	1.85	0.12	100	1.54
UA 1870-20	69.66	0.66	15.18	3.81	0.14	0.97	3.27	4.51	1.65	0.16	100	2.43
UA 1870-17	69.85	0.70	14.82	3.68	0.18	0.95	3.17	4.71	1.80	0.13	100	5.03
UA 1870-19	70.61	0.62	14.52	3.66	0.13	0.85	2.85	4.91	1.68	0.16	100	3.87
UA 1870-8	71.08	0.64	14.67	3.15	0.16	0.87	2.60	4.86	1.86	0.12	100	1.88
UA 1870-3	71.14	0.36	15.96	2.13	0.14	0.52	2.82	5.31	1.52	0.12	100	3.06
UA 1870-21	71.45	0.60	14.48	3.06	0.14	0.74	2.61	5.03	1.76	0.12	100	2.51
UA 1870-6	72.44	0.55	14.22	2.90	0.06	0.65	2.23	4.87	1.94	0.12	100	4.84
UA 1870-9	72.51	0.59	14.39	3.03	0.09	0.59	2.42	4.43	1.76	0.18	100	2.76
UA 1870-5	72.68	0.57	14.29	2.65	0.16	0.59	2.20	4.92	1.76	0.16	100	3.73
UA 1870-23	72.74	0.51	14.34	2.76	0.14	0.68	2.10	4.79	1.82	0.12	100	2.54
UA 1870-4	73.28	0.57	13.93	2.73	0.13	0.59	1.89	4.88	1.86	0.14	100	5.92
UA 1870-2	73.32	0.41	14.23	2.39	0.14	0.54	2.14	4.79	1.89	0.14	100	2.85
UA 1870-26	73.66	0.50	14.10	2.32	0.12	0.57	1.83	4.95	1.80	0.15	100	2.55
UA 1870-13	73.69	0.51	14.03	2.34	0.16	0.59	1.94	4.74	1.86	0.14	100	2.83
UA 1870-10	73.70	0.49	13.94	2.38	0.15	0.49	1.94	5.00	1.79	0.11	100	2.72
UA 1870-15	73.80	0.50	14.11	2.45	0.08	0.54	1.85	4.81	1.70	0.16	100	2.90
UA 1870-30	73.85	0.49	14.21	2.04	0.18	0.46	1.76	4.97	1.85	0.18	100	1.27
UA 1870-12	74.14	0.44	13.80	2.19	0.14	0.42	1.79	4.98	1.99	0.12	100	2.32

	UA 1870-11	74.14	0.43	13.97	2.20	0.19	0.46	1.79	4.78	1.89	0.14	100	4.55	
	UA 1870-24	74.25	0.44	13.77	2.16	0.17	0.50	1.80	4.94	1.88	0.09	100	3.12	
	UA 1870-27	74.32	0.47	13.91	2.23	0.13	0.46	1.69	4.72	1.91	0.15	100	2.96	
	UA 1870-14	74.37	0.39	14.07	2.26	0.10	0.40	1.68	4.70	1.88	0.13	100	2.84	
	UA 1870-25	74.39	0.46	13.81	2.25	0.12	0.43	1.72	4.69	1.95	0.18	100	2.69	
	Ua 1870-21	67.62	0.72	15.56	4.44	0.07	1.20	3.74	5.02	1.53	0.10	100	1.89	
	Ua 1870-8	68.60	0.74	15.24	4.48	0.08	0.92	3.30	4.94	1.61	0.09	100	2.59	
	Ua 1870-26	69.37	0.70	15.10	3.88	0.19	0.92	3.22	4.80	1.72	0.09	100	7.02	
	Ua 1870-30	70.90	0.64	14.66	3.46	0.09	0.75	2.60	4.97	1.81	0.11	100	1.24	
	Ua 1870-6	71.00	0.57	14.76	3.16	0.13	0.63	2.56	5.33	1.75	0.11	100	1.61	
	Ua 1870-22	72.41	0.56	14.30	2.69	0.14	0.57	2.00	5.30	1.89	0.13	100	5.93	
	Ua 1870-19	72.58	0.57	14.27	2.60	0.13	0.54	1.87	5.38	1.90	0.16	100	0.71	
	Ua 1870-4	73.08	0.44	14.08	2.35	0.14	0.51	1.82	5.55	1.90	0.14	100	1.44	
	Ua 1870-10	73.32	0.50	13.90	2.39	0.14	0.57	1.87	5.18	2.01	0.11	100	2.12	
	Ua 1870-23	73.39	0.39	13.98	2.32	0.17	0.55	1.74	5.41	1.89	0.15	100	1.67	
	Ua 1870-13	73.41	0.47	13.95	2.41	0.15	0.52	1.85	5.12	1.99	0.13	100	1.96	
	Ua 1870-20	73.58	0.49	13.87	2.22	0.07	0.45	1.80	5.40	2.01	0.13	100	3.18	
	Ua 1870-7	73.62	0.43	13.96	2.09	0.15	0.43	1.62	5.57	1.96	0.17	100	2.07	
	Ua 1870-14	73.75	0.42	13.69	2.36	0.13	0.41	1.61	5.55	1.94	0.16	100	4.40	
	Ua 1870-25	73.76	0.38	13.96	2.27	0.12	0.42	1.56	5.39	1.99	0.15	100	3.09	
	Ua 1870-24	73.80	0.51	13.77	2.20	0.16	0.44	1.64	5.28	2.05	0.14	100	6.60	
	Ua 1870-18	73.80	0.48	13.92	2.19	0.13	0.46	1.74	5.23	1.95	0.10	100	2.65	
	Ua 1870-17	73.81	0.42	13.96	2.06	0.08	0.45	1.59	5.52	2.01	0.09	100	2.93	
	Ua 1870-15	73.85	0.42	13.79	2.22	0.14	0.39	1.60	5.46	1.98	0.16	100	3.35	
	Ua 1870-11	73.89	0.49	13.84	2.31	0.09	0.40	1.59	5.37	1.88	0.14	100	2.47	
	Ua 1870-2	74.30	0.42	13.81	2.04	0.06	0.49	1.57	5.19	1.99	0.13	100	2.38	
	Mean	73.04	0.48	14.16	2.49	0.14	0.54	1.99	5.17	1.86	0.14	100	2.31	84
	StDev	1.47	0.09	0.44	0.56	0.03	0.16	0.50	0.27	0.11	0.02	0	1.40	
	UA 1453-6	64.69	0.48	18.43	3.19	0.06	0.84	5.32	5.68	1.22	0.09	100	5.10	
	UA 1453-14	66.09	0.56	17.90	3.16	0.02	0.78	4.73	5.51	1.16	0.09	100	0.64	
	UA 1453-11	67.29	0.55	17.38	2.91	0.10	0.71	4.37	5.22	1.38	0.08	100	0.37	
	Mean	66.03	0.53	17.90	3.09	0.06	0.78	4.81	5.47	1.25	0.08	100	2.04	3
	StDev	1.30	0.04	0.52	0.15	0.04	0.07	0.48	0.23	0.11	0.01	0	2.66	
VT	**UA1425-1**	70.68	0.56	15.11	3.02	0.16	0.67	2.33	4.36	2.96	0.14	100	4.60	
	UA1425-2	71.74	0.52	14.60	2.73	0.07	0.54	2.14	4.35	3.08	0.23	100	2.55	
	UA1425-3	70.64	0.54	14.90	3.15	0.12	0.64	2.33	4.43	3.11	0.15	100	3.02	
	UA1425-4	70.44	0.54	14.77	3.11	0.06	0.59	2.40	4.82	3.10	0.17	100	3.03	
	UA1425-6	71.12	0.57	14.42	3.06	0.07	0.68	2.30	4.68	2.96	0.14	100	1.41	
	UA1425-8	70.91	0.63	14.58	3.01	0.14	0.68	2.38	4.50	2.98	0.21	100	1.67	
	UA1425-9	71.83	0.61	14.26	2.98	0.10	0.58	2.28	4.20	3.02	0.15	100	1.76	
	UA1425-10	71.07	0.59	14.65	2.91	0.08	0.64	2.22	4.70	2.99	0.15	100	1.11	
	UA1425-11	70.51	0.56	15.01	3.19	0.14	0.67	2.44	4.31	2.98	0.17	100	2.65	
	UA1425-12	70.90	0.54	14.83	3.02	0.09	0.64	2.33	4.61	2.91	0.13	100	2.51	
	UA1425-13	70.80	0.59	14.91	3.03	0.10	0.70	2.37	4.36	2.99	0.15	100	3.51	
	UA1425-14	69.62	0.48	15.18	3.60	0.10	0.84	2.80	4.35	2.93	0.12	100	3.67	
	UA1425-15	70.74	0.55	15.12	3.12	0.09	0.59	2.47	4.22	2.97	0.13	100	3.51	
	UA1425-16	70.91	0.57	14.84	3.08	0.11	0.60	2.30	4.44	3.02	0.14	100	4.22	
	UA1425-17	70.09	0.59	15.02	3.19	0.10	0.68	2.36	4.96	2.83	0.18	100	3.52	
	UA1425-18	71.46	0.53	14.62	3.01	0.10	0.64	2.26	4.33	2.91	0.15	100	4.43	
	UA1425-19	74.95	0.40	13.20	1.78	0.08	0.26	1.51	3.85	3.66	0.31	100	5.05	
	UA1425-20	70.71	0.58	15.13	3.03	0.10	0.67	2.31	4.44	2.92	0.10	100	2.10	
	UA1425-21	70.78	0.55	14.83	3.06	0.08	0.56	2.39	4.57	2.95	0.21	100	3.96	

UA1425-22	70.65	0.60	14.88	3.17	0.13	0.62	2.48	4.23	3.07	0.18	100	3.72
UA1425-23	71.18	0.50	14.46	3.15	0.07	0.65	2.42	4.43	2.98	0.15	100	3.24
UA1425-24	70.58	0.62	14.68	3.14	0.08	0.63	2.42	4.46	3.15	0.24	100	5.17
UA1425-25	70.48	0.54	14.68	3.08	0.09	0.66	2.46	4.77	3.12	0.12	100	2.84
UA 1425-12	70.40	0.60	14.60	3.26	0.10	0.65	2.48	4.66	3.08	0.17	100	9.07
UA 1425-26	70.40	0.73	14.50	3.13	0.09	0.65	2.56	4.73	3.08	0.13	100	2.91
UA 1425-21	70.43	0.62	14.85	3.21	0.11	0.77	2.72	4.55	2.63	0.12	100	2.57
UA 1425-9	70.44	0.60	14.88	3.21	0.07	0.59	2.33	4.76	2.97	0.14	100	2.52
UA 1425-29	70.55	0.64	14.69	3.02	0.11	0.66	2.45	4.68	3.02	0.18	100	3.41
UA 1425-17	70.55	0.56	14.64	3.16	0.11	0.61	2.39	4.96	2.84	0.19	100	3.12
UA 1425-19	70.64	0.56	14.54	3.28	0.06	0.69	2.43	4.61	3.02	0.17	100	0.48
UA 1425-20	70.66	0.59	14.70	3.06	0.12	0.69	2.38	4.66	3.01	0.14	100	1.54
UA 1425-5	70.67	0.57	14.69	3.04	0.07	0.61	2.31	4.87	3.03	0.14	100	5.76
UA 1425-13	70.71	0.55	14.57	3.39	0.08	0.63	2.28	4.63	2.97	0.19	100	6.27
UA 1425-27	70.79	0.56	14.80	2.99	0.12	0.64	2.42	4.56	2.96	0.16	100	2.07
UA 1425-3	70.84	0.55	14.80	3.05	0.11	0.66	2.38	4.47	3.00	0.14	100	2.00
UA 1425-6	70.85	0.54	14.60	3.07	0.10	0.63	2.35	4.78	2.95	0.13	100	4.72
UA 1425-4	70.91	0.58	14.62	3.08	0.14	0.61	2.31	4.49	3.08	0.18	100	6.12
UA 1425-8	70.92	0.56	14.75	3.09	0.07	0.62	2.37	4.50	2.98	0.15	100	1.31
UA 1425-10	70.92	0.61	14.56	3.06	0.15	0.57	2.27	4.75	2.92	0.18	100	1.94
UA 1425-24	70.96	0.55	14.71	3.06	0.09	0.64	2.31	4.69	2.85	0.13	100	2.38
UA 1425-7	70.98	0.62	14.67	3.06	0.08	0.64	2.31	4.57	2.95	0.12	100	1.28
UA 1425-1	71.00	0.46	15.00	2.79	0.08	0.68	2.43	4.52	2.87	0.17	100	1.80
UA 1425-14	71.03	0.53	14.67	2.97	0.09	0.62	2.39	4.64	2.86	0.20	100	0.69
UA 1425-22	71.04	0.54	14.58	3.03	0.08	0.52	2.32	4.73	3.05	0.11	100	3.73
UA 1425-16	71.09	0.51	14.47	2.96	0.13	0.63	2.39	4.69	3.00	0.14	100	1.80
UA 1425-28	71.10	0.56	14.51	3.09	0.10	0.72	2.29	4.50	2.96	0.17	100	4.15
UA 1425-15	71.11	0.59	14.54	3.04	0.11	0.60	2.35	4.66	2.88	0.12	100	1.21
UA 1425-18	71.18	0.58	14.61	2.97	0.08	0.58	2.21	4.63	3.03	0.15	100	1.54
UA 1425-30	71.25	0.52	14.66	2.95	0.10	0.59	2.24	4.59	2.98	0.12	100	2.33
UA 1425-11	71.29	0.51	14.65	3.01	0.11	0.64	2.35	4.32	2.92	0.20	100	2.54
UA 1425-24	65.25	0.73	16.43	5.01	0.19	1.49	4.15	4.46	2.15	0.13	100	0.73
UA 1425-30	65.44	0.95	16.16	4.86	0.18	1.49	4.08	4.53	2.19	0.12	100	0.90
UA 1425-7	65.75	0.81	16.17	4.81	0.13	1.39	4.13	4.46	2.24	0.09	100	0.66
UA 1425-15	66.36	0.64	15.77	4.87	0.15	1.31	3.89	4.68	2.23	0.10	100	1.02
UA 1425-33	67.38	0.69	15.57	4.44	0.16	1.03	3.22	4.77	2.55	0.19	100	0.85
UA 1425-32	68.05	0.91	15.12	4.17	0.05	1.05	3.21	4.30	3.08	0.08	100	0.61
UA 1425-2	69.61	0.60	14.96	3.52	0.10	0.84	2.76	4.75	2.72	0.13	100	1.01
UA 1425-1	70.16	0.59	14.97	2.99	0.06	0.71	2.46	4.89	2.93	0.23	100	2.43
UA 1425-11	70.19	0.56	15.07	3.11	0.07	0.58	2.39	4.98	2.88	0.16	100	2.89
UA 1425-5	70.33	0.61	14.84	3.41	0.06	0.72	2.52	4.48	2.83	0.19	100	0.10
UA 1425-27	70.42	0.58	14.75	3.17	0.13	0.62	2.34	4.81	2.98	0.19	100	4.63
UA 1425-6	70.51	0.47	14.92	2.93	0.03	0.68	2.34	5.12	2.86	0.14	100	5.29
UA 1425-29	70.56	0.61	14.72	3.02	0.11	0.63	2.44	4.73	2.94	0.24	100	1.52
UA 1425-20	70.58	0.55	15.03	3.01	0.07	0.64	2.31	4.66	2.99	0.16	100	1.16
UA 1425-13	70.65	0.51	14.87	3.04	0.05	0.62	2.51	4.72	2.85	0.19	100	0.35
UA 1425-23	70.78	0.50	14.87	2.90	0.08	0.69	2.23	4.68	3.07	0.20	100	2.95
UA 1425-9	70.82	0.52	15.11	2.95	0.10	0.64	2.37	4.37	2.94	0.20	100	0.44
UA 1425-8	70.85	0.53	14.95	3.06	0.08	0.69	2.40	4.29	2.94	0.19	100	2.28
UA 1425-16	70.94	0.57	14.99	3.10	0.04	0.69	2.32	4.43	2.77	0.15	100	2.34
UA 1425-21	70.95	0.54	14.88	2.91	0.13	0.65	2.25	4.57	2.98	0.14	100	3.67
UA 1425-14	70.95	0.60	14.65	3.17	0.06	0.60	2.37	4.61	2.82	0.17	100	0.44
UA 1425-17	70.96	0.55	14.62	3.05	0.05	0.69	2.41	4.64	2.85	0.17	100	1.90

