



# An Update on the Alaska Tephra Database, Alaska Volcano Observatory





FT13B-213

Katherine M. Mulliken<sup>1</sup>, Cheryl Cameron<sup>1</sup>, Scott Crass<sup>1</sup>, Janet Schaefer<sup>1</sup>, Kristi Wallace<sup>2</sup>

**IAVCEI 2017 Scientific Assembly** Portland, Oregon

#### What is the Alaska Tephra Database?

Newest module of the Alaska Volcano Observatory (AVO) Geologic Database of Information on Volcanoes in Alaska (GeoDIVA). The Alaska Tephra Database search interface is going out for review soon! After incorporating peer-review comments, we hope to publish within a year.

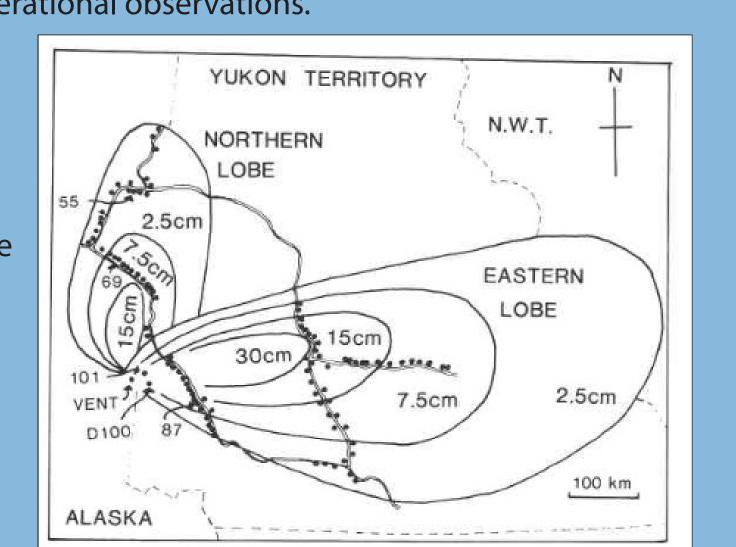
- GeoDIVA is the backend of AVO's public and internal websites. It contains information to support AVO in areas of eruption response, scientific investigations, and infomation dissemination to the public. Information stored in GeoDIVA includes eruption histories for Pleistocene-present volcanoes, station and sample data, references, whole-rock geochemistry, images, petrographic data, and operational observations.

#### Why develop the Alaska Tephra Database?

- Information on tephra (volcanic ash) deposits in Alaska is dispersed in hundreds of publications spanning numerous research disciplines.
- Understanding the distributions of historical and prehistoric tephra will aid in evaluation of future volcanic ash-related hazards, and in understanding the magnitude and frequency of eruptions.
- In addition, tephrochronology (use of tephra layers for correlation) is a multi-disciplinary research tool.
- Key chronostratigraphic markers may be used to link marine, lacustrine, and terrestrial
- Information on tephra is valuable to volcanology, tsunami and seismic hazards analysis,

B.J.L. Jensen et al. / Quaternary Science Reviews 63 (2013) 91-108

paleoenvironmental studies, and archaeology.



<sup>1</sup>White River Ash east and north lobe contours from Downes (1985).

#### Alaska Tephra Database Goals

Make all Alaska tephra data readily accessible in one searchable interface:

- Previously, Alaska tephra data have been dispersed in publications. As part of Alaska Tephra Database development, over 600 publications were reviewed for tephra sample or geochemical information for inclusion into the database.

To support AVO hazard assessments and eruption response:

- Having tephra deposit information, such as physical and chemical characteristics, distribution, age, etc., in one location is highly valuable and allows for greater analytical/interpretive potential.

#### • To provide a means for and promote tephra correlations:

coefficients.

#### • To encourage researchers to share data and promote specific data practices:

- Tephra data reporting is not standardized; however, we will encourage database contributions with recommended data fields.

#### Published vs Unpublished Alaska Tephra Data

• Currently, the Alaska Tephra Database contains published data that will be publicly database contributions, we are developing user profiles to allow researchers to

- Correlation of tephra requires an understanding of the age, physical, and chemical characteristics of tephra deposits. A comprehensive database of Alaska tephra will make these data easily accessible and provide an interface for calculating similarity

searchable; the database also stores AVO unpublished data. In an effort to encourage upload unpublished data and set permissions. A researcher may allow unpublished data to be publicly available, or may specifiy certain users that can access it.