	UA 1425-28	70.99	0.53	14.73	2.92	0.08	0.54	2.32	4.81	2.89	0.18	100	2.59		
	UA 1425-12	71.04	0.52	14.66	2.99	0.09	0.70	2.52	4.35	2.97	0.17	100	0.63		
	UA 1425-25	71.05	0.49	14.84	2.92	0.11	0.63	2.42	4.42	2.94	0.18	100	1.56		
	UA 1425-10	71.06	0.53	14.84	3.00	0.10	0.61	2.31	4.41	2.98	0.16	100	0.94		
	UA 1425-4	71.06	0.55	14.75	3.04	0.13	0.69	2.25	4.56	2.84	0.12	100	0.32		
	UA 1425-22	71.10	0.57	14.86	2.90	0.06	0.58	2.06	4.58	3.13	0.16	100	1.41		
	UA 1425-31	71.32	0.59	14.63	2.92	0.09	0.60	2.26	4.53	2.97	0.10	100	1.31		
	AVERAGE	70.51	0.58	14.83	3.17	0.10	0.69	2.47	4.57	2.92	0.16	100	2.52		
	STDEV	1.36	0.08	0.41	0.49	0.03	0.20	0.42	0.21	0.21	0.04	0	1.66	=79	
HH4	**UA 1869-16**	72.23	0.22	15.70	1.74	0.00	0.55	2.34	4.58	2.62	0.01	100	8.70		
	UA 1869-11	72.36	0.25	15.79	1.67	0.05	0.54	2.24	4.42	2.64	0.06	100	9.80		
	UA 1869-18	72.64	0.26	15.62	1.45	0.10	0.52	2.12	4.42	2.81	0.07	100	9.15		
	UA 1869-7	73.09	0.12	15.35	1.45	0.01	0.43	2.11	4.69	2.72	0.04	100	8.42		
	UA 1869-12	73.12	0.25	15.59	1.38	0.08	0.47	2.10	4.27	2.72	0.02	100	9.68		
	UA 1869-19	73.65	0.17	15.30	1.34	0.03	0.45	1.96	4.33	2.74	0.03	100	6.28		
	UA 1869-3	73.75	0.18	15.18	1.26	0.07	0.46	1.98	4.22	2.86	0.06	100	8.31		
	UA 1869-2	74.05	0.10	15.18	1.25	0.03	0.40	2.08	4.13	2.76	0.02	100	6.91		
	UA 1869-10	71.78	0.24	16.45	1.57	0.06	0.42	2.43	4.63	2.36	0.06	100	6.00		
	UA 1869-29	72.81	0.32	15.59	1.56	0.00	0.51	2.01	4.44	2.75	0.03	100	2.26		
	UA 1869-26	73.10	0.17	15.52	1.43	0.07	0.43	2.02	4.54	2.68	0.04	100	5.41		
	UA 1869-19	73.62	0.13	15.42	1.37	0.05	0.38	1.99	4.41	2.55	0.08	100	8.70		
	UA 1869-20	74.18	0.15	14.96	1.28	0.08	0.39	1.87	4.30	2.75	0.04	100	4.72		
	UA 2107-2	71.52	0.16	17.28	1.61	0.00	0.49	2.33	4.21	2.38	0.02	100	5.75		
	UA 2107-1	72.19	0.20	16.08	1.32	0.02	0.40	2.37	4.74	2.61	0.07	100	4.97		
	UA 2107-21	72.33	0.20	15.89	1.58	0.07	0.53	2.35	4.66	2.35	0.04	100	2.21		
	UA 2107-11	72.52	0.24	15.59	1.64	0.03	0.53	2.30	4.62	2.49	0.05	100	6.56		
	UA 2107-29	72.57	0.22	15.77	1.53	0.11	0.49	2.24	4.43	2.59	0.04	100	3.61		
	UA 2107-25	72.84	0.20	15.53	1.55	0.08	0.47	2.07	4.46	2.76	0.05	100	5.76		
	UA 2107-14	73.03	0.20	15.44	1.67	0.05	0.56	2.21	4.30	2.50	0.03	100	1.66		
	UA 2107-18	73.13	0.19	15.45	1.61	0.05	0.46	2.07	4.50	2.50	0.04	100	8.70		
	UA 2107-12	73.18	0.22	15.50	1.40	0.09	0.44	2.11	4.56	2.50	0.02	100	5.17		
	UA 2107-16	73.21	0.18	15.56	1.38	0.09	0.43	2.10	4.47	2.55	0.05	100	1.55		
	UA 2107-26	73.39	0.22	15.80	1.44	0.00	0.46	1.97	4.08	2.60	0.05	100	6.41		
	UA 2107-15	73.43	0.24	15.37	1.40	0.05	0.44	1.93	4.44	2.66	0.03	100	1.78		
	UA 2107-30	73.47	0.17	15.39	1.41	0.03	0.46	1.98	4.48	2.56	0.05	100	2.21		
	UA 2107-3	73.85	0.22	15.21	1.39	0.10	0.39	1.89	4.29	2.63	0.04	100	5.03		
	UA 2107-19	73.96	0.20	14.98	1.31	0.07	0.32	1.79	4.48	2.85	0.04	100	4.48		
	UA 2107-28	73.97	0.25	14.77	1.46	0.08	0.46	1.91	4.36	2.70	0.04	100	7.28		
	Mean	73.07	0.20	15.56	1.46	0.05	0.46	2.10	4.43	2.63	0.04	100	5.77	29	Correlates to SC-K
	StDev	0.69	0.05	0.47	0.13	0.03	0.06	0.17	0.16	0.14	0.02	0	2.57		
	UA 2107-4	76.69	0.23	13.32	1.48	0.07	0.33	1.65	4.73	1.35	0.15	100	1.03		
	UA 1869-8	76.31	0.22	13.39	1.57	0.13	0.34	1.65	4.78	1.46	0.15	100	5.27		
	UA 1869-11	76.63	0.20	13.07	1.35	0.12	0.30	1.68	5.02	1.48	0.15	100	4.21		
	UA 1869-5	76.65	0.32	13.27	1.52	0.11	0.32	1.70	4.41	1.60	0.15	100	9.40		
	UA 1869-15	77.12	0.26	12.92	1.64	0.08	0.36	1.82	4.02	1.65	0.18	100	8.64		
	UA 1869-17	76.28	0.31	12.93	1.58	0.07	0.36	1.94	4.64	1.76	0.13	100	3.18		
	UA 1869-21	76.95	0.23	12.62	1.73	0.07	0.27	1.93	4.12	1.98	0.13	100	8.66		
	UA 1869-5	76.14	0.18	13.50	1.55	0.12	0.29	1.71	4.40	1.99	0.13	100	5.92		
	Mean	76.60	0.24	13.13	1.55	0.10	0.32	1.76	4.51	1.66	0.15	100	5.79	8	Stampede tephra potential
	StDev	0.34	0.05	0.29	0.11	0.03	0.03	0.12	0.34	0.24	0.02	0	2.97		

UA 2107-6	75.39	0.28	12.96	1.73	0.05	0.33	1.56	3.73	3.70	0.28	100	5.86	Old Crow shard?
UA 1869-2	72.16	0.40	14.00	2.29	0.08	0.46	1.94	3.97	4.27	0.42	100	6.07	high Cl
UA 1869-30	72.42	0.38	13.91	2.24	0.08	0.42	1.90	4.25	3.95	0.46	100	2.82	high Cl
UA 1869-6	74.14	0.20	15.54	1.55	0.03	0.46	1.37	3.82	2.84	0.03	100	9.36	Alterned shards?
UA 1869-21	74.49	0.30	13.35	1.60	0.00	0.27	1.19	4.05	4.65	0.09	100	6.14	
UA 1869-22	75.37	0.10	14.51	0.67	0.04	0.09	1.70	4.57	2.88	0.07	100	5.47	
UA 1869-28	75.41	0.17	13.93	1.25	0.07	0.39	1.57	4.13	3.07	0.03	100	5.00	
UA 1869-7	76.33	0.17	13.80	0.80	0.00	0.19	1.48	4.27	2.92	0.03	100	4.21	
UA 1869-24	76.99	0.28	13.12	1.22	0.00	0.17	1.13	3.90	3.13	0.06	100	5.96	
UA 1869-12	77.68	0.10	12.84	0.79	0.01	0.17	1.17	2.48	4.73	0.04	100	8.12	
UA 1869-25	78.48	0.08	12.45	1.28	0.06	0.01	0.50	1.45	5.56	0.14	100	9.98	
UA 1869-24	76.37	0.16	12.79	2.15	0.02	0.02	1.27	2.75	4.38	0.12	100	9.02	
UA 1869-27	75.10	0.20	13.61	1.74	0.13	0.32	1.40	5.24	2.11	0.15	100	4.97	
UA 1869-4	76.85	0.18	12.75	1.33	0.07	0.15	0.89	5.34	2.28	0.17	100	4.89	
UA 1869-15	75.60	0.34	12.97	1.50	0.01	0.21	0.96	3.90	4.40	0.12	100	4.16	
UA 1869-13	76.24	0.24	12.75	1.31	0.04	0.13	0.71	3.92	4.55	0.11	100	4.81	
UA 1869-14	75.30	0.18	13.79	1.64	0.00	0.17	1.34	2.20	5.35	0.03	100	8.31	
UA 1869-18	77.34	0.16	12.40	1.03	0.01	0.13	0.55	3.58	4.74	0.06	100	5.40	
UA 1869-3	77.46	0.10	12.28	0.79	0.09	0.04	0.47	3.65	5.05	0.06	100	6.37	
UA 1869-14	77.58	0.14	12.60	0.82	0.04	0.05	0.52	3.13	5.11	0.04	100	8.94	
UA 2107-23	77.64	0.05	12.36	1.27	0.02	0.04	0.51	1.88	6.08	0.15	100	7.55	
UA 2107-27	77.82	0.15	12.89	0.75	0.01	0.12	0.71	1.85	5.55	0.15	100	7.98	
UA 2107-17	77.92	0.00	12.38	1.28	0.06	0.00	0.49	1.46	6.28	0.12	100	8.37	
UA 2107-7	75.59	0.06	13.20	1.23	0.08	0.02	0.61	4.02	5.18	0.01	100	6.00	
UA 2107-8	76.17	0.06	13.10	1.13	0.03	0.01	0.60	3.67	5.21	0.03	100	5.42	
UA 2107-10	76.19	0.12	12.83	1.29	0.05	0.05	0.47	4.06	4.85	0.08	100	6.25	
UA 2107-22	76.23	0.24	12.94	1.13	0.06	0.18	0.82	3.78	4.50	0.10	100	5.18	
UA 2107-13	76.50	0.08	12.74	1.28	0.06	0.04	0.78	2.03	6.33	0.17	100	6.10	
UA 2107-5	76.88	0.08	13.57	0.73	0.03	0.10	0.56	4.29	3.70	0.06	100	4.35	
UA 2107-9	77.11	0.17	12.54	0.88	0.08	0.10	0.58	3.50	4.95	0.08	100	4.70	