# What Information is Stored in the Alaska Tephra Database?

- Alaska Tephra Lab Number (AT#)

- Source Volcano

#### Station and sample Information:

- Description (sample or location) - Age

Pavlof plume, March 28, 2016.

inor ashfall occurred at Nelsor

agoon, 48 miles NE of Pavlof, as

Table 1 from Jensen and others

glass geochemistry data on tephra

mples from the Palisades along

(2012), containing major oxide

e Yukon River, Alaska.

Reference or Author

Geologist (collector)

Tephra Unit Name

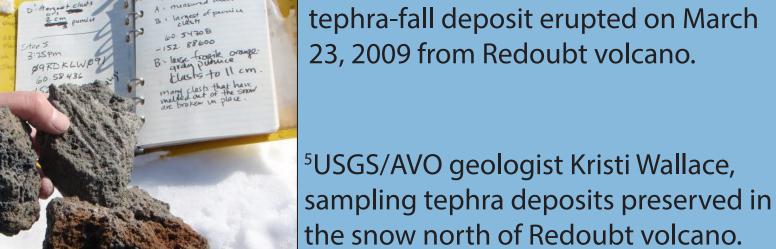
a result of this eruption.

- Station name, geologist, date visited, location coordinates, description, comments, etc. - Sample name, date sampled, possible source volcano, sample type (bulk, hand-picked pumice, etc.), description, color, comments, tephra name, alternative

- Reference, table number in reference, table title, table comments.
- secondary standards, analytical conditions.

- Sample age, age error, age prefix/suffix, method of age determination, reference, notes. - Both absolute ages and relative ages are stored in the database.

- When possible, tephra samples have been linked to eruptions in the recently expanded eruption history module of GeoDIVA, which now includes prehistoric eruptions (Holocene and Pleistocene-aged).



### • We have recently expanded the Alaska Volcano Observatory eruption database to include information on orehistoric eruptions and as part of tephra data entry, samples were linked to eruptions. This will allow users to search for tephra samples and analyses (and eventually rock samples and whole-rock analyses) from specific Number of eruptions in database: 484 Historical: 257

#### Holocene: 144 Pleistocene: 83 Number of tephra samples linked to an eruption: 2,101 Min/Max/Median number of tephra samples linked to an eruption: - Min: 1 sample (18 eruptions)

Alaska Prehistoric Eruption Database

- Max: 458 samples (Redoubt 2009) - Median: 5 samples (five eruptions)

<sup>6</sup>Right: Figure 6 from Wallace and others (2014). Subaerial Haye

\_eft: Figure 10 from azard assessment.

#### <sup>1</sup>Alaska Division of Geological & Geophysical Surveys, Fairbanks AK <sup>2</sup>U.S. Geological Survey, Anchorage AK

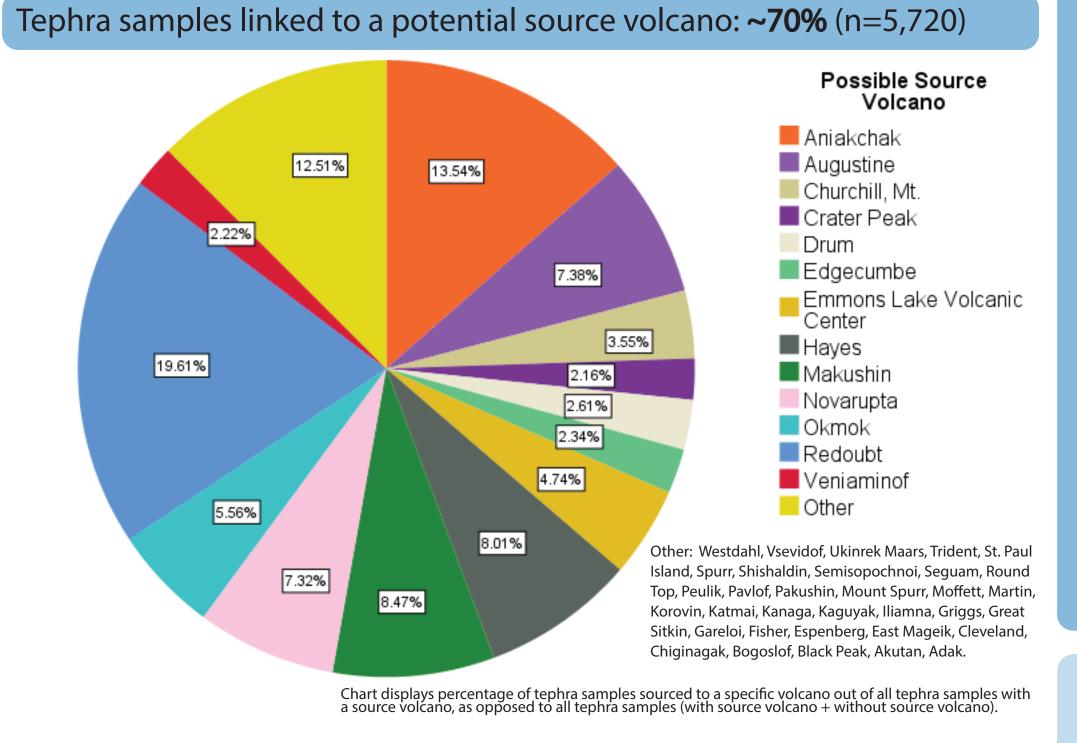
#### What Data are in the Alaska Tephra Database?

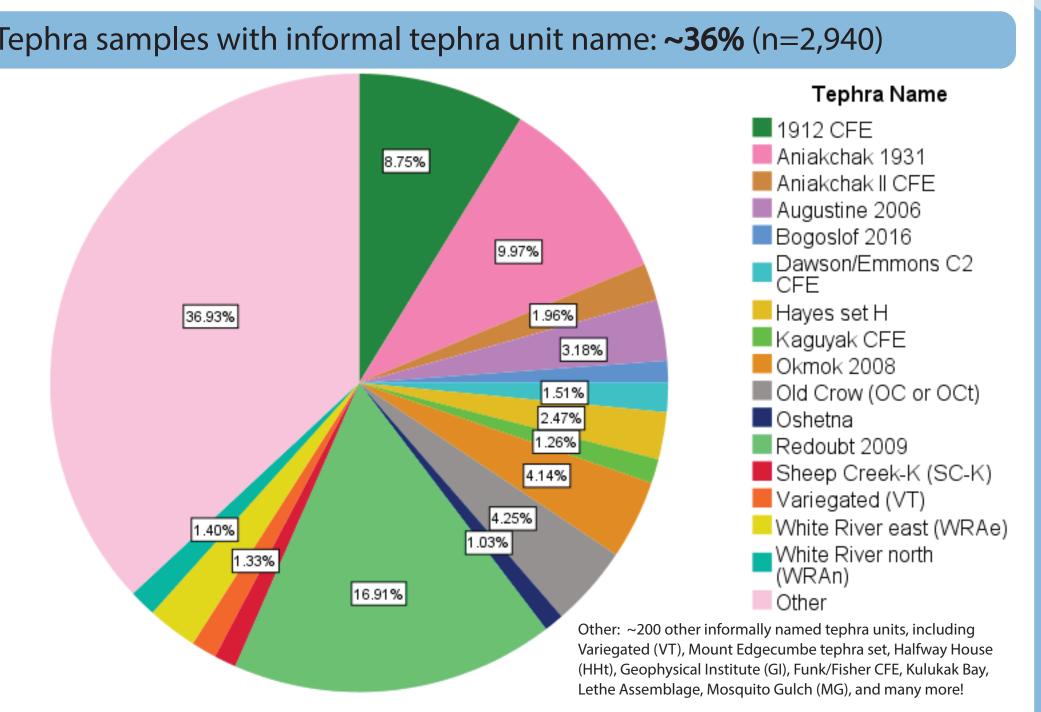
- Number of tephra samples: about 8,000. ~5,700 are published samples, entered from >200 publications such as peer-
- Number of informally named tephras units: 217 ~2,940 tephra samples have an associated informal tephra name.
- Number of eruptions that tephra samples have been linked to: 74 ~2,101 tephra samples linked to eruptions.

reviewed journal articles, theses, dissertations, and reports.