HH5

UA 1857-17	72.06	0.51	14.14	2.50	0.06	0.42	1.69	4.48	4.03	0.10	100	2.90
UA 1857-20	68.65	0.81	14.69	3.95	0.13	1.01	3.13	4.42	3.14	0.08	100	2.33
UA 1857-3	69.30	0.83	14.65	3.77	0.02	0.80	2.63	4.64	3.31	0.05	100	1.47
UA 1858-12	72.13	0.54	14.40	2.59	0.09	0.47	1.75	4.22	3.73	0.11	100	4.37
UA 1858-4	69.49	0.73	14.94	3.70	0.05	0.86	2.69	4.23	3.23	0.08	100	3.15
UA 1858-7	71.37	0.61	14.45	2.94	0.05	0.52	1.93	4.36	3.68	0.12	100	2.00
UA 1859-1	70.86	0.64	14.29	2.99	0.10	0.67	2.18	4.59	3.56	0.14	100	1.19
UA 1859-13	69.42	0.91	14.94	3.53	0.10	0.90	2.68	3.80	3.65	0.08	100	3.32
UA 1859-18	70.16	0.85	14.42	3.44	0.08	0.80	2.40	4.33	3.42	0.15	100	1.58
UA 1860-10	69.49	0.98	14.77	3.75	0.10	0.93	2.53	4.23	3.18	0.06	100	2.18
UA 1860-11	68.58	1.02	14.68	4.16	0.10	1.05	2.86	3.81	3.68	0.07	100	0.78
UA 1860-20	71.19	0.66	14.40	2.88	0.06	0.58	2.14	4.36	3.62	0.11	100	2.02
UA 1860-22	71.73	0.62	14.36	2.81	0.06	0.56	1.95	4.37	3.46	0.10	100	2.55
UA 1860-3	71.26	0.67	14.58	2.88	0.07	0.67	2.05	4.18	3.60	0.04	100	0.77
UA 1860-4	68.53	0.86	14.97	4.09	0.06	1.00	3.00	4.29	3.14	0.06	100	2.28
UA 1860-8	68.87	0.91	14.83	4.06	0.06	0.99	2.94	4.12	3.14	0.09	100	0.70
UA 1862-7	69.31	0.77	14.72	3.54	0.04	0.84	2.68	4.69	3.34	0.08	100	3.94
UA 1863-23	68.78	0.88	14.81	3.63	0.11	0.87	2.79	4.59	3.46	0.11	100	3.53
UA 1863-3	68.36	0.83	14.94	3.86	0.07	1.00	2.95	4.72	3.20	0.08	100	0.24
UA 1863-5	73.69	0.42	13.74	2.21	0.03	0.27	1.29	4.27	4.00	0.08	100	5.94
UA 1864-20	69.01	0.77	15.07	3.57	0.16	0.90	2.56	4.55	3.34	0.10	100	3.18

UA 1864-21	71.62	0.59	14.67	2.66	0.05	0.55	1.90	4.01	3.85	0.11	100	3.79	
UA 1864-8	71.89	0.57	14.39	2.65	0.01	0.47	1.80	4.21	3.91	0.13	100	5.17	
UA 1865-11	69.99	0.79	14.64	3.50	0.10	0.77	2.46	4.28	3.36	0.11	100	1.22	
UA 1865-14	71.03	0.53	14.22	2.95	0.04	0.58	2.35	4.16	3.70	0.43	100	0.76	
UA 1865-23	70.37	0.57	14.78	3.17	0.13	0.64	2.25	4.88	3.03	0.18	100	2.57	
UA 1865-25	69.71	0.67	14.82	3.42	0.11	0.80	2.49	4.46	3.46	0.06	100	0.98	
UA 1865-26	70.78	0.64	14.62	3.07	0.08	0.47	1.98	4.59	3.64	0.13	100	2.81	
UA 1865-31	70.55	0.66	14.48	3.13	0.08	0.66	2.44	4.83	2.98	0.20	100	1.99	
UA 1865-8	72.05	0.54	14.09	2.76	0.02	0.53	1.81	4.57	3.55	0.09	100	0.95	
UA 1865-32	72.16	0.56	14.27	2.70	0.05	0.54	1.85	4.12	3.66	0.10	100	1.28	
UA 1865-10	73.51	0.26	13.95	1.92	0.07	0.26	0.95	4.80	4.17	0.09	100	3.46	
UA 1866-19	71.13	0.61	14.56	2.92	0.07	0.65	2.18	4.11	3.72	0.08	100	4.70	
UA 1866-23	71.46	0.58	14.44	2.77	0.05	0.52	1.98	4.44	3.68	0.09	100	9.22	
UA 1867-19	67.83	1.02	15.64	3.82	0.12	0.81	3.74	3.99	2.98	0.08	100	1.60	
UA 1867-5	70.80	0.63	14.77	3.05	0.12	0.60	2.54	4.44	2.92	0.19	100	3.64	
UA 1867-8	71.68	0.57	14.41	2.92	0.06	0.56	1.98	4.06	3.65	0.12	100	2.62	
UA 1868-1	70.55	0.59	14.77	3.04	0.13	0.55	2.39	4.88	2.94	0.18	100	2.05	
UA 1868-10	72.74	0.43	14.09	2.44	0.00	0.46	1.69	4.07	3.97	0.12	100	2.27	
UA 1868-17	72.75	0.57	14.32	2.35	0.11	0.50	1.67	3.91	3.73	0.11	100	2.52	
UA 1868-21	68.68	0.96	14.95	4.03	0.05	0.86	2.85	4.32	3.21	0.08	100	1.44	
UA 1873-22	69.37	0.99	14.52	4.20	0.07	0.99	2.84	3.75	3.21	0.05	100	2.35	
UA 1873-23	69.61	0.92	14.65	3.49	0.08	0.69	2.73	4.42	3.32	0.09	100	1.92	
UA 1901-6	70.40	0.67	14.48	3.37	0.07	0.57	2.15	4.71	3.50	0.09	100	2.28	
UA 1901-26	70.86	0.60	14.46	3.04	0.04	0.60	2.12	4.59	3.58	0.10	100	1.31	
UA 1901-12	71.43	0.60	14.34	2.90	0.03	0.59	2.04	4.45	3.51	0.11	100	4.53	
UA 1901-31	71.98	0.70	14.32	2.96	0.01	0.58	2.05	3.62	3.66	0.13	100	2.16	
UA 1877-8	71.48	0.63	14.39	3.07	0.09	0.60	2.18	4.06	3.43	0.08	100	2.43	
Mean	70.60	0.69	14.56	3.19	0.07	0.68	2.30	4.33	3.48	0.11	100	2.55	48 Dome Ash Bed
StDev	1.43	0.17	0.33	0.55	0.03	0.20	0.51	0.30	0.30	0.06	0	1.59	

HH6

UA 1862-11	74.57	0.43	13.68	1.55	0.07	0.29	1.21	3.63	4.51	0.07	100	5.92
UA 1863-6	74.65	0.40	13.43	1.57	0.07	0.26	1.13	3.74	4.65	0.13	100	8.98
UA 1862-17	74.68	0.27	13.25	1.50	0.09	0.24	1.11	3.95	4.73	0.23	100	4.46
UA 1863-7	75.10	0.32	13.22	1.48	0.03	0.28	1.13	3.55	4.79	0.12	100	6.98
UA 1863-24	75.14	0.28	13.15	1.52	0.00	0.26	1.04	3.88	4.63	0.10	100	5.71
UA 1866-1	75.23	0.35	13.08	1.50	0.09	0.24	1.05	3.75	4.64	0.09	100	6.46
UA 1864-11	75.32	0.30	13.16	1.59	0.00	0.26	1.01	3.66	4.59	0.14	100	6.59
UA 1868-17	75.37	0.33	12.95	1.46	0.06	0.20	1.04	3.93	4.53	0.13	100	4.21
UA 1866-5	75.39	0.21	13.06	1.48	0.01	0.21	1.08	3.70	4.80	0.07	100	8.45
UA 1866-24	75.40	0.24	13.26	1.57	0.04	0.20	1.05	3.53	4.62	0.12	100	7.71
UA 1864-1	75.45	0.38	13.34	1.56	0.00	0.31	1.14	3.54	4.23	0.06	100	7.59
UA 1866-13	75.52	0.30	13.22	1.39	0.03	0.21	0.91	3.86	4.45	0.13	100	7.59
UA 1857-24	75.53	0.31	13.10	1.41	0.03	0.17	0.89	3.94	4.56	0.07	100	5.27
UA 1857-22	75.57	0.26	13.14	1.42	0.00	0.17	0.89	3.95	4.47	0.12	100	4.81
UA 1857-1	75.59	0.28	13.13	1.40	0.07	0.23	0.89	3.80	4.53	0.08	100	7.83
UA 1860-16	75.63	0.28	12.96	1.42	0.08	0.23	1.02	3.74	4.57	0.09	100	6.14
UA 1860-24	75.67	0.26	13.16	1.27	0.10	0.17	0.89	3.89	4.48	0.15	100	5.50
UA 1864-5	75.69	0.26	13.13	1.42	0.03	0.21	0.94	3.73	4.52	0.07	100	2.28
UA 1863-12	75.70	0.24	13.19	1.30	0.09	0.16	0.86	3.97	4.37	0.13	100	6.09
UA 1861-18	75.70	0.26	13.42	1.27	0.07	0.17	0.91	3.73	4.36	0.14	100	6.20
UA 1863-18	75.73	0.28	12.83	1.25	0.03	0.19	0.88	4.16	4.50	0.13	100	6.80
UA 1857-15	75.73	0.23	13.38	1.32	0.07	0.18	0.84	3.79	4.39	0.11	100	4.89

UA 1863-16	75.75	0.24	12.95	1.36	0.04	0.21	0.99	3.79	4.61	0.08	100	7.62		
UA 1859-5	75.76	0.34	13.15	1.13	0.12	0.17	0.84	3.79	4.62	0.11	100	5.54		
UA 1868-1	75.79	0.23	13.31	1.25	0.01	0.21	0.86	3.61	4.62	0.14	100	7.28		
UA 1857-31	75.81	0.26	13.03	1.34	0.00	0.20	0.88	3.83	4.53	0.11	100	5.26		
UA 1866-21	75.82	0.22	13.20	1.40	0.09	0.22	0.95	3.60	4.38	0.16	100	7.53		
UA 1867-11	75.83	0.28	13.30	1.23	0.00	0.22	0.89	3.63	4.51	0.14	100	7.22		
UA 1863-12	75.84	0.34	13.10	1.20	0.03	0.18	0.86	3.71	4.64	0.14	100	8.57		
UA 1857-26	75.87	0.22	13.01	1.24	0.02	0.19	0.82	3.94	4.58	0.11	100	3.99		
UA 1857-23	75.89	0.24	13.19	1.20	0.07	0.22	0.87	3.80	4.42	0.11	100	6.46		
UA 1857-22	75.94	0.32	13.10	1.25	0.02	0.19	0.85	3.71	4.55	0.11	100	5.45		
UA 1861-8	75.98	0.27	12.94	1.27	0.10	0.14	0.74	3.57	4.87	0.16	100	9.25		
UA 1863-5	75.99	0.29	12.99	1.26	0.07	0.16	0.78	3.68	4.67	0.14	100	3.36		
UA 1868-18	76.01	0.29	13.21	1.34	0.03	0.25	0.88	3.49	4.43	0.09	100	6.57		
UA 1867-12	76.01	0.25	12.90	1.36	0.02	0.18	0.87	3.65	4.69	0.08	100	8.08		
UA 1864-15	76.04	0.27	12.93	1.37	0.01	0.22	0.76	3.78	4.55	0.10	100	8.03		
UA 1857-4	76.05	0.25	13.24	1.33	0.02	0.19	0.86	3.70	4.28	0.10	100	5.86		
UA 1860-2	76.06	0.32	12.96	1.25	0.00	0.19	0.96	3.80	4.35	0.14	100	4.22		
UA 1857-6	76.06	0.24	13.20	1.32	0.03	0.19	0.89	3.50	4.42	0.18	100	6.91		
UA 1863-26	76.18	0.21	13.02	1.21	0.04	0.17	0.79	3.75	4.54	0.08	100	6.90		
UA 1862-18	76.23	0.31	12.68	1.32	0.07	0.18	0.75	3.58	4.78	0.15	100	9.29		
UA 1859-15	76.26	0.25	12.67	1.30	0.08	0.16	0.68	3.89	4.65	0.05	100	6.05		
UA 1857-5	76.27	0.19	12.79	1.35	0.07	0.12	0.77	3.65	4.71	0.07	100	5.59		
UA 1859-14	76.31	0.21	12.92	1.25	0.08	0.19	0.76	3.69	4.49	0.15	100	6.37		
UA 1867-3	76.32	0.21	12.88	1.27	0.03	0.15	0.70	3.80	4.58	0.06	100	5.51		
UA 1857-11	76.34	0.22	12.90	1.27	0.01	0.16	0.82	3.59	4.60	0.09	100	5.08		
UA 1859-17	76.35	0.30	13.12	1.23	0.04	0.19	0.78	3.57	4.30	0.16	100	5.42		
UA 1868-24	76.35	0.25	12.80	1.14	0.04	0.13	0.65	3.92	4.63	0.08	100	6.22		
UA 1868-11	76.38	0.31	12.76	1.27	0.05	0.16	0.66	3.82	4.49	0.09	100	6.61		
UA 1857-21	76.39	0.21	12.93	1.26	0.05	0.14	0.70	3.73	4.53	0.07	100	4.39		
UA 1861-3	76.44	0.25	12.72	1.41	0.00	0.19	0.74	3.62	4.51	0.16	100	8.21		
UA 1864-19	76.63	0.21	12.71	1.17	0.06	0.11	0.57	3.76	4.67	0.14	100	7.81		
UA 1858-19	76.71	0.21	12.82	1.32	0.05	0.15	0.68	3.51	4.48	0.09	100	6.04		
UA 1857-3	76.78	0.21	12.77	1.24	0.10	0.13	0.66	3.46	4.58	0.09	100	6.66		
UA 1860-5	77.07	0.23	12.62	1.12	0.06	0.08	0.56	3.41	4.76	0.11	100	5.47		
UA 1857-19	77.09	0.17	12.37	1.15	0.05	0.10	0.64	3.79	4.55	0.11	100	5.36		
UA 1865-20	74.25	0.34	13.54	1.75	0.04	0.27	1.20	4.19	4.34	0.09	100	4.68		
UA 1865-16	75.24	0.35	12.96	1.65	0.08	0.31	1.15	3.65	4.52	0.09	100	4.05		
UA 1865-5	75.84	0.22	13.08	1.32	0.06	0.20	0.87	3.95	4.35	0.12	100	5.66		
UA 1865-28	76.38	0.21	12.75	1.21	0.01	0.17	0.69	3.95	4.51	0.12	100	5.04		
UA 1865-7	76.57	0.25	12.77	1.26	0.06	0.14	0.70	3.69	4.45	0.11	100	5.43		
UA 1873-7	75.58	0.33	13.22	1.43	0.11	0.26	1.02	3.45	4.51	0.10	100	6.01		
UA 1873-20	75.61	0.31	12.88	1.56	0.01	0.25	0.98	3.74	4.60	0.07	100	3.47		
UA 1873-16	75.87	0.29	13.02	1.31	0.00	0.23	0.97	3.67	4.58	0.06	100	6.26		
UA 1873-1	76.27	0.24	13.03	1.19	0.01	0.20	0.91	3.63	4.39	0.13	100	5.69		
UA 1873-5	76.49	0.27	12.84	1.22	0.02	0.18	0.78	3.62	4.49	0.09	100	4.47		
UA 1452-19	75.76	0.30	13.21	1.23	0.06	0.21	0.87	3.83	4.37	0.16	100	5.94		
UA 1452-5	75.80	0.28	13.02	1.24	0.04	0.23	0.89	3.92	4.50	0.08	100	5.74		
UA 1452-15	75.84	0.24	13.22	1.16	0.09	0.19	0.89	3.78	4.47	0.11	100	6.30		
UA 1452-20	76.21	0.25	13.04	1.36	0.05	0.18	0.81	3.63	4.40	0.07	100	4.65		
UA 1877-19	76.09	0.24	12.99	1.42	0.04	0.16	0.94	3.37	4.62	0.16	100	5.60		
UA 1877-24	76.19	0.29	12.97	1.28	0.00	0.17	0.85	3.83	4.33	0.10	100	1.44		
Mean	75.88	0.27	13.04	1.34	0.05	0.19	0.88	3.73	4.53	0.11	100	6.04	73	Correlates to Dominion Creek