 Number of volcanoes that tephra samples have been linked to: 55 ~5,720 tephra samples have been linked to a potential source volcano.

Percentage of total tephra samples with/without certain attributes (total n=8,069):





## **Data Dilemmas**

• Non-standardized tephra data reporting (see Bursik and others, 2015) complicated by publications spanning decades and changes in analytical techniques.

-Addressed by developing database fields to maximize garnering data from publications.

Tephra units with complicated nomenclature history: some tephra units have been given numerous names by independent researchers.

- Addressed by developing database fields to store alternate tephra names and tephra name comments.

· Samples reported as being a mix of multiple tephra units (re-worked)/with multiple geochemical population - Addressed by entering daughter samples with distinct tephra names/geochemistry, associated with original parent samples.

• Some authors reported tephra unit averages that were calculated by averaging analyses of multiple samples from different locations.

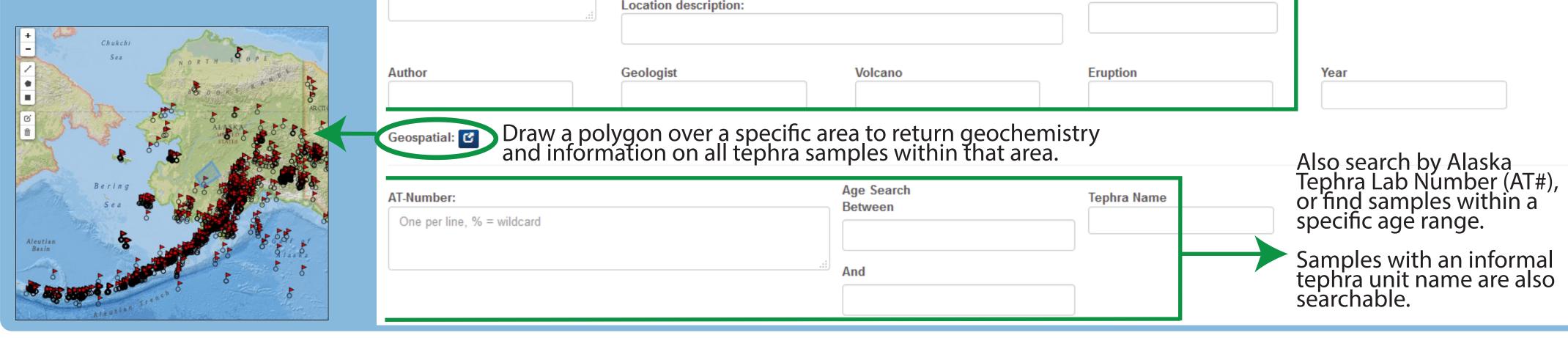
- Addressed by entering a unique sample for the tephra unit average geochemistry to be associated with.

Correlation of the Holocene Jarvis Creek, Tangle Lakes, Cantwell, and Hayes Tephras in South-Central and Central Alaska JAMES E. BEGÉT,\*\*† RICHARD D. REGER,‡ DEANNE PINNEY,\*\*‡ TOM GILLISPIE,§ AND KATHY CAMPBELL\* \*Department of Geology and Geophysics, University of Alaska, Fairbanks, Alaska 99775; ‡Department of Natural Resources, Alaska Division of Geologic and Geophysical Surveys, 3700 Airport Way, Fairbanks, Alaska 99709; §GDM Consultants, POB 7-3768, Fairbanks, Alaska 99707; and †Alaska Volcano Observatory, Geophysical Institute, University of Alaska, Fairbanks, Alaska 99775

The geochemistry, petrography, and distribution of the Jarvis Creek Ash (Péwé, 1965, 1975a) indicate that this tephra from the lower Delta River area of central Alaska is correlative with canic ash from sites in south-central Alaska near Tangle Lakes (upper Delta River area) and the anic glass compositions of distal Jarvis Creek and Tangle Lakes tephra samples are compo cano tephras across the Alaska Range and into central Alaska, a distance of more than 650 km. New geochronologic data for the Jarvis Creek Ash suggest it was deposited ca. 3660 ± 125 yr B.P., consistent with previous age estimates of tephra eruptions at the Hayes volcano. The name "Jarvis Creek Ash" has well-established priority with respect to "Cantwell ash" or other local names for