StdDev	0.53	0.05	0.23	0.13	0.03	0.05	0.15	0.16	0.13	0.03	0	1.52

HH7 pop.1

UA 1451-11	78.11	0.14	12.77	0.74	0.10	0.10	1.24	3.55	2.99	0.25	100	6.19
UA 1451-6	78.32	0.12	12.22	0.95	0.05	0.22	1.09	3.65	3.18	0.20	100	6.18
UA 1451-16	78.39	0.13	12.44	0.91	0.08	0.15	1.14	3.40	3.16	0.21	100	6.71
UA 1451-3	78.59	0.11	12.25	0.78	0.09	0.12	0.87	3.17	3.76	0.27	100	9.17
UA 1451-12	78.66	0.12	12.13	0.82	0.03	0.18	1.02	3.71	3.05	0.29	100	6.53
UA 1451-10	78.93	0.12	11.76	0.91	0.11	0.17	0.95	3.16	3.65	0.25	100	7.76
UA 1451-17	78.97	0.09	12.32	0.69	0.02	0.13	1.03	3.44	3.14	0.18	100	7.04
UA 1451-9	79.02	0.09	11.94	0.85	0.04	0.15	0.99	3.59	3.14	0.20	100	6.60
UA 1451-8	79.20	0.14	11.83	0.89	0.08	0.13	0.84	3.30	3.35	0.26	100	6.28
UA 1902-3	78.15	0.19	12.45	0.81	0.05	0.22	1.03	2.90	4.00	0.20	100	6.33
UA 1902-17	78.55	0.14	12.53	0.90	0.08	0.21	1.18	3.25	3.01	0.16	100	5.20
UA 1902-13	78.72	0.09	12.58	0.92	0.06	0.17	1.15	2.69	3.44	0.17	100	9.06
UA 1902-19	78.82	0.13	12.20	0.78	0.06	0.17	0.96	2.88	3.80	0.21	100	7.04
UA 1902-16	78.88	0.14	12.12	0.88	0.11	0.21	1.01	2.92	3.52	0.21	100	6.46
UA 1902-22	79.01	0.13	12.28	0.89	0.10	0.20	0.90	3.44	2.92	0.14	100	5.69
UA 1902-21	79.12	0.15	12.16	0.77	0.10	0.21	0.91	2.96	3.44	0.18	100	6.05
UA 1902-11	79.35	0.15	11.86	0.83	0.09	0.17	0.93	3.20	3.12	0.29	100	8.13
UA 1902-20	79.52	0.08	12.10	0.81	0.00	0.13	0.92	3.22	3.09	0.14	100	6.94
UA 1903-7	77.75	0.12	13.04	0.69	0.00	0.16	1.06	2.96	3.97	0.25	100	5.89
UA 1903-22	78.10	0.15	12.66	0.98	0.06	0.23	1.24	3.26	3.03	0.29	100	8.28
UA 1903-14	78.45	0.18	12.48	0.88	0.06	0.18	1.10	3.40	3.05	0.23	100	5.85
UA 1903-8	78.51	0.17	12.33	0.91	0.11	0.16	1.05	3.27	3.26	0.24	100	7.12
UA 1903-10	78.68	0.13	12.46	0.98	0.09	0.22	1.08	3.19	2.97	0.20	100	6.59
UA 1903-3	78.69	0.14	12.39	0.96	0.00	0.22	1.11	3.25	3.06	0.17	100	5.47
UA 1903-2	78.73	0.15	12.28	0.79	0.05	0.17	0.89	3.52	3.24	0.19	100	6.09
UA 1903-15	78.74	0.20	12.43	0.91	0.03	0.21	1.00	3.19	3.06	0.21	100	6.46
UA 1903-11	78.78	0.21	12.13	0.95	0.05	0.40	1.02	3.46	2.85	0.16	100	6.48
UA 1903-5	78.78	0.13	12.35	0.87	0.05	0.24	1.11	3.19	3.05	0.23	100	6.93
UA 1903-23	78.95	0.02	11.98	1.03	0.07	0.22	0.96	2.62	3.96	0.20	100	7.14
UA 1903-1	78.98	0.19	12.30	0.94	0.02	0.18	1.01	3.03	3.18	0.16	100	6.72
UA 1903-9	79.07	0.17	12.25	0.77	0.05	0.14	1.00	3.51	2.88	0.16	100	5.56
UA 1903-4	79.12	0.13	12.08	0.86	0.05	0.22	0.96	3.21	3.18	0.18	100	5.93
UA 1915-2	78.13	0.19	12.61	1.20	0.02	0.32	1.14	3.19	2.99	0.21	100	7.45
UA 1915-1	78.18	0.16	12.64	0.90	0.10	0.24	1.15	3.49	2.96	0.17	100	5.47
UA 1915-22	78.22	0.12	12.69	0.91	0.08	0.26	1.02	3.37	3.13	0.21	100	5.08
UA 1915-9	78.31	0.14	12.72	1.03	0.04	0.26	1.19	3.26	2.90	0.15	100	6.46
UA 1915-8	78.38	0.13	12.64	0.80	0.03	0.11	1.07	3.11	3.56	0.17	100	6.92
UA 1915-5	78.52	0.08	12.31	0.86	0.04	0.21	1.06	3.15	3.56	0.20	100	6.62
UA 1915-7	78.54	0.11	12.53	0.83	0.09	0.19	1.21	3.46	2.83	0.21	100	5.56
UA 1915-3	78.63	0.07	12.41	0.97	0.01	0.20	1.02	3.38	3.12	0.20	100	6.31
UA 1915-24	78.68	0.18	12.54	0.92	0.03	0.17	1.15	3.35	2.78	0.19	100	6.58
UA 1915-26	78.69	0.16	12.48	0.86	0.06	0.15	1.03	3.12	3.24	0.21	100	6.12
UA 1915-19	78.69	0.12	12.47	0.85	0.07	0.16	1.20	3.14	3.10	0.21	100	5.31
UA 1915-4	78.72	0.06	12.40	0.88	0.06	0.23	1.00	3.15	3.33	0.17	100	6.50
UA 1915-23	78.76	0.10	12.41	0.90	0.05	0.23	1.01	3.10	3.24	0.19	100	6.80
UA 1915-6	78.77	0.15	12.39	0.88	0.05	0.19	1.01	3.28	3.11	0.16	100	6.00
UA 1915-28	78.92	0.12	12.14	0.71	0.10	0.09	0.97	3.17	3.62	0.16	100	5.65
UA 1915-21	79.25	0.11	12.23	0.72	0.05	0.17	0.93	3.30	3.02	0.21	100	5.31
UA 1915-10	79.77	0.08	11.81	0.80	0.07	0.13	0.86	2.93	3.40	0.14	100	5.78
UA 1901-5	78.56	0.07	12.59	0.82	0.09	0.22	1.07	3.00	3.42	0.17	100	3.45

	UA 1901-8	78.60	0.08	11.97	0.89	0.06	0.12	0.91	3.23	4.02	0.11	100	5.56		
	UA 1901-17	78.70	0.09	12.22	0.97	0.14	0.24	1.01	3.02	3.47	0.14	100	1.79		
	AVERAGE	78.71	0.13	12.33	0.87	0.06	0.19	1.03	3.23	3.26	0.20	100	6.32	52	
	STDEV	0.38	0.04	0.27	0.09	0.03	0.05	0.10	0.23	0.32	0.04	0	1.17		
HH7-pop.2															
	UA 1915-13	76.42	0.15	13.55	1.11	0.00	0.35	1.75	4.10	2.42	0.14	100	1.33		
	UA 1915-16	76.43	0.14	13.65	1.03	0.05	0.27	1.87	3.86	2.55	0.15	100	3.25		
	UA 1915-17	76.68	0.19	13.38	1.09	0.02	0.31	1.75	3.90	2.52	0.14	100	7.16		
	UA 1915-12	76.69	0.12	13.46	1.07	0.11	0.32	1.70	3.88	2.41	0.25	100	2.50		
	UA 1915-20	76.70	0.15	13.56	1.01	0.07	0.29	1.76	3.84	2.46	0.16	100	3.33		
	UA 1915-18	76.90	0.21	13.34	0.96	0.08	0.30	1.69	3.76	2.58	0.16	100	3.52		
	UA 1915-15	77.11	0.15	13.26	0.80	0.07	0.16	1.46	3.96	2.82	0.20	100	5.80		
	UA 1915-25	77.44	0.14	13.32	0.96	0.04	0.25	1.37	3.38	2.93	0.18	100	6.90		
	UA 1902-23	76.88	0.18	13.39	1.09	0.08	0.32	1.70	3.78	2.44	0.13	100	5.38		
	UA 1902-4	77.01	0.11	13.44	1.04	0.07	0.30	1.70	3.70	2.48	0.17	100	5.42		
	UA 1902-24	77.01	0.03	13.49	1.03	0.03	0.28	1.75	3.70	2.49	0.18	100	4.35		
	UA 1902-8	77.14	0.13	13.33	1.03	0.08	0.26	1.58	3.72	2.61	0.12	100	3.47		
	UA 1902-18	77.23	0.19	13.29	0.92	0.05	0.24	1.62	3.71	2.60	0.13	100	5.38		
	UA 1902-7	77.39	0.08	13.38	0.98	0.11	0.23	1.54	3.62	2.53	0.13	100	2.81		
	UA 1901-12	76.20	0.19	13.50	1.15	0.04	0.26	1.78	4.11	2.61	0.16	100	4.25		
	UA 1901-14	76.66	0.12	13.50	1.07	0.06	0.31	1.62	3.94	2.58	0.14	100	5.15		
	UA 1901-9	76.69	0.16	13.43	1.15	0.10	0.30	1.72	3.86	2.45	0.15	100	0.00		
	UA 1901-23	77.28	0.11	13.14	0.82	0.12	0.13	1.39	4.06	2.86	0.11	100	5.49		
	UA 1451-5	76.32	0.11	13.64	1.10	0.06	0.29	1.82	3.98	2.50	0.18	100	5.69		
	UA 1451-2	76.52	0.18	13.76	1.06	0.07	0.32	1.72	3.72	2.48	0.16	100	7.86		
	UA 1451-15	76.53	0.12	13.65	1.11	0.06	0.25	1.80	3.79	2.54	0.15	100	6.26		
	UA 1451-4	76.72	0.11	13.34	1.06	0.08	0.31	1.76	3.90	2.52	0.18	100	4.60		
	UA 1877-11	76.50	0.17	14.10	1.13	0.01	0.31	1.64	3.81	2.31	0.02	100	7.44		
	UA 1877-2	76.75	0.19	13.49	1.13	0.03	0.31	1.74	3.69	2.57	0.14	100	3.72		
	Mean	76.80	0.14	13.47	1.04	0.06	0.28	1.68	3.82	2.55	0.15	100	4.63	24	Potential Chatanika tephra correlative
	StDev	0.34	0.04	0.19	0.09	0.03	0.05	0.13	0.16	0.14	0.04	0	1.93		
HH7-All	**Mean**	78.10	0.13	12.69	0.92	0.06	0.22	1.24	3.41	3.03	0.18	100	5.78	76	Potential EB tephra correlative
	StDev	0.96	0.04	0.59	0.12	0.03	0.07	0.32	0.35	0.43	0.05	0	1.64		
HH8															
	UA 1901-13	73.86	0.28	13.54	2.17	0.05	0.22	1.32	4.74	3.61	0.21	100	4.86		
	UA 1901-19	74.00	0.24	13.55	2.19	0.12	0.29	1.30	4.51	3.64	0.17	100	5.40		
	UA 1901-27	74.09	0.23	13.46	1.89	0.08	0.25	1.18	5.27	3.38	0.19	100	8.42		
	UA 1901-1	74.14	0.32	13.65	2.18	0.06	0.19	1.28	4.38	3.59	0.19	100	6.16		
	UA 1901-14	74.45	0.31	13.59	2.16	0.04	0.18	1.17	4.19	3.62	0.29	100	5.76		
	UA 1901-15	74.61	0.27	13.62	2.10	0.10	0.17	1.18	4.20	3.51	0.25	100	4.53		
	UA 1877-25	74.07	0.34	13.72	2.21	0.10	0.27	1.20	4.34	3.56	0.26	100	2.02		
	UA 1877-14	74.35	0.21	13.63	2.31	0.08	0.24	1.25	4.29	3.47	0.23	100	1.59		
	Mean	74.19	0.27	13.60	2.15	0.08	0.22	1.23	4.49	3.55	0.22	100	4.84	8	Dawson tephra
	StDev	0.25	0.05	0.08	0.12	0.02	0.04	0.06	0.36	0.09	0.04	0	2.21		