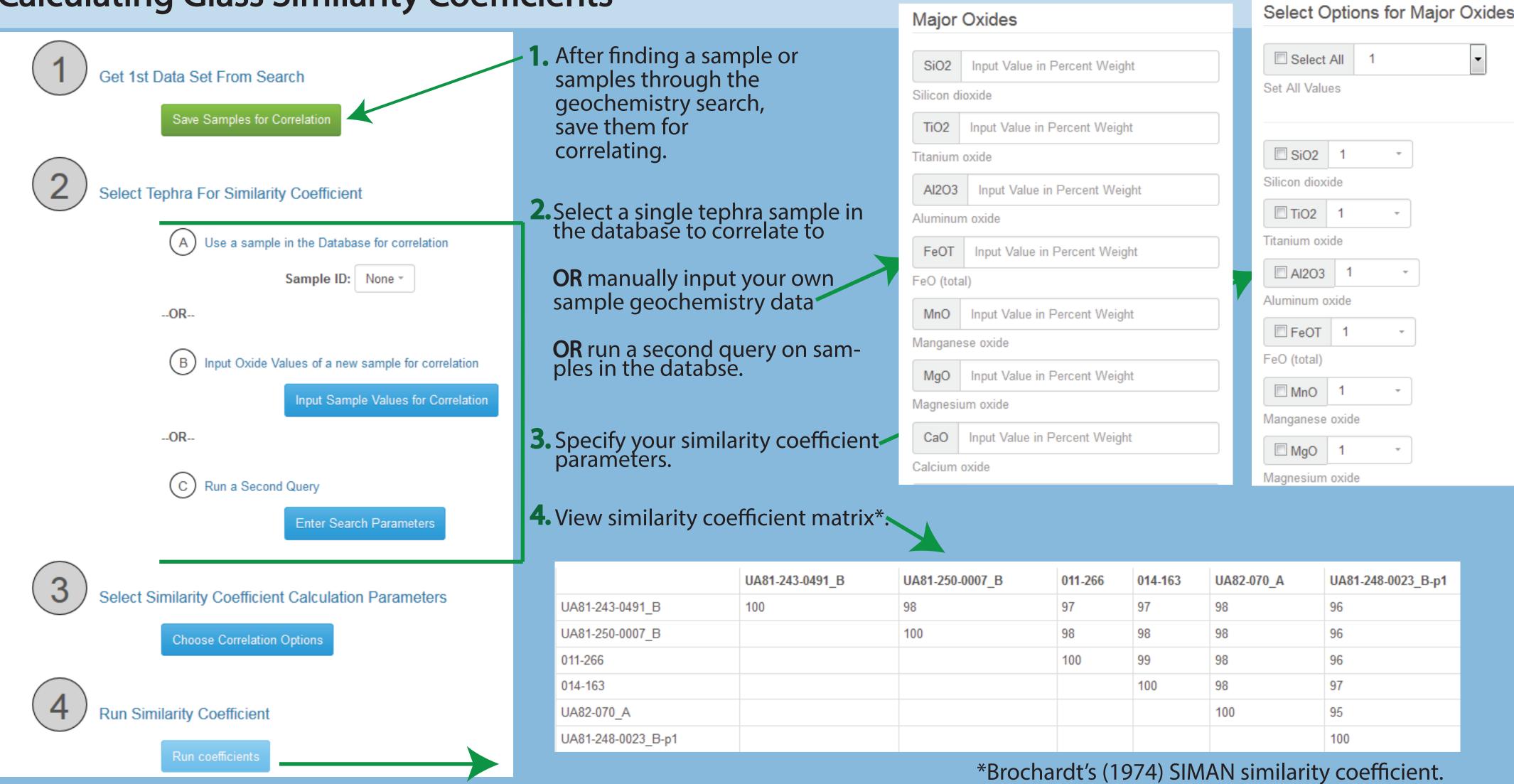
Beget and others (1991) formally correlated three informally named tephra units found independently in different areas of Alaska.

# One per line, % = wildcard



#### **Calculating Glass Similarity Coefficients**

Using the Alaska Tephra Database Geochemistry Search Interface



#### **Future Database Developments**

Acknowledgements

- Pre-generated queries of vetted reference datasets for marker horizons. • Store more detailed information on tephra physical characteristics.
- Store individual point data (glass and mineral).
- Store detailed processing information and workflow data from the Alaska Tephra Laboratory (U.S. Geological Survey AVO, Anchorage, AK).