on exposed face	**UA 1454-14**	72.37	0.49	14.47	2.35	0.00	0.41	1.69	4.39	3.71	0.12	100	3.43		
	UA 1454-8	71.99	0.52	14.62	2.44	0.02	0.49	1.82	4.48	3.54	0.09	100	4.23		
	UA 1454-16	71.66	0.51	14.33	2.72	0.05	0.52	1.86	4.72	3.51	0.13	100	0.75		
	UA 1454-20	71.61	0.56	14.49	2.55	0.06	0.47	1.89	4.53	3.71	0.13	100	6.32		
	UA 1454-3	71.55	0.51	14.25	2.65	0.02	0.46	2.03	4.73	3.65	0.16	100	4.39		
	UA 1454-1	71.46	0.54	14.48	2.71	0.07	0.52	1.85	4.66	3.59	0.12	100	0.63		
	UA 1454-18	71.40	0.48	14.58	2.47	0.14	0.44	1.77	4.77	3.83	0.11	100	3.97		
	UA 1454-4	71.37	0.47	14.61	2.72	0.06	0.49	1.89	4.56	3.71	0.11	100	2.79		
	UA 1454-6	71.34	0.50	14.55	2.73	0.06	0.52	1.80	4.61	3.78	0.11	100	2.95		
	UA 1454-7	71.21	0.49	14.50	2.73	0.16	0.50	1.89	4.76	3.65	0.09	100	4.63		
	UA 1454-19	71.20	0.57	14.61	2.79	0.06	0.55	2.04	4.44	3.67	0.08	100	0.97		
	UA 1454-2	71.16	0.57	14.57	2.82	0.04	0.55	2.07	4.58	3.55	0.09	100	2.28		
	UA 1454-13	70.85	0.61	14.87	2.88	0.05	0.56	2.03	4.48	3.56	0.10	100	6.02		
	UA 1454-5	70.16	0.66	14.75	3.09	0.11	0.65	2.46	4.54	3.50	0.08	100	3.27		
	UA 1454-12	70.15	0.62	15.15	3.18	0.08	0.77	2.36	4.19	3.44	0.06	100	1.79		
	UA 1454-11	70.12	0.64	14.94	3.26	0.04	0.75	2.37	4.43	3.38	0.08	100	1.79		
	UA 1454-10	69.98	0.69	14.79	3.19	0.10	0.59	2.41	4.56	3.57	0.11	100	5.50		
	UA 1454-15	69.94	0.66	15.08	3.24	0.07	0.70	2.46	4.36	3.40	0.08	100	2.02		
	UA 1454-17	69.82	0.72	14.98	3.13	0.13	0.67	2.40	4.54	3.51	0.09	100	1.90		
	UA 1454-9	69.07	0.81	14.95	3.44	0.06	0.80	2.68	4.48	3.60	0.11	100	1.94		
	UA 1454-30	68.31	0.88	15.00	3.93	0.07	0.95	2.87	4.64	3.25	0.11	100	1.72		
	UA 1454-18	68.99	0.85	14.80	3.56	0.05	0.84	2.54	4.86	3.39	0.12	100	0.72		
	UA 1454-27	69.40	0.77	14.85	3.55	0.07	0.76	2.53	4.49	3.48	0.09	100	1.17		
	UA 1454-21	69.50	0.79	14.93	3.48	0.08	0.74	2.62	4.46	3.30	0.09	100	2.11		
	UA 1454-13	69.70	0.70	14.93	3.17	0.06	0.71	2.36	4.74	3.52	0.11	100	1.77		
	UA 1454-3	69.92	0.63	15.00	3.21	0.08	0.67	2.34	4.52	3.51	0.13	100	2.88		
	UA 1454-14	69.93	0.72	14.64	3.23	0.08	0.68	2.43	4.69	3.48	0.11	100	2.36		
	UA 1454-25	70.08	0.63	14.65	3.14	0.10	0.65	2.25	4.73	3.63	0.14	100	2.57		
	UA 1454-8	70.38	0.61	14.59	3.03	0.05	0.54	2.16	4.75	3.78	0.11	100	5.69		
	UA 1454-29	70.43	0.61	14.69	2.88	0.06	0.64	2.16	4.81	3.65	0.07	100	5.90		
	UA 1454-2	70.45	0.65	14.57	3.21	0.07	0.64	2.16	4.56	3.56	0.13	100	1.89		
	UA 1454-9	70.45	0.61	14.68	3.09	0.09	0.57	2.05	4.61	3.70	0.15	100	9.10		
	UA 1454-16	70.55	0.55	14.66	2.86	0.11	0.63	2.03	4.79	3.72	0.11	100	2.17		
	UA 1454-7	70.59	0.70	14.66	3.04	0.05	0.63	2.17	4.64	3.41	0.13	100	2.73		
	UA 1454-12	70.63	0.67	14.79	2.84	0.05	0.59	2.05	4.67	3.57	0.12	100	5.42		
	UA 1454-19	70.70	0.66	14.59	2.99	0.02	0.63	2.20	4.53	3.56	0.13	100	3.00		
	UA 1454-11	71.16	0.58	14.47	2.72	0.04	0.54	1.97	4.63	3.77	0.12	100	5.41		
	UA 1454-26	71.20	0.51	14.50	2.89	0.05	0.52	1.96	4.64	3.58	0.14	100	2.45		
	UA 1454-17	71.31	0.52	14.75	2.51	0.15	0.51	1.77	4.60	3.71	0.17	100	8.21		
	UA 1454-5	71.35	0.48	14.71	2.64	0.08	0.50	1.72	4.71	3.68	0.15	100	9.20		
	UA 1454-15	71.36	0.52	14.39	2.65	0.10	0.49	1.81	4.71	3.84	0.13	100	6.55		
	UA 1454-28	71.66	0.58	14.38	2.62	0.02	0.52	1.77	4.63	3.70	0.12	100	2.40		
	UA 1454-4	71.66	0.55	14.40	2.62	0.05	0.45	1.79	4.52	3.86	0.10	100	5.03		
	UA 1454-6	71.71	0.59	14.66	2.58	0.01	0.50	1.80	4.40	3.65	0.09	100	2.41		
	UA 1454-20	71.85	0.50	14.34	2.68	0.03	0.45	1.76	4.42	3.87	0.11	100	2.26		
	UA 1454-24	72.05	0.43	14.37	2.49	0.05	0.44	1.66	4.50	3.87	0.14	100	3.65		
	UA 1454-23	72.16	0.52	14.16	2.52	0.00	0.36	1.70	4.77	3.73	0.08	100	4.52		
	AVERAGE	70.76	0.60	14.65	2.92	0.07	0.59	2.09	4.59	3.61	0.11	100	3.51	47	Correlates to DAB
	STDEV	0.93	0.11	0.23	0.35	0.04	0.12	0.31	0.14	0.15	0.02	0	2.13		

PALEOMAGNETIC DATA FROM HALFWAY HOUSE

5-cm interval

Depth (m)	Height	Sample	Dg	Dg - 360	Ig
0.05	13.25	HH-537	147	147	76
0.10	13.20	HH-538	320	-39.9	78.8
0.15	13.15	HH-539	135	135	61.8
0.20	13.10	HH-540	28.8	28.8	83.3
0.25	13.05	HH-541	22.9	22.9	76.9
0.30	13.00	HH-542	347	-13.3	72.7
0.35	12.95	HH-543	301	-59.5	-26.4
0.40	12.90	HH-544	5.3	5.3	44.1
0.45	12.85	HH-545	36.6	36.6	79.2
0.50	12.80	HH-546	299	-61.2	60.9
0.55	12.75	HH-547	310	-50.3	-3.3
0.60	12.70	HH-548	58.6	58.6	68
0.65	12.65	HH-549	25.6	25.6	77.6
0.70	12.60	HH-550	6.5	6.5	66.5
0.75	12.55	HH-551	14.1	14.1	62
0.80	12.50	HH-552	197	163	81.1
0.85	12.45	HH-553	25	25	69.7
0.90	12.40	HH-554	16.8	16.8	65.4
0.95	12.35	HH-555	13.5	13.5	66.5
1.00	12.30	HH-556	7.7	7.7	70.1
1.05	12.25	HH-557	18.8	18.8	61.7
1.10	12.20	HH-558	8.9	8.9	68.8
1.15	12.15	HH-559	353	-6.8	66.7
1.20	12.10	HH-560	352	-7.7	65.6
1.25	12.05	HH-561	0.1	0.1	65.2
1.30	12.00	HH-562	12.6	12.6	62
1.35	11.95	HH-563	7.8	7.8	61.3
1.40	11.90	HH-564	358	-2.4	63
1.45	11.85	HH-565	17.6	17.6	68.5
1.50	11.80	HH-566	346	-14	67.1
1.55	11.75	HH-567	326	-34.2	66.9
1.60	11.70	HH-568	358	-2.3	64.4
1.65	11.65	HH-569	355	-5.4	66.5
1.70	11.60	HH-570	344	-15.7	72
1.75	11.55	HH-571	357	-3.3	63.2
1.80	11.50	HH-572	356	-4.4	67.4
1.85	11.45	HH-573	2.6	2.6	67.1
1.90	11.40	HH-574	346	-14.4	62.1
1.95	11.35	HH-575	322	-37.8	62.3
2.00	11.30	HH-576	348	-11.6	66.5
2.05	11.25	HH-577	11.6	11.6	77.4
2.10	11.20	HH-578	26.4	26.4	76.4

2cm-interval- corrected height for rising paleosol through excurion

Corrected	Height	Depth	ID	Dg	Dg-360	Ig
8.20	8.10	2.80	75-HH	84.6	85	57.9
8.18	8.08	2.82	76-HH	85.9	86	49.7
8.16	8.06	2.84	77-HH	57	57	60.7
8.14	8.04	2.86	78-HH	79.7	80	51
8.12	8.02	2.88	79-HH	51.4	51	59.8
8.10	8.00	2.90	80-HH	48	48	65.1
8.08	7.98	2.92	81-HH	15.1	15	34.7
8.06	7.96	2.94	82-HH	31.8	32	56.5
8.04	7.94	2.96	83-HH	1.3	1	46.1
8.02	7.92	2.98	84-HH	26	26	44.5
8.00	7.90	3.00	85-HH	12.2	12	54
7.98	7.88	3.02	86-HH	11.8	12	44
7.96	7.86	3.04	87-HH	357.4	-3	44.3
7.94	7.84	3.06	88-HH	359.6	0	45.9
7.92	7.82	3.08	89-HH	359.5	-1	39.4
7.90	7.80	3.10	90-HH	14.9	15	46.4
7.88	7.78	3.12	91-HH	36.9	37	59.1
7.86	7.76	3.14	92-HH	11	11	61.2
7.84	7.74	3.16	93-HH	27.2	27	46.4
7.82	7.72	3.18	94-HH	6.3	6	53.6
7.80	7.70	3.20	95-HH	30.7	31	53.9
7.78	7.68	3.22	96-HH	2	2	48.7
7.76	7.66	3.24	97-HH	10.6	11	51.6
7.74	7.64	3.26	98-HH	13.8	14	52.9
7.72	7.62	3.28	99-HH	30.5	31	60.4
7.70	7.60	3.30	100-HH	21.1	21	55.5
7.68	7.58	3.32	101-HH	56.5	57	46.7
7.66	7.56	3.34	102-HH	20.6	21	60
7.64	7.54	3.36	103-HH	29.1	29	55.5
7.62	7.52	3.38	104-HH	34.8	35	65.8
7.60	7.50	3.40	105-HH	25.7	26	50.9
7.58	7.48	3.42	106-HH	19.8	20	55.4
7.56	7.46	3.44	107-HH	47	47	70.1
7.54	7.44	3.46	108-HH	50.1	50	62.7
7.52	7.42	3.48	109-HH	31.1	31	70.7
7.50	7.40	3.50	110-HH	21.5	22	67.3
7.48	7.38	3.52	111-HH	22.3	22	66.2
7.46	7.36	3.54	112-HH	51.7	52	67.4
7.44	7.34	3.56	113-HH	24.3	24	62
7.42	7.32	3.58	114-HH	18.7	19	62.4
7.40	7.30	3.60	115-HH	21.6	22	70.9
7.38	7.28	3.62	116-HH	23.3	23	66.7

2.15	11.15	HH-579	26.7	26.7	64.5
2.20	11.10	HH-580	14	14	71.7
2.25	11.05	HH-581	17.9	17.9	66.1
2.30	11.00	HH-582	19.6	19.6	64.4
2.35	10.95	HH-583	16.8	16.8	77.8
0.10	10.90	HH-1	352	-7.9	72.1
0.15	10.85	HH-2	1.9	1.9	72.3
0.20	10.80	HH-3	351	-8.9	69
0.25	10.75	HH-4	356	-3.8	61.5
0.30	10.70	HH-5	3.6	3.6	63.8
0.35	10.65	HH-6	357	-3.5	54.7
0.40	10.60	HH-7	347	-12.9	58.2
0.45	10.55	HH-8	357	-3.4	58.2
0.50	10.50	HH-9	348	-11.6	69.9
0.55	10.45	HH-10	356	-3.9	62.3
0.60	10.40	HH-11	7.6	7.6	69.3
0.65	10.35	HH-12	344	-16.3	75.5
0.70	10.30	HH-13	348	-12.5	68.9
0.75	10.25	HH-14	335	-24.9	70.4
0.80	10.20	HH-15	359	-0.6	64.8
0.85	10.15	HH-16A	5.7	5.7	63.6
0.90	10.10	HH-17A	22.5	22.5	61.5
0.95	10.05	HH-18	319	-40.7	70.5
1.00	10.00	HH-19	2.7	2.7	82.6
1.05	9.95	HH-20	348	-12.2	78.5
1.10	9.90	HH-21	352	-8.3	75.6
1.15	9.85	HH-22	13.5	13.5	78
1.20	9.80	HH-23	31.4	31.4	82.3
1.25	9.75	HH-24	350	-10.1	70.6
1.30	9.70	HH-25	14.3	14.3	76.5
1.35	9.65	HH-26	18.1	18.1	69
1.40	9.60	HH-27	24.9	24.9	68.1
1.45	9.55	HH-28	52	52	72.3
1.50	9.50	HH-29	51.7	51.7	80
1.55	9.45	HH-30	62.1	62.1	70.7
1.60	9.40	HH-31A	98.1	98.1	52.5
1.65	9.35	HH-32A	146	146	77
1.70	9.30	HH-33A	97.3	97.3	53.6
1.72	9.28	HH-33B	74.3	74.3	72.2
1.75	9.25	HH-34	57.4	57.4	67.6
1.80	9.20	HH-35	58.5	58.5	66.7
1.85	9.15	HH-36	72.9	72.9	70
1.90	9.10	HH-37	65.4	65.4	69.5
1.95	9.05	HH-38	64.9	64.9	62.6
2.00	9.00	HH-39	50.9	50.9	70.8
2.05	8.95	HH-40C	61.6	61.6	70
2.10	8.90	HH-41C	18.6	18.6	72.1
2.15	8.85	HH-42B	33.9	33.9	73.4
2.20	8.80	HH-43B	347	-13.1	62.6
2.25	8.75	HH-44	14.9	14.9	68.4
2.30	8.70	HH-45	12.7	12.7	74.6
2.35	8.65	HH-46	49.6	49.6	71.2
2.40	8.60	HH-47	56	56	56.4

7.36	7.26	3.64	117-HH	29.3	29	70.6
7.34	7.24	3.66	118-HH	24.5	25	67.2
7.32	7.22	3.68	119-HH	10.7	11	61
7.30	7.20	3.70	120-HH	14.9	15	68.3
7.28	7.18	3.72	121-HH	13.4	13	59.5
7.26	7.16	3.74	122-HH	23	23	56.7
7.24	7.14	3.76	123-HH	9.9	10	70.9
7.22	7.12	3.78	124-HH	40.2	40	76.8
7.20	7.10	3.80	125-HH	6.8	7	72.2
7.18	7.08	3.82	126-HH	359.6	0	73
7.16	7.06	3.84	127-HH	6.9	7	81.2
7.14	7.04	3.86	128-HH	35.5	36	81.5
7.12	7.02	3.88	129-HH	2.5	3	60.2
7.10	7.00	3.90	130-HH	2.7	3	57.7
7.08	6.98	3.92	131-HH	357.7	-2	71.5
7.06	6.96	3.94	132-HH	350.7	-9	79.6
7.04	6.94	3.96	133-HH	18.2	18	71.5
7.02	6.92	3.98	134-HH	29.3	29	77.6
7.00	6.90	4.00	135-HH	22.4	22	69.3

2.45	8.55	HH-48	279	-80.9	65.3	
2.50	8.50	HH-49	23.7	23.7	61.6	
2.55	8.45	HH-50	38.9	38.9	67.6	
2.60	8.40	HH-51	78.1	78.1	74.1	
2.65	8.35	HH-52	52.7	52.7	67.5	
2.70	8.30	HH-53	24.6	24.6	69.1	
2.75	8.25	HH-54	28.4	28.4	67.1	
2.80	8.20	HH-55	5.9	5.9	54.8	
2.85	8.15	HH-56	6.4	6.4	66.9	
2.90	8.10	HH-57	358	-2.4	66.8	
2.95	8.05	HH-58	6.6	6.6	75.8	excursion interval
3.00	8.00	HH-59	43.3	43.3	73.7	
3.05	7.95	HH-60	58.6	58.6	75.7	
3.10	7.90	HH-61	49.3	49.3	62.1	
3.15	7.85	HH-62B	37.6	37.6	46.9	
3.20	7.80	HH-63B	29	29	29.5	
3.25	7.75	HH-64B	20.6	20.6	42.9	
3.30	7.70	HH-65	305	-55.2	45.9	
3.35	7.65	HH-66	77.1	77.1	52.2	
3.40	7.60	HH-67	29	29	61.3	
3.45	7.55	HH-68	27.6	27.6	59.7	
3.50	7.50	HH-69	32.8	32.8	46.3	
3.55	7.45	HH-70	28.3	28.3	46.5	
3.60	7.40	HH-71	35.6	35.6	53.1	
3.65	7.35	HH-72	350	-10.2	56.1	
3.70	7.30	HH-73	356	-3.6	59.4	
3.75	7.25	HH-74	7.4	7.4	59.3	
3.80	7.20	HH-75	3.6	3.6	63.7	
3.85	7.15	HH-76	3	3	66.6	
3.90	7.10	HH-77	335	-25.5	71.6	
3.95	7.05	HH-78	330	-29.9	71.9	
4.00	7.00	HH-79	11.2	11.2	75	
4.05	6.95	HH-80	351	-9.3	80.4	
4.10	6.90	HH-81	353	-7.1	74	
4.15	6.85	HH-82	6.7	6.7	77.8	
4.20	6.80	HH-83	5.4	5.4	75	
4.25	6.75	HH-84	344	-15.8	67.1	
4.30	6.70	HH-85	4.9	4.9	68.6	
4.35	6.65	HH-86	347	-13.2	65.8	
4.40	6.60	HH-87	8	8	63.4	
4.45	6.55	HH-88	4.3	4.3	58.7	
4.50	6.50	HH-89B	1.8	1.8	66.3	
4.55	6.45	HH-90	53.7	53.7	77	
4.60	6.40	HH-91	57.2	57.2	67.5	
4.65	6.35	HH-92	3.9	3.9	67.7	
4.70	6.30	HH-93	6.1	6.1	74.2	
4.75	6.25	HH-94	12.6	12.6	70.2	
4.80	6.20	HH-95	37.3	37.3	72.1	
4.85	6.15	HH-96	34.4	34.4	71.1	
4.90	6.10	HH-97	7	7	57	
4.95	6.05	HH-98	15.4	15.4	58.7	
5.00	6.00	HH-99	2.6	2.6	58.6	
5.05	5.95	HH-100	1.9	1.9	58.9	

5.10	5.90	HH-101	359	-0.8	51.9
5.15	5.85	HH-102	10.2	10.2	61.6
5.20	5.80	HH-103	10.7	10.7	62.3
5.25	5.75	HH-104	23.4	23.4	65.4
5.30	5.70	HH-105	29	29	67.5
5.35	5.65	HH-106	16.7	16.7	73.7
5.40	5.60	HH-107	19.9	19.9	79.4
5.45	5.55	HH-108	313	-47.5	72.4
5.50	5.50	HH-109	338	-21.9	74.8
5.55	5.45	HH-110	8.1	8.1	76.8
5.60	5.40	HH-111	36.3	36.3	77.2
5.65	5.35	HH-112	354	-5.6	78.7
5.70	5.30	HH-113	344	-15.8	67.4
5.75	5.25	HH-114	8.5	8.5	65
5.80	5.20	HH-115	1.7	1.7	58.1
5.85	5.15	HH-116	344	-16.2	60.2
5.90	5.10	HH-117	4.1	4.1	56.9
5.95	5.05	HH-118	356	-3.9	63.7
6.00	5.00	HH-119	334	-25.9	60.1
6.05	4.95	HH-120	350	-10.5	74.5
6.10	4.90	HH-121	353	-6.9	63.4
6.15	4.85	HH-122	343	-17.5	69.1
6.20	4.80	HH-123	319	-40.8	68.4
6.25	4.75	HH-124	26.5	26.5	55.9
6.30	4.70	HH-125	330	-29.8	64.2
6.35	4.65	HH-126	330	-29.7	73.2
6.40	4.60	HH-127	30.2	30.2	69.6
6.45	4.55	HH-128	78.3	78.3	77.6
6.50	4.50	HH-129	32.9	32.9	68.5
6.55	4.45	HH-130	27.9	27.9	67.5
6.60	4.40	HH-131	16.9	16.9	67
6.65	4.35	HH-132	31.7	31.7	73.6
6.70	4.30	HH-133	18.6	18.6	76.6
6.75	4.25	HH-134	16.7	16.7	74.2
6.80	4.20	HH-135	32	32	67.3
6.85	4.15	HH-136	4.6	4.6	75.6
6.90	4.10	HH-137	23.8	23.8	71.4
6.95	4.05	HH-138	21.9	21.9	70.9
7.00	4.00	HH-139	23.5	23.5	71.3
7.05	3.95	HH-140	6.4	6.4	69.1
7.10	3.90	HH-141	17.4	17.4	72.8
7.15	3.85	HH-142	2.4	2.4	73.5
7.20	3.80	HH-143	10.2	10.2	74.7
7.25	3.75	HH-144	11.3	11.3	67.1
7.30	3.70	HH-145	1.1	1.1	77.1
7.35	3.65	HH-146	16	16	74.5
7.40	3.60	HH-147	10.6	10.6	72.8
7.45	3.55	HH-148	356	-4.1	70.8
7.50	3.50	HH-149	9.9	9.9	69.6
7.55	3.45	HH-150	9.2	9.2	65.1
7.60	3.40	HH-151	353	-6.7	67.6
7.65	3.35	HH-152	3.8	3.8	68.2
7.70	3.30	HH-153	0.3	0.3	62.9

7.75	3.25	H-154	18.7	18.7	67.1
7.80	3.20	H-155	33.2	33.2	67.9
7.85	3.15	H-156	30.1	30.1	63
7.90	3.10	H-157	22.3	22.3	67.3
7.95	3.05	H-158	13.6	13.6	56
8.00	3.00	H-159	12	12	54.6
8.05	2.95	**skipped - in tephra**			
8.10	2.90	H-161	37.6	37.6	49.9
8.15	2.85	H-162	19.4	19.4	63.5
8.20	2.80	H-163	15.1	15.1	73.5
8.25	2.75				
8.30	2.70				
8.35	2.65	**OLD CROW**			
8.40	2.60				
8.45	2.55				
8.50	2.50				
8.55	2.45	H-164	15.7	15.7	58.6
8.60	2.40	H-165	11.1	11.1	54.1
8.65	2.35	H-166	15.8	15.8	45.4
8.70	2.30	H-167	19.2	19.2	58.9
8.75	2.25	H-168	7.1	7.1	52.3
8.80	2.20	H-169	11.7	11.7	49.8
8.85	2.15	H-170	18.2	18.2	58.6
8.90	2.10	H-171	23.5	23.5	54.5
8.95	2.05	H-172	31.8	31.8	58
9.00	2.00	H-508	351	-9	75
9.05	1.95	H-509	350	-10.4	84.7
9.10	1.90	H-510	9.1	9.1	76.7
9.15	1.85	H-511	56.5	56.5	69.1
9.20	1.80	H-512	3.5	3.5	78.4
9.25	1.75	H-513	3.5	3.5	79.2
9.30	1.70	H-514	353	-6.7	78.4
9.35	1.65	H-515	7.9	7.9	77.5
9.40	1.60	H-516	352	-7.6	73.1
9.45	1.55	H-517	332	-27.9	77.8
9.50	1.50	H-518	286	-73.8	80.7
9.55	1.45	H-519	347	-13.4	77.6
9.60	1.40	H-520	331	-29.5	74.1
9.65	1.35	H-521	339	-20.8	76.6
9.70	1.30	H-522	338	-22.4	70.2
9.75	1.25	H-523	299	-60.6	67
9.80	1.20	H-524	300	-60.5	68.3
9.85	1.15	H-525	321	-38.6	71.3
9.90	1.10	H-526	15.1	15.1	79.3
9.95	1.05	H-527	331	-28.7	59.4
10.00	1.00	H-528	320	-40	68.2
10.05	0.95	H-529	4.7	4.7	78.9
10.10	0.90	H-530	358	-1.9	52.3
10.15	0.85	H-531	34	34	72.9
10.20	0.80	H-532	352	-8.5	88.8
10.25	0.75	H-533	23.5	23.5	69.8
10.30	0.70	H-534	3.3	3.3	73.6
10.35	0.65	H-535	34.9	34.9	81.1

10.40	0.60	HH-536	338	-21.9	64.8
10.45	0.55				
10.50	0.50				
10.55	0.45				
10.60	0.40				
10.65	0.35				
10.70	0.30	BASE OF TRENCH			
10.75	0.25	NO SAMPLE COLLECTED			
10.80	0.20				
10.85	0.15				
10.90	0.10				
10.95	0.05				
11.00	0.00				

MAGNETIC SUSCEPTIBILITY

5 cm interval

Depth	Height	Sample	LF Sus	HF Sus	eq.Dep.%
0.20	13.25	HH-537	179	171	4.64
0.25	13.20	HH-538	131	125	4.95
0.30	13.15	HH-539	127	122	4.08
0.35	13.10	HH-540	166	158	5.17
0.40	13.05	HH-541	176	168	4.67
0.45	13.00	HH-542	83.8	80	4.53
0.50	12.95	HH-543	73	69.2	5.21
0.55	12.90	HH-544	109	102	6.24
0.60	12.85	HH-545	102	97	4.81
0.65	12.80	HH-546	136	125	8.44
0.70	12.75	HH-547	191	180	5.72
0.75	12.70	HH-548	130	124	4.7
0.80	12.65	HH-549	48.7	46.4	4.72
0.85	12.60	HH-550	57.4	55.3	3.66
0.90	12.55	HH-551	58.7	56.3	4.09
0.95	12.50	HH-552	62.5	60.5	3.2
1.00	12.45	HH-553	53.6	51.6	3.73
1.05	12.40	HH-554	53.7	50.9	5.21
1.10	12.35	HH-555	166	163	1.81
1.15	12.30	HH-556	108	106	1.95
1.20	12.25	HH-557	218	214	2.06
1.25	12.20	HH-558	249	244	2.05
1.30	12.15	HH-559	197	199	-1.07
1.35	12.10	HH-560	127	126	0.71
1.40	12.05	HH-561	145	146	-0.55
1.45	12.00	HH-562	124	124	0.16
1.50	11.95	HH-563	110	108	1.1
1.55	11.90	HH-564	134	132	1.34
1.60	11.85	HH-565	155	153	1.29
1.65	11.80	HH-566	174	172	1.15
1.70	11.75	HH-567	184	182	1.3
1.75	11.70	HH-568	194	191	1.39
1.80	11.65	HH-569	168	162	3.1

2 cm interval

Depth	Height	Sample	Weight	LF Sus	F S	Freq.Dep.%
2.80	8.20	75-HH	13	106.2	##	1.04
2.82	8.18	76-HH	13	93.9	93	1.17
2.84	8.16	77-HH	13	97.1	95	1.75
2.86	8.14	78-HH	13	88.4	88	1.02
2.88	8.12	79-HH	13	87.7	87	0.91
2.90	8.10	80-HH	13	87.9	86	1.71
2.92	8.08	81-HH	12	92.5	92	0.86
2.94	8.06	82-HH	12	97.8	95	3.27
2.96	8.04	83-HH	13	42.1	41	2.85
2.98	8.02	84-HH	13	43.1	41	4.64
3.00	8.00	85-HH	12	39	38	3.08
3.02	7.98	86-HH	12	43	42	3.26
3.04	7.96	87-HH	12	65.8	63	4.56
3.06	7.94	88-HH	12	60	58	2.83
3.08	7.92	89-HH	12	36.8	35	4.35
3.10	7.90	90-HH	12	55	53	3.64
3.12	7.88	91-HH	12	51	49	4.12
3.14	7.86	92-HH	12	67.7	65	3.69
3.16	7.84	93-HH	12	61.9	60	3.39
3.18	7.82	94-HH	12	73.4	71	3.54
3.20	7.80	95-HH	13	60.2	59	1.99
3.22	7.78	96-HH	13	54	54	0.93
3.24	7.76	97-HH	13	94.3	93	1.17
3.26	7.74	98-HH	13	100.5	##	0.9
3.28	7.72	99-HH	13	82.1	81	1.1
3.30	7.70	100-HH	13	58.7	58	1.7
3.32	7.68	101-HH	12	112.4	##	1.33
3.34	7.66	102-HH	13	68.8	68	1.74
3.36	7.64	103-HH	13	95.4	94	1.57
3.38	7.62	104-HH	13	51.6	50	3.1
3.40	7.60	105-HH	13	50.5	49	2.38
3.42	7.58	106-HH	12	32.6	32	2.76
3.44	7.56	107-HH	13	45.5	45	1.54

1.85	11.60	HH-570	188	189	-0.69
1.90	11.55	HH-571	153	151	1.25
1.95	11.50	HH-572	157	152	3.69
2.00	11.45	HH-573	190	187	1.58
2.05	11.40	HH-574	164	161	1.71
2.10	11.35	VERAG	154	150	2.43
2.15	11.30	VERAG	133	131	1.47
2.20	11.25	HH-577	148	146	0.88
2.25	11.20	HH-578	164	161	1.89
2.30	11.15	HH-579	155	152	2.19
2.35	11.10	HH-580	168	164	2.14
2.40	11.05	HH-581	126	124	1.51
2.45	11.00	HH-582	161	157	2.12
2.50	10.95	HH-583	135	133	1.49
0.00	10.90	VERAG	138	137	0.43
0.05	10.85	VERAG	136	134	1.55
0.10	10.80	VERAG	131	131	0.3
0.15	10.75	HH-4	159	158	0.57
0.20	10.70	HH-5	75.1	73.3	2.4
0.25	10.65	HH-6	172	170	0.81
0.30	10.60	HH-7	211	210	0.43
0.35	10.55	HH-8	220	216	1.82
0.40	10.50	HH-9	266	263	0.98
0.45	10.45	HH-10	290	284	1.9
0.50	10.40	HH-11	275	269	2.14
0.55	10.35	HH-12	243	243	-0.25
0.60	10.30	HH-13	218	214	1.74
0.65	10.25	HH-14	239	238	0.63
0.70	10.20	HH-15	278	276	0.79
0.75	10.15	VERAG	250	248	0.78
0.80	10.10	VERAG	215	214	0.79
0.85	10.05	HH-18	178	174	1.8
0.90	10.00	HH-19	153	147	4.24
0.95	9.95	HH-20	142	140	1.76
1.00	9.90	HH-21	129	128	0.7
1.05	9.85	HH-22	159	158	0.88
1.10	9.80	HH-23	206	201	2.29
1.15	9.75	HH-24	162	160	1.36
1.20	9.70	HH-25	133	134	-1.21
1.25	9.65	HH-26	130	130	0.08
1.30	9.60	HH-27	129	127	1.48
1.35	9.55	HH-28	106	104	1.98
1.40	9.50	HH-29	122	122	0.57
1.45	9.45	HH-30	125	121	2.89
1.50	9.40	VERAG	120	117	2.13
1.55	9.35	VERAG	119	118	1.18
1.60	9.30	VERAG	147	144	1.83
1.65	9.25	HH-34	109	109	0.18
1.70	9.20	HH-35	111	109	1.9
1.75	9.15	HH-36	125	123	1.68
1.80	9.10	HH-37	98	96.1	1.94
1.85	9.05	HH-38	99.1	97.7	1.41
1.90	9.00	HH-39	107	105	1.68

3.46	7.54	108-HH	13	50.5	50	1.98
3.48	7.52	109-HH	14	144.5	##	2.01
3.50	7.50	110-HH	13	90.4	89	1.99
3.52	7.48	111-HH	14	143.9	##	1.46
3.54	7.46	112-HH	14	143.6	##	1.18
3.56	7.44	113-HH	14	154.6	##	1.62
3.58	7.42	114-HH	14	147.6	##	2.03
3.60	7.40	115-HH	13	155.5	##	2.32
3.62	7.38	116-HH	13	149.7	##	2.27
3.64	7.36	117-HH	14	162.1	##	2.9
3.66	7.34	118-HH	14	159.1	##	1.26
3.68	7.32	119-HH	13	152.6	##	1.11
3.70	7.30	120-HH	14	172.4	##	1.22
3.72	7.28	121-HH	13	166.7	##	1.26
3.74	7.26	122-HH	13	147.5	##	1.29
3.76	7.24	123-HH	13	161.1	##	0.93
3.78	7.22	124-HH	13	165.7	##	1.39
3.80	7.20	125-HH	13	158.1	##	1.14
3.82	7.18	126-HH	13	149.8	##	0.87
3.84	7.16	127-HH	13	157.7	##	0.57
3.86	7.14	128-HH	13	159.1	##	0.94
3.88	7.12	129-HH	13	152.1	##	0.92
3.90	7.10	130-HH	13	149.7	##	0.67
3.92	7.08	131-HH	12	137.3	##	1.17
3.94	7.06	132-HH	13	152.1	##	0.72
3.96	7.04	133-HH	13	147.9	##	0.88
3.98	7.02	134-HH	12	152.5	##	1.05
4.00	7.00	135-HH	13	155.6	##	0.26

1.95	8.95	VERAG	174	170	2.93
2.00	8.90	VERAG	156	153	3.11
2.05	8.85	VERAG	107	106	0.93
2.10	8.80	VERAG	104	104	0.6
2.15	8.75	HH-44	111	108	2.62
2.20	8.70	HH-45	113	109	3.45
2.25	8.65	HH-46	106	105	1.51
2.30	8.60	HH-47	108	107	1.75
2.35	8.55	HH-48	107	106	1.12
2.40	8.50	HH-49	129	124	3.42
2.45	8.45	HH-50	106	105	1.6
2.50	8.40	HH-51	141	139	1.84
2.55	8.35	HH-52	177	175	1.47
2.60	8.30	HH-53	156	152	2.44
2.65	8.25	HH-54	174	170	2.58
2.70	8.20	HH-55	125	122	2.41
2.75	8.15	HH-56	128	126	1.79
2.80	8.10	HH-57	143	141	1.54
2.85	8.05	HH-58	138	135	1.6
2.90	8.00	HH-59	148	145	2.17
2.95	7.95	HH-60	103	101	2.13
3.00	7.90	VERAG	90.4	87.9	2.8
3.05	7.85	VERAG	97.9	95.8	2.2
3.10	7.80	VERAG	93.9	91	3.14
3.15	7.75	VERAG	78.6	76.6	2.71
3.20	7.70	VERAG	69.4	68.1	2.27
3.25	7.65	VERAG	50.7	49.2	2.97
3.30	7.60	HH-67	71.7	69.2	3.49
3.35	7.55	HH-68	68.7	67.8	1.31
3.40	7.50	VERAG	72.5	71.1	1.97
3.45	7.45	VERAG	31.4	30.7	2.19
3.50	7.40	VERAG	69.1	67	3.43
3.55	7.35	HH-72	43.5	42.4	2.53
3.60	7.30	HH-73	120	121	-0.83
3.65	7.25	HH-74	145	141	2.56
3.70	7.20	HH-75	159	157	1.76
3.75	7.15	HH-76	161	156	3.35
3.80	7.10	HH-77	157	153	2.17
3.85	7.05	HH-78	162	158	2.4
3.90	7.00	HH-79	160	155	3.12
3.95	6.95	HH-80	142	141	0.92
4.00	6.90	HH-81	159	155	3.01
4.05	6.85	HH-82	161	158	1.98
4.10	6.80	VERAG	154	153	0.49
4.15	6.75	VERAG	183	179	2.19
4.20	6.70	VERAG	279	274	1.69
4.25	6.65	VERAG	125	124	0.56
4.30	6.60	VERAG	133	130	2.21
4.35	6.55	VERAG	146	143	2.18
4.40	6.50	VERAG	138	136	1.75
4.45	6.45	VERAG	106	105	1.36
4.50	6.40	VERAG	136	133	2.05
4.55	6.35	HH-92	130	132	-1.15

4.60	6.30	HH-93	164	160	2.2
4.65	6.25	HH-94	175	171	1.83
4.70	6.20	HH-95	147	146	0.88
4.75	6.15	HH-96	156	157	-0.32
4.80	6.10	HH-97	164	157	4.63
4.85	6.05	HH-98	168	164	2.73
4.90	6.00	HH-99	159	156	2.2
4.95	5.95	HH-100	145	141	2.49
5.00	5.90	HH-101	131	127	2.75
5.05	5.85	HH-102	141	138	1.56
5.10	5.80	HH-103	120	118	2
5.15	5.75	HH-104	119	124	-4.29
5.20	5.70	HH-105	112	109	2.23
5.25	5.65	HH-106	137	133	3.14
5.30	5.60	HH-107	125	121	3.28
5.35	5.55	HH-108	138	135	2.32
5.40	5.50	HH-109	90.8	88.5	2.53
5.45	5.45	HH-110	79.2	76.4	3.54
5.50	5.40	HH-111	69.1	67.6	2.17
5.55	5.35	HH-112	87.7	87.2	0.57
5.60	5.30	HH-113	83.8	81.1	3.22
5.65	5.25	HH-114	72.1	69.2	4.02
5.70	5.20	HH-115	58.4	55.2	5.48
5.75	5.15	HH-116	67.5	65.3	3.26
5.80	5.10	HH-117	86.9	83.4	4.03
5.85	5.05	HH-118	95.7	94.3	1.46
5.90	5.00	HH-119	146	142	2.47
5.95	4.95	HH-120	104	102	1.92
6.00	4.90	HH-121	80	80.1	-0.12
6.05	4.85	HH-122	95.6	94.6	1.05
6.10	4.80	HH-123	87.4	87.9	-0.57
6.15	4.75	HH-124	82.9	82.2	0.84
6.20	4.70	HH-125	92.8	91.5	1.4
6.25	4.65	HH-126	85.7	84.4	1.52
6.30	4.60	VERAG	105	105	0.78
6.35	4.55	VERAG	91	89.1	2.02
6.40	4.50	HH-129	99.1	97.8	1.31
6.45	4.45	HH-130	106	104	1.33
6.50	4.40	HH-131	89.2	88.3	1.01
6.55	4.35	HH-132	80.2	82.2	-2.49
6.60	4.30	HH-133	99.5	97.1	2.41
6.65	4.25	HH-134	97.5	96.1	1.44
6.70	4.20	HH-135	101	99.1	1.88
6.75	4.15	HH-136	91.5	89.5	2.19
6.80	4.10	HH-137	89.6	88.6	1.12
6.85	4.05	HH-138	102	101	1.08
6.90	4.00	HH-139	91.2	89.5	1.86
6.95	3.95	HH-140	118	117	1.18
7.00	3.90	VERAG	124	121	2.78
7.05	3.85	HH-142	124	122	1.38
7.10	3.80	HH-143	116	115	0.43
7.15	3.75	HH-144	144	142	1.04
7.20	3.70	HH-145	140	140	0.21

7.25	3.65	HH-146	99.9	99	0.9
7.30	3.60	HH-147	99.1	98.3	0.81
7.35	3.55	HH-148	85.3	83.6	1.99
7.40	3.50	HH-149	99.4	97	2.41
7.45	3.45	HH-150	111	107	3.33
7.50	3.40	HH-151	122	122	0.57
7.55	3.35	HH-152	104	103	0.87
7.60	3.30	HH-153	114	113	1.22
7.65	3.25	HH-154	55.6	54.7	1.62
7.70	3.20	VERAG	68.3	68.1	0.28
7.75	3.15	VERAG	65.4	65.3	-0.05
7.80	3.10	HH-157	104	103	1.25
7.85	3.05	HH-158	112	109	2.67
7.90	3.00	HH-159	77.9	78.7	-1.03
7.95	2.95	HH-160			
8.00	2.90	HH-161	87.1	86.2	1.03
8.05	2.85	HH-162	91.9	90.4	1.63
8.10	2.80	HH-163	93.1	91.3	1.93
8.15	2.75				
8.20	2.70				
8.25	2.65				
8.30	2.60				
8.35	2.55				
8.40	2.50				
8.45	2.45	HH-164	103	102	0.97
8.50	2.40	HH-165	150	150	0.07
8.55	2.35	HH-166	150	148	0.94
8.60	2.30	HH-167	123	120	2.29
8.65	2.25	HH-168	85.7	85.8	-0.12
8.70	2.20	HH-169	120	119	1.17
8.75	2.15	HH-170	140	138	1.57
8.80	2.10	HH-171	253	248	1.94
8.85	2.05	HH-172	260	258	0.77
8.90	2.00	HH-508	283	291	-2.76
8.95	1.95	HH-509	221	219	1.08
9.00	1.90	HH-510	305	307	-0.76
9.05	1.85	HH-511	237	240	-0.93
9.10	1.80	HH-512	219	216	1.37
9.15	1.75	HH-513	157	160	-1.72
9.20	1.70	HH-514	218	216	0.78
9.25	1.65	HH-515	181	183	-1.16
9.30	1.60	HH-516	277	272	1.98
9.35	1.55	HH-517	291	288	0.93
9.40	1.50	HH-518	260	257	0.85
9.45	1.45	HH-519	328	327	0.12
9.50	1.40	HH-520	229	228	0.35
9.55	1.35	HH-521	277	273	1.51
9.60	1.30	HH-522	258	253	1.93
9.65	1.25	HH-523	203	203	-0.1
9.70	1.20	HH-524	138	136	0.8
9.75	1.15	HH-525	162	162	-0.19
9.80	1.10	HH-526	188	187	0.37
9.85	1.05	HH-527	149	148	0.34

9.90	1.00	HH-528	185	181	2
9.95	0.95	HH-529	150	150	0.13
10.00	0.90	HH-530	145	144	0.21
10.05	0.85	HH-531	174	174	0.17
10.10	0.80	HH-532	118	117	0.85
10.15	0.75	HH-533	156	153	1.74
10.20	0.70	HH-534	142	141	0.98
10.25	0.65	HH-535	144	144	0.62
10.30	0.60	HH-536	123	122	0.65

APPENDIX 4: CHAPTER 5

Major-element glass geochemical analyses of reference (UA 1119) and AD 860B samples

Tephra ID	Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Cl	Total	H_2O_{diff}	n	Notes
	UA 1119-36	71.46	0.00	15.14	2.25	0.02	0.55	2.10	4.78	3.16	0.54	100	0.88		
	UA 1119-7	71.56	0.23	15.68	1.71	0.03	0.28	2.35	4.31	3.48	0.38	100	2.08		
	UA 1119-21	71.57	0.14	16.09	1.55	0.03	0.29	2.51	5.16	2.47	0.19	100	1.52		
	UA 1119-4	71.87	0.29	15.88	1.94	-0.05	0.48	1.72	4.61	2.87	0.41	100	4.44		
	UA 1119-29	71.90	0.29	14.48	2.42	0.15	0.39	2.45	4.34	3.23	0.35	100	6.69		
	UA 1119-25	72.43	0.24	14.60	2.25	0.14	0.23	2.14	4.15	3.36	0.47	100	4.63		
	UA 1119-27	72.57	0.13	14.01	2.48	0.03	0.79	2.34	4.42	2.85	0.37	100	1.39		
	UA 1119-35	72.61	0.17	13.51	1.96	-0.15	0.75	2.37	4.58	3.93	0.27	100	0.89		
	UA 1119-24	72.63	0.28	14.39	2.22	-0.11	0.37	1.92	4.34	3.62	0.34	100	1.72		
	UA 1119-12	72.74	0.20	14.46	2.04	0.20	0.19	1.99	4.85	2.93	0.41	100	1.95		
	UA 1119-33	73.05	0.29	15.12	1.40	0.03	0.32	1.78	4.79	2.96	0.25	100	1.93		
	UA 1119-38	73.19	0.23	14.12	1.27	0.16	0.41	2.55	4.60	3.08	0.39	100	3.48		
	UA 1119-14	73.49	0.26	13.66	1.58	0.03	0.14	2.57	4.96	3.09	0.23	100	1.18		
	UA 1119-13	73.53	0.42	13.65	1.73	0.10	0.23	1.91	4.59	3.58	0.27	100	3.06		
	UA 1119-28	73.67	0.07	14.46	1.64	-0.14	0.47	2.08	4.37	2.95	0.43	100	2.56		
	UA 1119-11	73.78	0.35	13.96	1.36	0.04	0.84	1.70	4.34	3.24	0.39	100	2.31		
	UA 1119-10	73.93	0.29	14.10	1.43	0.07	0.13	1.53	4.30	4.00	0.24	100	3.77		
	UA 1119-20	73.94	0.30	13.71	1.90	0.14	0.26	1.79	4.95	2.69	0.32	100	2.93		
	UA 1119-26	73.98	0.50	14.10	1.44	0.05	0.33	1.75	4.24	3.25	0.37	100	2.40		
	UA 1119-15	73.99	0.25	14.20	1.63	-0.05	0.43	1.64	4.27	3.38	0.26	100	1.27		
	UA 1119-17	74.08	0.40	13.36	1.82	-0.15	0.75	2.63	4.32	2.45	0.34	100	5.76		
	UA 1119-8	74.14	0.12	13.46	2.08	0.09	0.25	1.60	4.54	3.48	0.24	100	2.50		
	UA 1119-9	74.16	0.05	14.31	1.55	-0.32	0.30	1.53	4.27	3.70	0.46	100	5.46		
	UA 1119-37	74.39	0.14	14.05	1.41	-0.23	0.42	1.88	4.43	3.11	0.41	100	2.68		
	UA 1119-23	74.49	0.14	13.52	1.64	-0.07	0.33	1.93	4.70	3.02	0.30	100	2.91		
	UA 1119-40	74.98	0.23	13.81	1.12	-0.14	0.72	1.11	4.33	3.56	0.28	100	1.44		
	UA 1119-19	75.06	0.24	13.70	0.74	-0.07	0.22	1.59	4.67	3.44	0.42	100	3.96		
	UA 1119-30	75.12	0.18	14.37	1.49	-0.07	0.21	1.52	3.99	2.95	0.24	100	1.81		
	UA1119-6	71.28	0.24	15.40	1.85	0.10	0.31	2.26	4.56	3.66	0.35	100	1.05		
	UA1119-11	72.27	0.39	15.09	1.82	0.20	0.62	2.10	4.59	2.66	0.24	100	0.61		
	UA1119-12	72.38	0.28	13.74	2.88	-0.11	0.79	2.21	4.40	2.99	0.43	100	3.64		
	UA1119-4	72.49	0.38	15.13	1.53	0.20	0.41	1.61	4.42	3.36	0.47	100	3.97		
	UA1119-15	72.65	0.18	15.28	1.20	0.26	0.67	1.90	4.49	3.10	0.27	100	0.82		
	UA1119-22	72.67	0.07	14.92	1.96	0.03	0.39	1.81	4.80	3.01	0.34	100	-0.14		
	UA1119-25	72.84	-0.03	15.59	2.06	-0.18	0.34	2.29	3.97	2.92	0.20	100	0.29		
	UA1119-2	73.04	0.12	14.58	1.32	-0.03	0.86	2.27	4.47	3.06	0.31	100	4.78		
	UA1119-17	73.12	0.02	15.37	1.40	0.04	0.25	2.10	4.18	3.18	0.33	100	-0.59		
	UA1119-7	73.23	0.27	14.50	1.75	-0.03	0.70	1.68	4.29	3.30	0.31	100	4.92		
	UA1119-24	73.27	0.06	14.03	2.03	-0.11	0.47	1.93	4.37	3.64	0.32	100	3.02		
	UA1119-31	73.32	0.18	14.66	1.66	0.25	0.25	1.67	4.10	3.45	0.46	100	2.62		
	UA1119-3	73.39	0.11	14.85	1.26	0.06	0.74	1.51	4.41	3.24	0.43	100	6.50		
	UA1119-29	73.76	0.08	14.54	1.26	0.26	0.11	1.88	3.95	3.80	0.36	100	3.79		
	UA1119-23	74.04	0.08	14.14	1.49	0.12	0.37	1.74	4.55	2.99	0.48	100	2.24		
	UA1119-9	74.07	0.15	13.65	1.64	0.34	0.21	1.63	4.17	3.74	0.38	100	3.12		
	UA1119-1	74.37	0.32	13.62	1.53	0.21	0.11	2.17	4.11	3.20	0.36	100	5.29		
	UA1119-16	74.43	0.02	13.83	1.30	0.55	0.00	1.59	4.22	3.78	0.30	100	2.03		
	UA1119-27	74.49	0.40	14.19	1.01	0.24	0.27	1.44	4.23	3.09	0.63	100	2.53		

UA1119-13	74.56	-0.03	14.54	1.30	-0.04	0.07	1.66	4.27	3.41	0.26	100	1.78	
UA1119-5	74.57	0.20	13.20	1.46	0.74	0.06	1.71	4.41	3.41	0.24	100	7.28	
UA1119-8	74.77	0.15	13.39	1.44	0.08	0.14	1.85	4.06	3.78	0.33	100	3.34	
UA1119-20	74.88	0.18	13.57	1.42	0.36	0.45	1.83	4.33	2.70	0.28	100	3.16	
UA1119-14	74.90	0.00	13.89	1.50	0.17	0.11	1.60	3.45	4.05	0.32	100	2.68	
UA1119-30	74.91	0.00	14.62	1.47	-0.15	0.14	1.62	4.06	2.97	0.35	100	3.89	
UA1119-19	74.97	-0.11	14.18	1.13	-0.24	0.53	2.19	4.12	2.92	0.33	100	5.47	
UA1119-21	75.49	0.10	14.29	1.32	0.20	0.28	1.86	3.52	2.70	0.23	100	5.56	
UA 1119-22	72.96	0.27	15.11	1.60	0.01	0.38	2.22	4.29	2.90	0.25	100	3.12	
UA 1119-19	73.36	0.29	14.60	1.70	0.03	0.37	1.98	4.21	3.13	0.32	100	6.27	
UA 1119-11	73.38	0.21	14.41	1.76	0.07	0.37	2.03	4.29	3.12	0.36	100	1.24	
UA 1119-12	73.39	0.26	14.62	1.91	0.10	0.37	2.05	3.94	2.96	0.39	100	1.87	
UA 1119-26	73.52	0.20	14.41	1.66	0.07	0.39	2.03	4.30	3.03	0.40	100	2.47	
UA 1119-2	73.55	0.24	14.55	1.62	0.01	0.42	1.95	4.07	3.26	0.33	100	3.50	
UA 1119-17	73.56	0.28	14.26	1.59	0.03	0.38	2.06	4.49	2.99	0.36	100	2.69	
UA 1119-9	73.58	0.28	14.60	1.52	0.08	0.39	1.86	4.22	3.13	0.33	100	3.00	
UA 1119-16	73.67	0.17	14.42	1.53	0.06	0.38	1.95	4.17	3.27	0.36	100	1.70	
UA 1119-7	73.69	0.17	14.54	1.57	0.03	0.41	1.99	4.17	3.11	0.33	100	3.14	
UA 1119-14	73.74	0.20	14.65	1.39	0.06	0.24	1.87	4.37	3.17	0.30	100	2.35	
UA 1119-13	73.94	0.21	14.32	1.53	0.03	0.46	1.81	4.21	3.16	0.33	100	2.30	
UA 1119-3	74.23	0.32	14.35	1.50	0.05	0.31	1.85	3.66	3.39	0.34	100	2.77	
UA 1119-24	74.35	0.16	14.21	1.47	0.04	0.24	1.66	4.21	3.33	0.32	100	3.57	
UA 1119-25	74.41	0.20	14.11	1.41	0.07	0.31	1.67	4.20	3.31	0.31	100	3.79	
UA 1119-6	74.49	0.22	14.24	1.27	0.01	0.32	1.59	4.19	3.36	0.31	100	1.95	
UA 1119-5	75.31	0.16	13.79	1.20	0.04	0.23	1.54	4.00	3.43	0.31	100	3.33	
Mean	73.61	0.20	14.36	1.61	0.06	0.37	1.91	4.33	3.22	0.34	100	2.92	72
StDev	0.99	0.12	0.62	0.36	0.17	0.20	0.30	0.30	0.34	0.08	0	1.64	
NGRIP-AD86	72.60	0.32	14.82	1.82	0.04	0.22	2.04	4.51	3.30	0.33	100	4.69	
NGRIP-AD86	73.66	0.38	14.18	1.45	-0.08	0.42	2.05	4.14	3.22	0.59	100	9.52	
NGRIP-AD86	73.76	0.02	13.90	1.21	-0.09	0.18	2.27	4.38	4.05	0.31	100	4.68	
NGRIP-AD86	74.25	0.24	13.65	1.11	0.26	0.31	2.26	4.88	2.73	0.32	100	4.63	
NGRIP-AD86	74.66	0.25	13.73	1.06	0.08	0.37	2.02	4.27	3.24	0.32	100	0.00	
NGRIP-AD86	74.83	0.10	14.13	1.48	-0.24	0.44	1.51	4.31	3.13	0.30	100	1.54	
NGRIP-AD86	75.93	0.13	13.14	0.98	-0.13	0.05	1.27	4.78	3.38	0.46	100	-0.05	
Mean	74.24	0.21	13.94	1.30	-0.02	0.28	1.92	4.47	3.29	0.38	100	3.57	7
StDev	1.05	0.12	0.52	0.30	0.16	0.14	0.38	0.27	0.40	0.11	0	3.39	
QUB-108-37	73.28	0.23	14.62	1.38	-0.07	0.42	2.19	4.83	2.83	0.31	100	4.11	
QUB-108-46	73.43	0.37	14.86	1.18	-0.31	0.68	1.87	3.89	3.66	0.37	100	5.28	
QUB-108-31	74.40	0.10	14.21	1.17	-0.03	0.42	2.31	4.32	2.82	0.28	100	5.66	
QUB-108-15	75.30	0.18	13.72	1.10	-0.17	0.66	1.92	4.00	3.00	0.30	100	3.47	
QUB-108(Mo	71.75	0.13	15.25	3.18	0.05	0.29	0.93	4.40	3.83	0.18	100	3.32	
QUB-108(Mo	74.90	0.16	14.07	1.81	0.04	0.46	1.75	3.94	2.62	0.25	100	2.35	
QUB-108(Mo	75.72	0.26	14.11	1.59	-0.26	0.16	1.61	3.60	2.85	0.37	100	5.36	
Mean	74.11	0.20	14.41	1.63	-0.11	0.44	1.80	4.14	3.09	0.29	100	4.22	7
StDev	1.38	0.09	0.53	0.73	0.14	0.19	0.45	0.41	0.47	0.07	0	1.25	
DOM-26	71.49	0.33	15.02	2.05	0.11	0.88	2.68	4.20	3.01	0.23	100	1.29	
DOM-27	72.03	0.33	14.79	2.10	0.07	0.69	2.44	3.89	3.09	0.55	100	6.17	
DOM-6	73.67	0.20	14.54	1.59	0.06	0.37	1.91	4.26	3.07	0.32	100	1.94	
DOM-34	73.70	0.28	14.48	1.53	0.04	0.42	1.96	4.10	3.05	0.45	100	2.27	
DOM-5	73.84	0.23	14.25	1.54	0.05	0.41	1.95	4.12	3.16	0.45	100	6.21	

DOM-23	74.15	0.25	14.17	1.37	0.06	0.35	1.74	4.26	3.27	0.38	100	3.61	
Mean	73.15	0.27	14.54	1.70	0.07	0.52	2.11	4.14	3.11	0.40	100	3.58	6
StDev	1.10	0.05	0.32	0.30	0.02	0.22	0.36	0.14	0.09	0.11	0	2.16	
JAM-33	73.55	0.20	14.62	1.51	0.07	0.42	1.90	4.32	3.04	0.36	100	1.11	
JAM-3	73.59	0.22	14.34	1.60	0.06	0.48	2.03	4.10	3.11	0.46	100	4.54	
JAM-27	73.66	0.21	14.55	1.55	0.08	0.37	1.95	4.20	3.03	0.40	100	1.94	
JAM-9	73.70	0.22	14.33	1.38	0.03	0.41	1.86	4.59	3.17	0.31	100	3.42	
JAM-14	73.74	0.21	14.55	1.62	0.04	0.37	1.92	4.08	3.09	0.38	100	3.38	
JAM-34	73.79	0.19	14.43	1.55	0.09	0.36	1.92	4.25	3.06	0.37	100	1.09	
JAM-10	74.19	0.19	14.13	1.56	0.09	0.42	1.89	3.97	3.03	0.51	100	5.72	
Mean	73.75	0.21	14.42	1.54	0.06	0.40	1.92	4.22	3.08	0.40	100	3.03	7
StDev	0.21	0.01	0.17	0.08	0.02	0.04	0.05	0.20	0.05	0.07	0	1.75	