#### Alaska Volcano Observatory website: avo.alaska.edu Information on Alaska volcanoes and eruptions, real-time monitoring data.

Find the Alaska Volcano Observatory Online

Volcano Notification sign-up: volcanoes.usgs.gov/vns2/ Written statements on the location, time, size of eruptions in Alaska; descriptions of plume paths.

Follow the Alaska Volcano Observatory on Social Media

Twitter handle @alaska\_avo Follow us on Facebook: alaska\_avo

Comments/Questions? cheryl.cameron@alaska.gov or katherine.mulliken@alaska.gov

olcano Observatory is a joint program of the U.S. Geological Survey (USGS), the Geophysical Institute of the University of Alaska Fairbanks (UAFGI), and the State of Alaska Division of Geological & Geophysical Surveys (ADGGS).

We thank GeoROC, EarthChem, the Smithsonian's Global Volcanism Program, and the State of Alaska GERILA project for their aid in database efforts.

his project was funded through the DGGS Cooperative Agreement with the USGS Volcano Hazards Program, Alaska Volcano Observatory. The Alaska

This poster has not undergone technical peer review and should not be used or cited as reviewed. Future reviewed publications may or may not change what is presented here.

## eget, J. E., Reger, R. D., Pinney, D., Gillispie, T., and Campbell, K., 1991, Correlation of the Holocene Jarvis Creek, Tangle Lakes, Cantwell, and Hayes tephras in south-central and central Alaska: Quaternary Research, v. 35, n.

rochardt, G. A., 1974, The SIMAN coefficient for similarity analysis: The Classification Society Bulletin 3(2):2-8. ursik, M., Pouget, S., Kuehn, S. C., Wallace, K. L., 2015, Tephra 2014 Consensus Document," "https://vhub.org/resources/3860.

wnes, H., 1985, Evidence for magma heterogeneity in the White River Ash (Yukon Territory): Canadian Journal of Earth Sciences, v. 22, n. 6, p. 929-934. andmoss, N., "A spectacular view to the northeast of the Pavlof eruption taken at 20,000 feet, by our friends at the U.S. Coast Guard." Alaska Volcano Observatory, id=93551, https://www.avo.alaska.edu/images/im-

ensen, B. J. L., Reyes, A. V., Froese, D. G., and Stone, D. B., 2013, The Palisades is a key reference site for the middle Pleistocene of eastern Beringia: new evidence from paleomagnetics and regional tephrostratigraphy: ternary Science Reviews, v. 63, p. 91-108, http://dx.doi.org/10.1016/j.quascirev.2012.11.035 Wallace, K.L. "Large pumice clasts from the tephra-fall deposit erupted on March 23, 2009; Redoubt volcano." Alaska Volcano Observatory, id=19481, https://www.avo.alaska.edu/images/image.php?id=19481. ⁵Wallace, K.L. "USGS/AVO geologist Kristi Wallace, sampling tephra deposits preserved in the snow north of Redoubt volcano." Alaska Volcano Observatory, id=18435, https://www.avo.alaska.edu/images/im-

Waythomas, C. F., and Miller, T. P., 2002, Preliminary volcano-hazard assessment for Hayes Volcano, Alaska: U.S. Geological Survey Open-File Report OF 02-0072, 33p. <sup>7</sup>Wallace, K.L., Coombs, M.L., Hayden, L.A., and Waythomas, C.F., 2014, Significance of a near-source tephra-stratigraphic sequence to the eruptive history of Hayes Volcano, south-central Alaska: U.S. Geological Survey Sci-

ntific Investigations Report 2014-5133, 32 p., available online at: http://pubs.usgs.gov/sir/2014/5133/

# <sup>4</sup>Large pumice clasts from the

tephra name, tephra name comments, references, images, lithology, and unit.

## Sample geochemistry (if reported) and analysis information:

Using an online interface, users will be able to search for tephra samples using these criteria:

- Compositional averages (oxide weight percents), standard deviation, number of analyses.

- Electron Probe Microanalysis (EPMA) details: laboratory and instrument, primary and

# Sample age information:

**GeoDIVA** integration:

