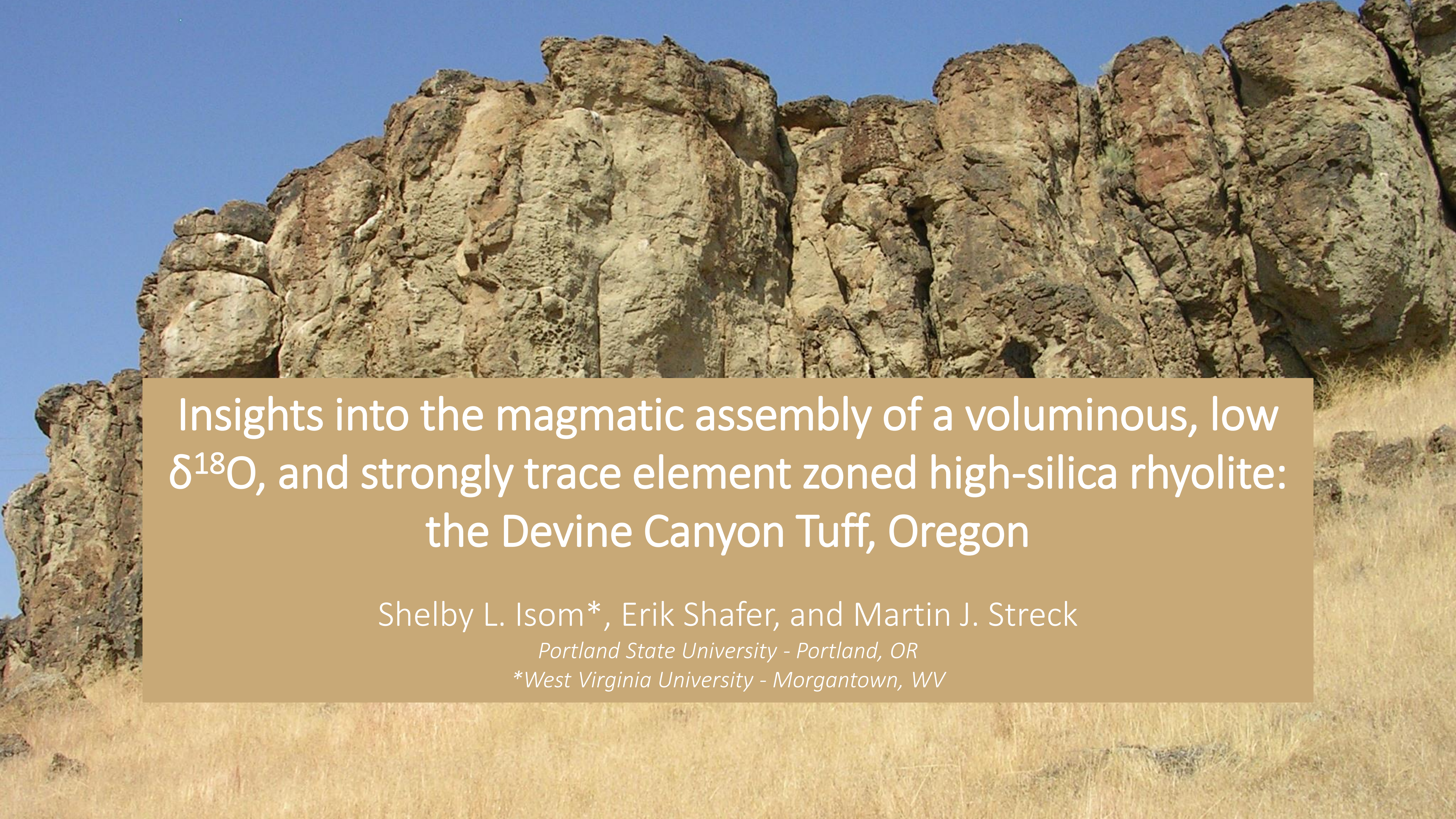

# Insights into the magmatic assembly of a voluminous, low $\delta^{18}O$, and strongly trace element zoned high-silica rhyolite: the Devine Canyon Tuff, Oregon

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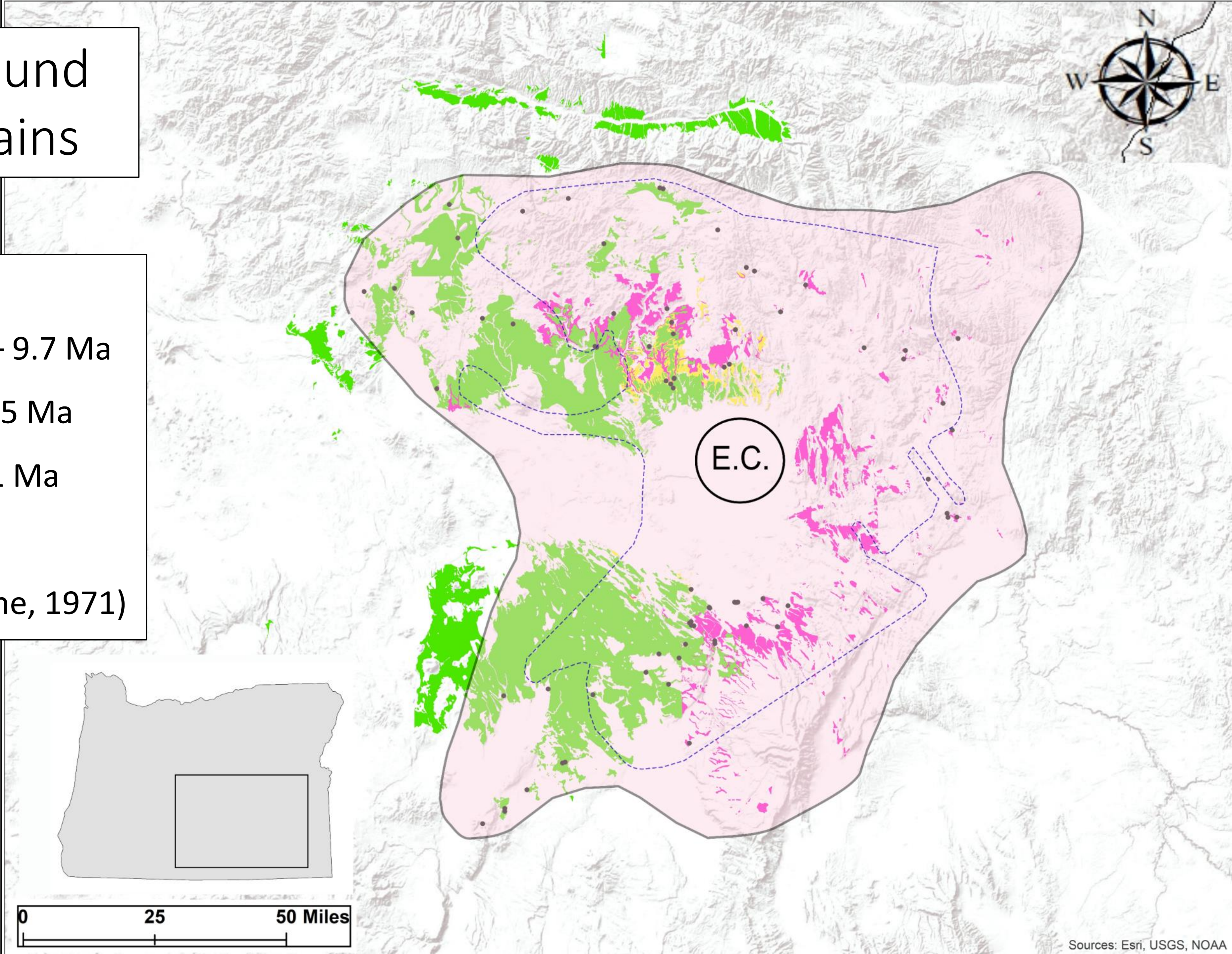
The Devine Canyon Tuff (DCT) exhibits:

- progressive increase of trace elements
- no distinct mineral populations
- low $\delta^{18}O$ values across all rhyolites & dacite
- late thermal overprint – zoned quartz phenocrysts

*Suggesting the DCT assembled and evolved in a single contiguous magma reservoir*

# Geologic Background
# The High Lava Plains

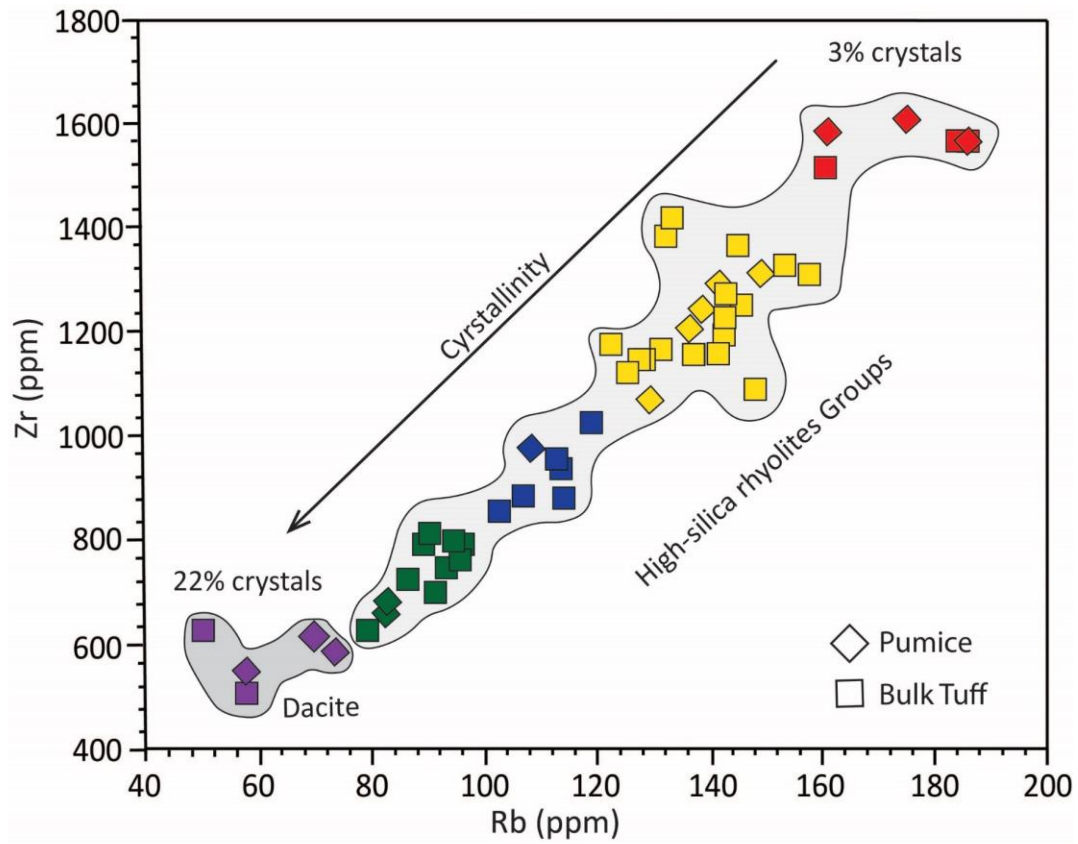


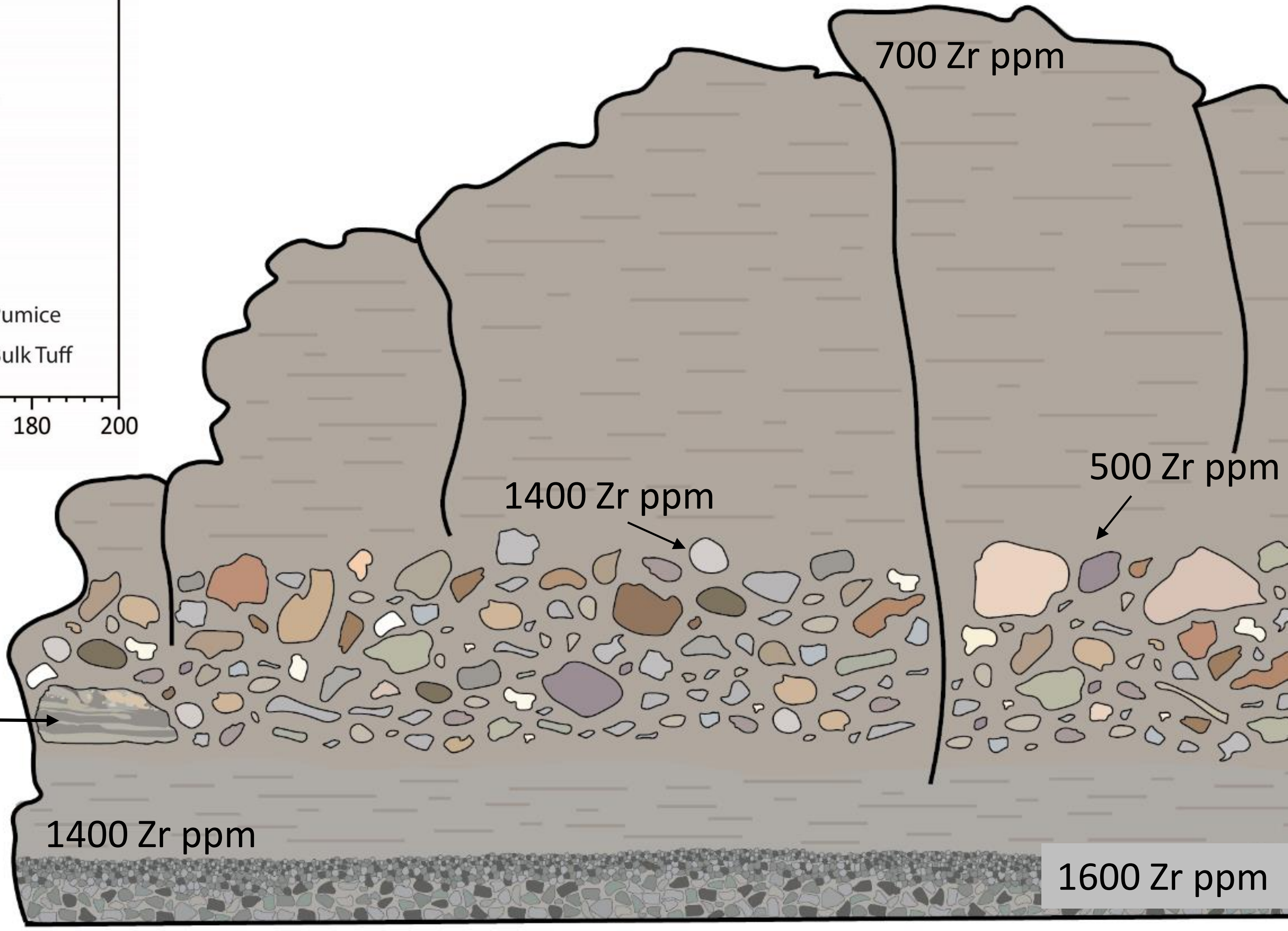

## Legend

- Devine Canyon Tuff (DCT) – 9.7 Ma
- Prater Creek Tuff (PCT) – 8.5 Ma
- Rattlesnake Tuff (RST) – 7.1 Ma
- Sampled DCT locations
- Previous DCT extent (Greene, 1971)

Isom, 2017

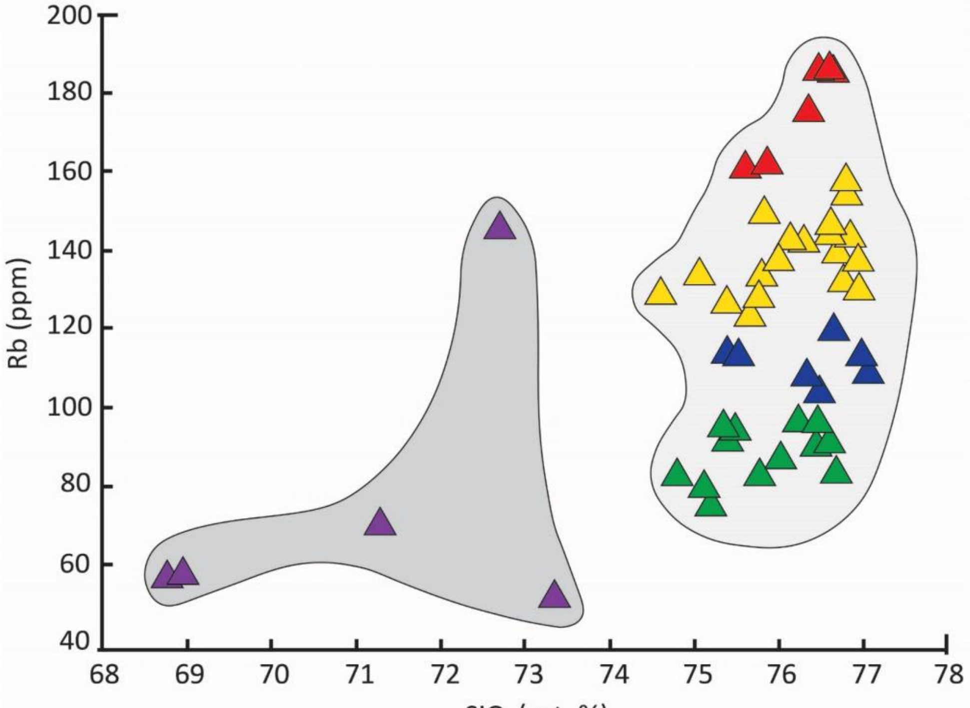
# Chemical and physical characteristics of the Devine Canyon Tuff

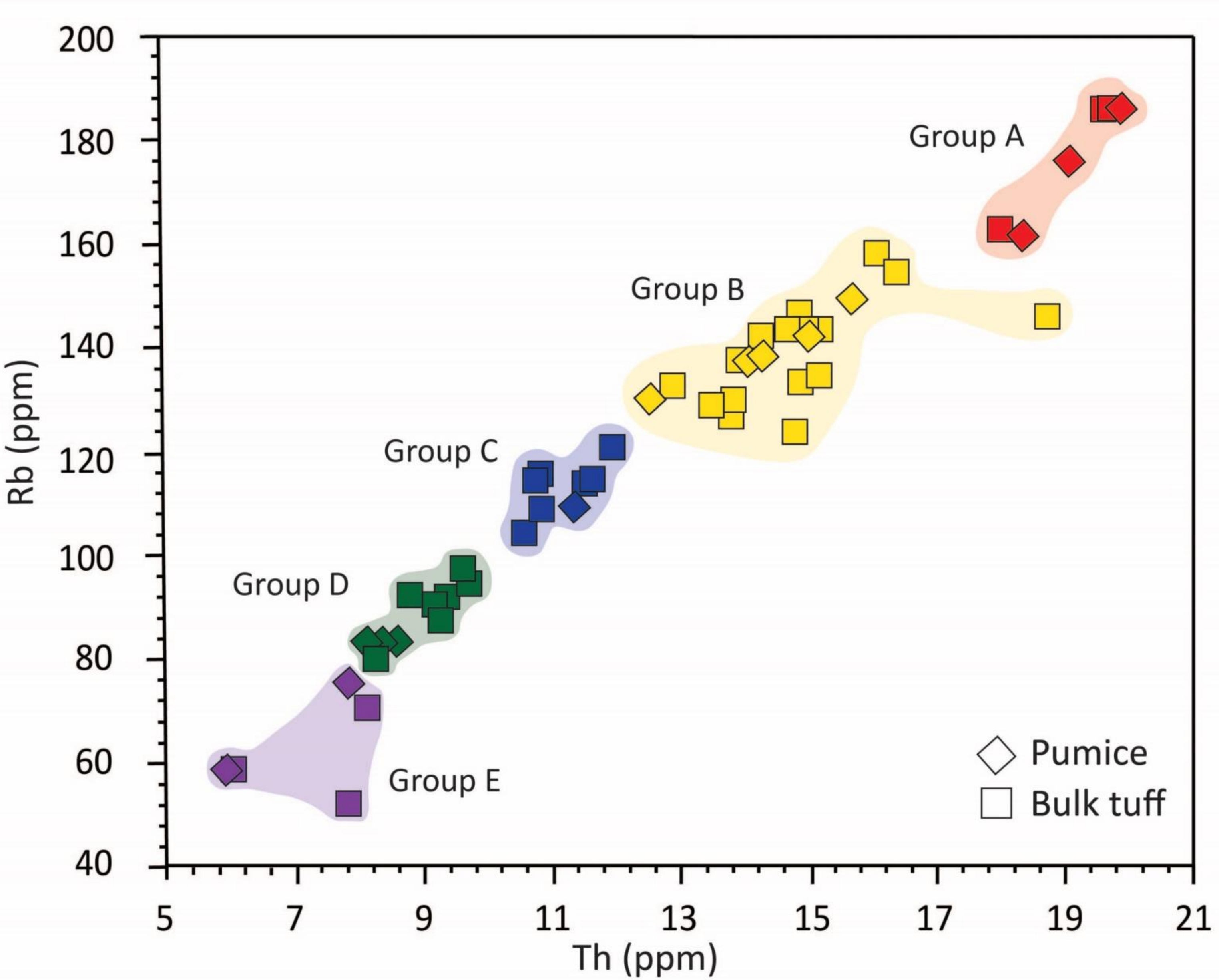



Banded pumices:
light band – 950 Zr ppm
dark band – 700 ppm

# Geochemical zonation of the Devine Canyon Tuff



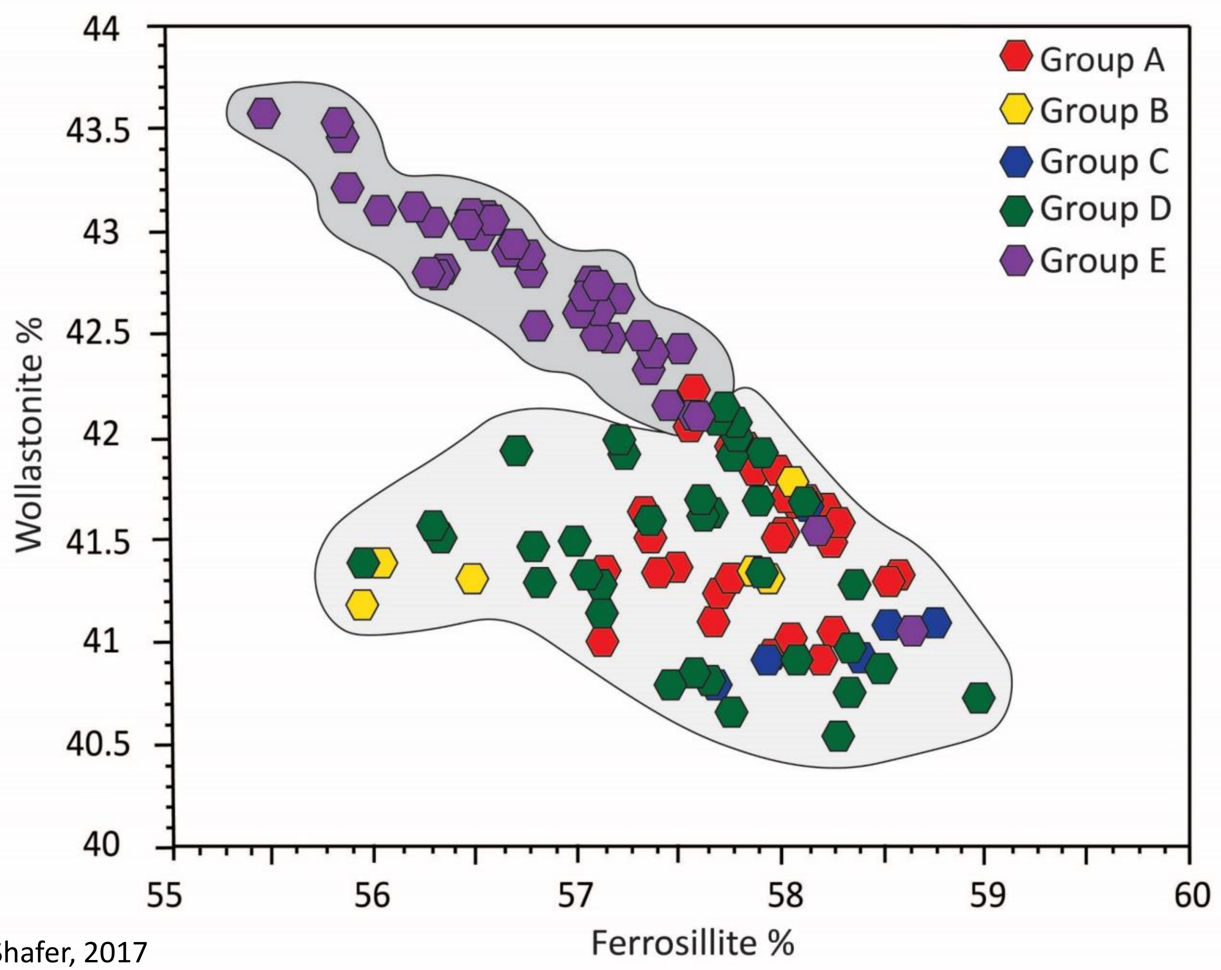

Isom, 2017; Shafer, 2017

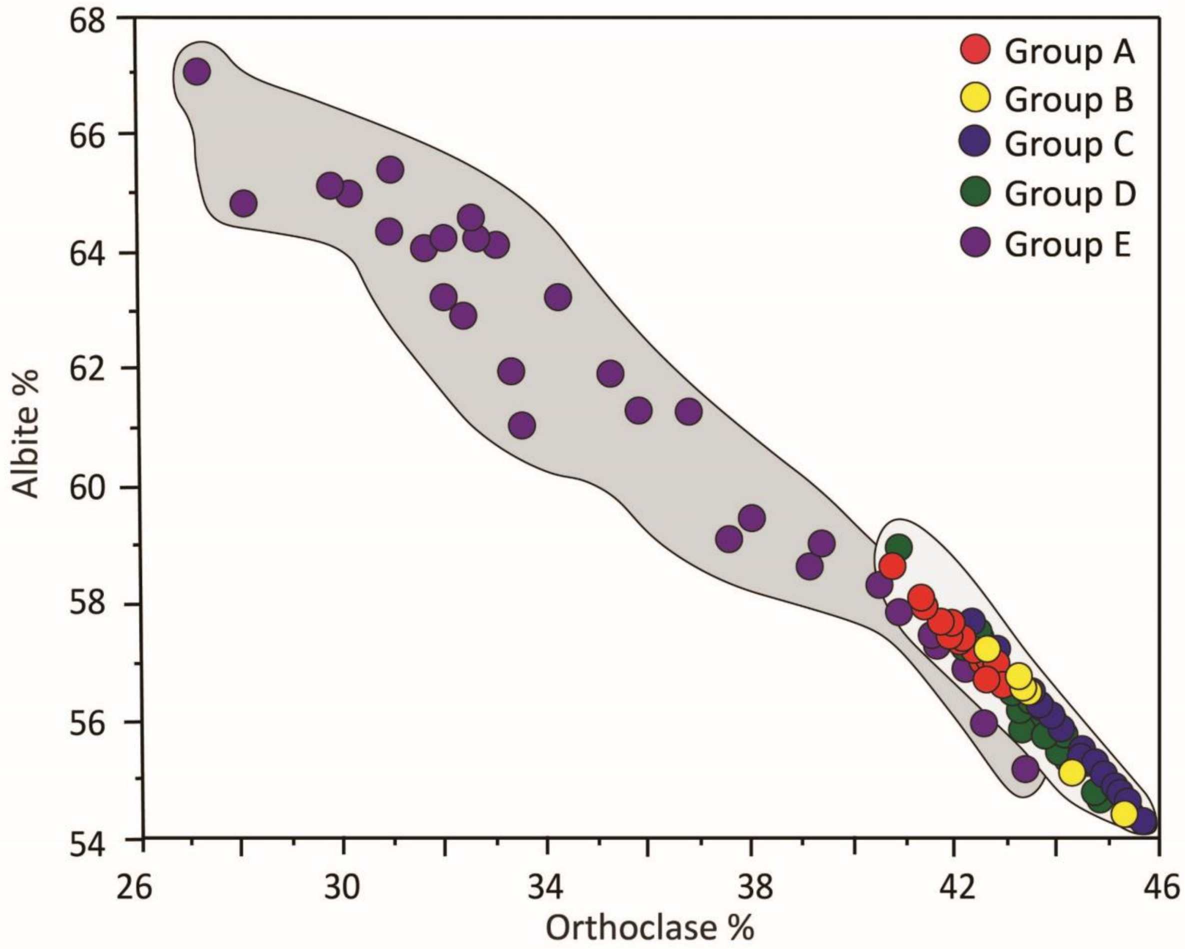
# Results - Pyroxene Mineral Data

- 2 pyroxene groups
- dacite group overlaps rhyolite groups
- distinct trend of increasing Ca for Group E

# Results - Feldspar Mineral Data

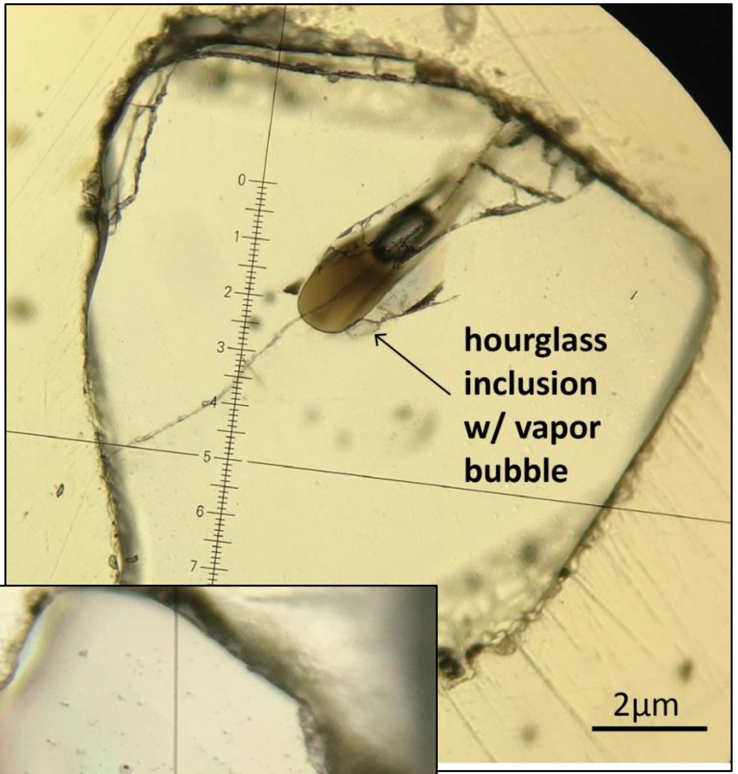
- 2 feldspar groups
- dacite group overlaps rhyolite groups
- Group E trends away with increasing Na

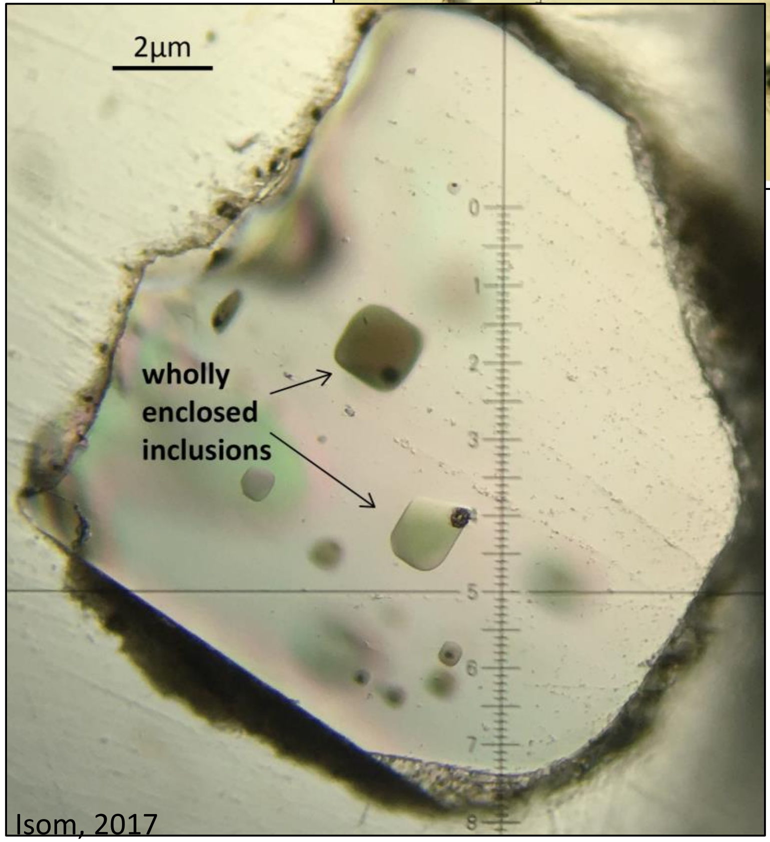


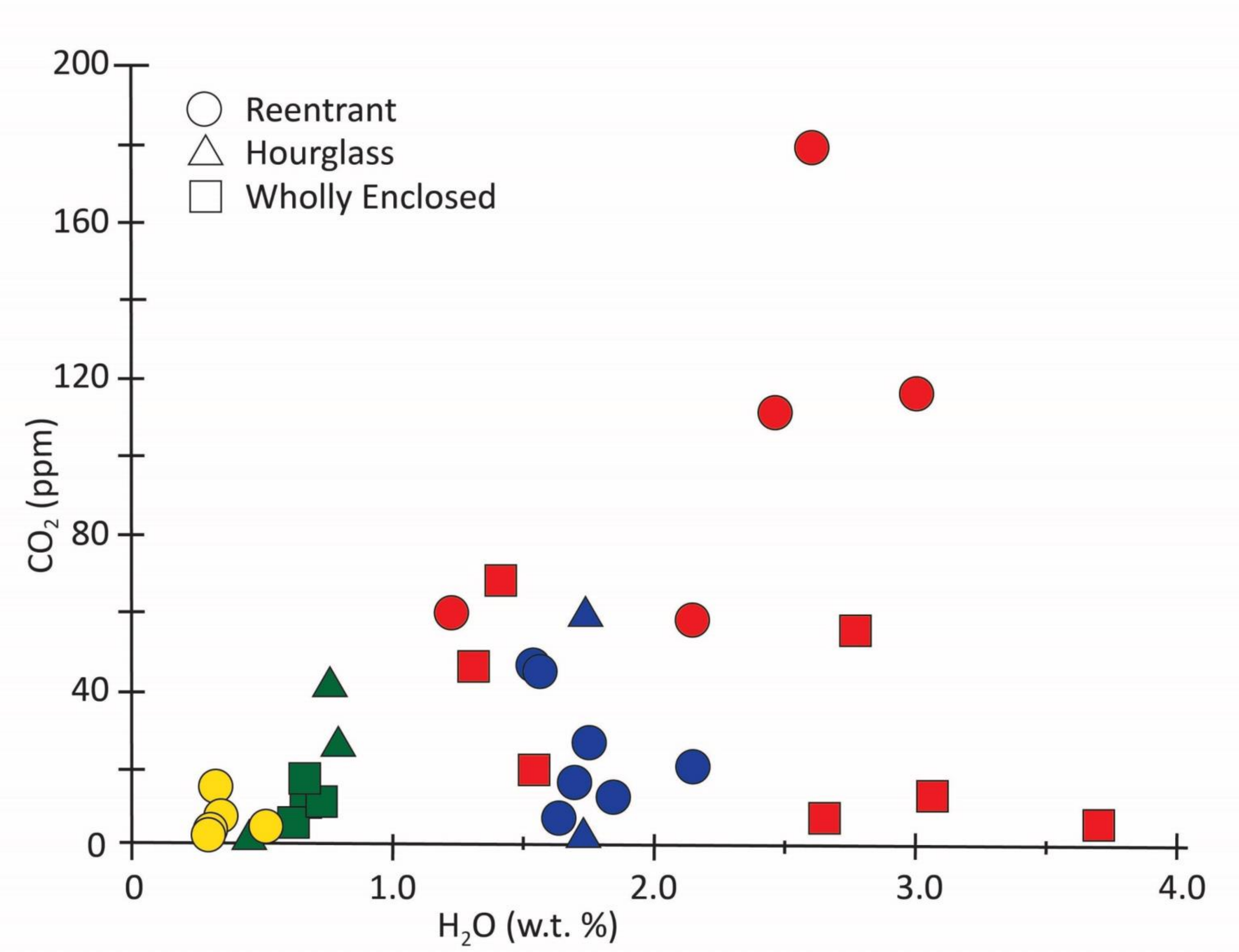




Shafer, 2017

# Results – $H_2O$ and $CO_2$ concentrations in melt inclusions



# Results – Stable Isotopes

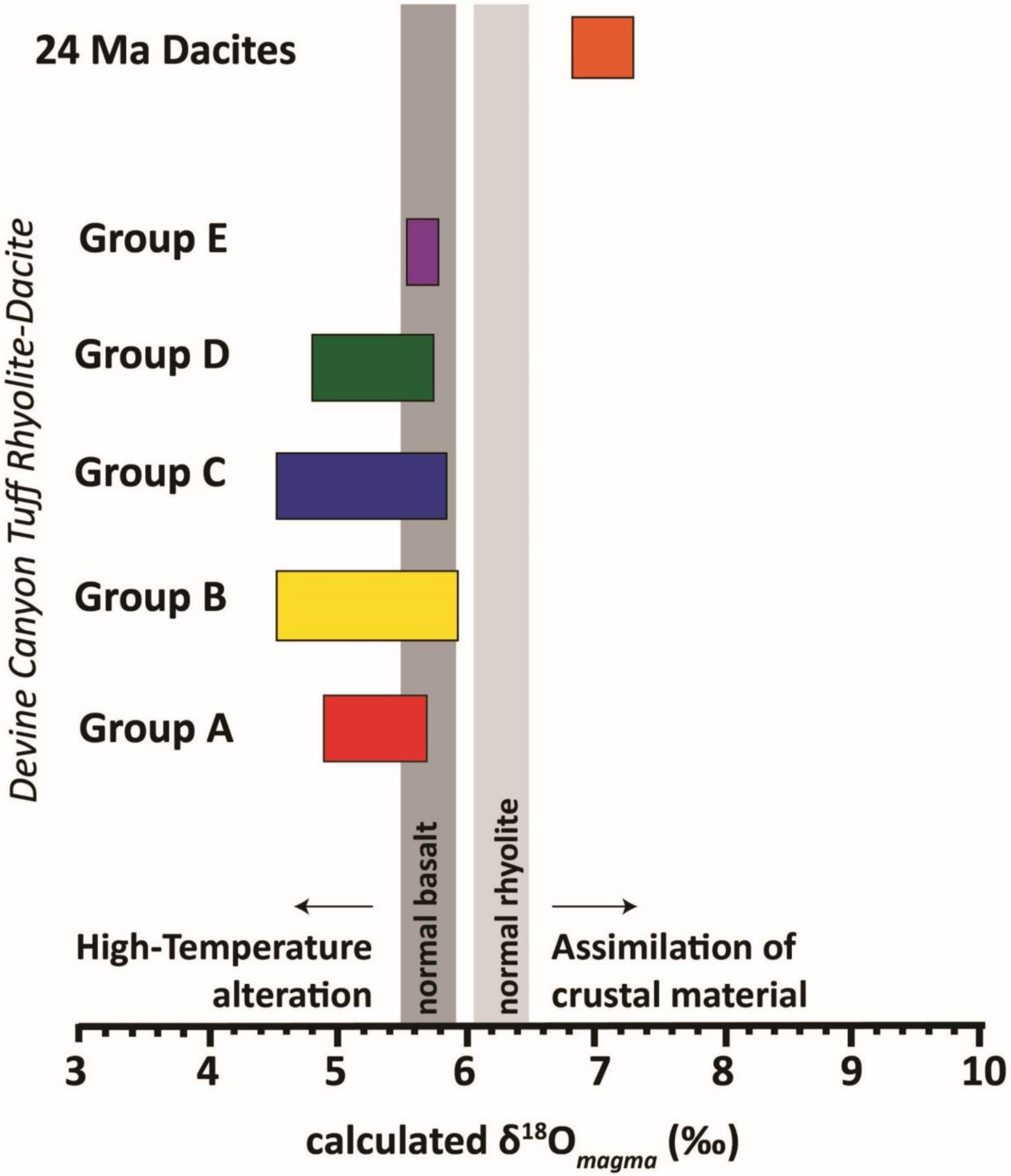
- bulk and single quartz and feldspar phenocrysts analyzed from all 5 DCT groups
- maximum range of $\delta^{18}O_{magma}$ values of ~2.0‰
- Groups B and C show the largest range in $\delta^{18}O_{magma}$ values
- 24 Ma dacites have higher $\delta^{18}O_{magma}$

**$\delta^{18}O_{magma}$ Calculations**

Quartz: $\delta^{18}O_{magma} = \delta^{18}O_{qtz} - 0.45$

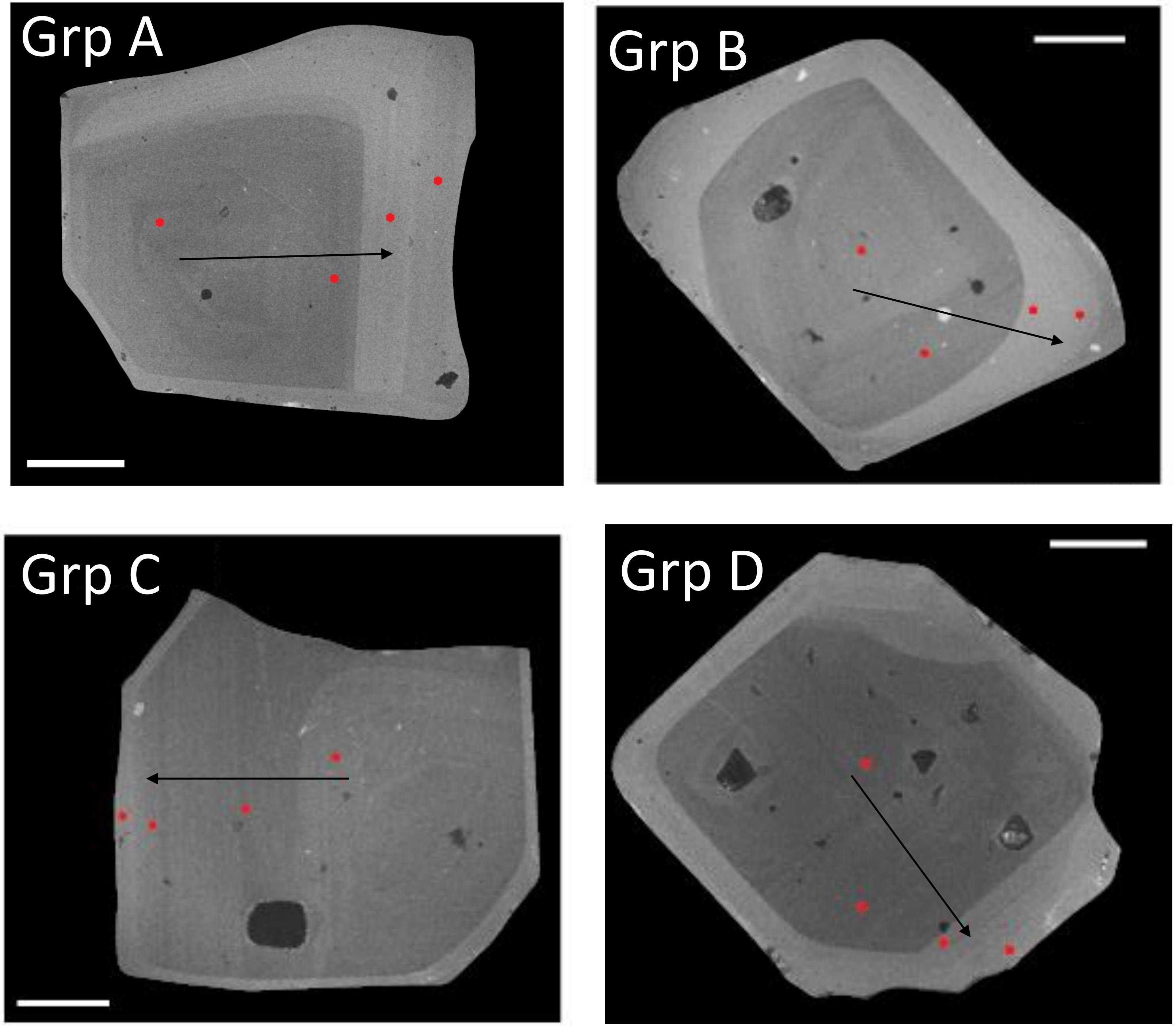
Alkali Feldspar: $\delta^{18}O_{magma} = \delta^{18}O_{feldspar} + 0.29$

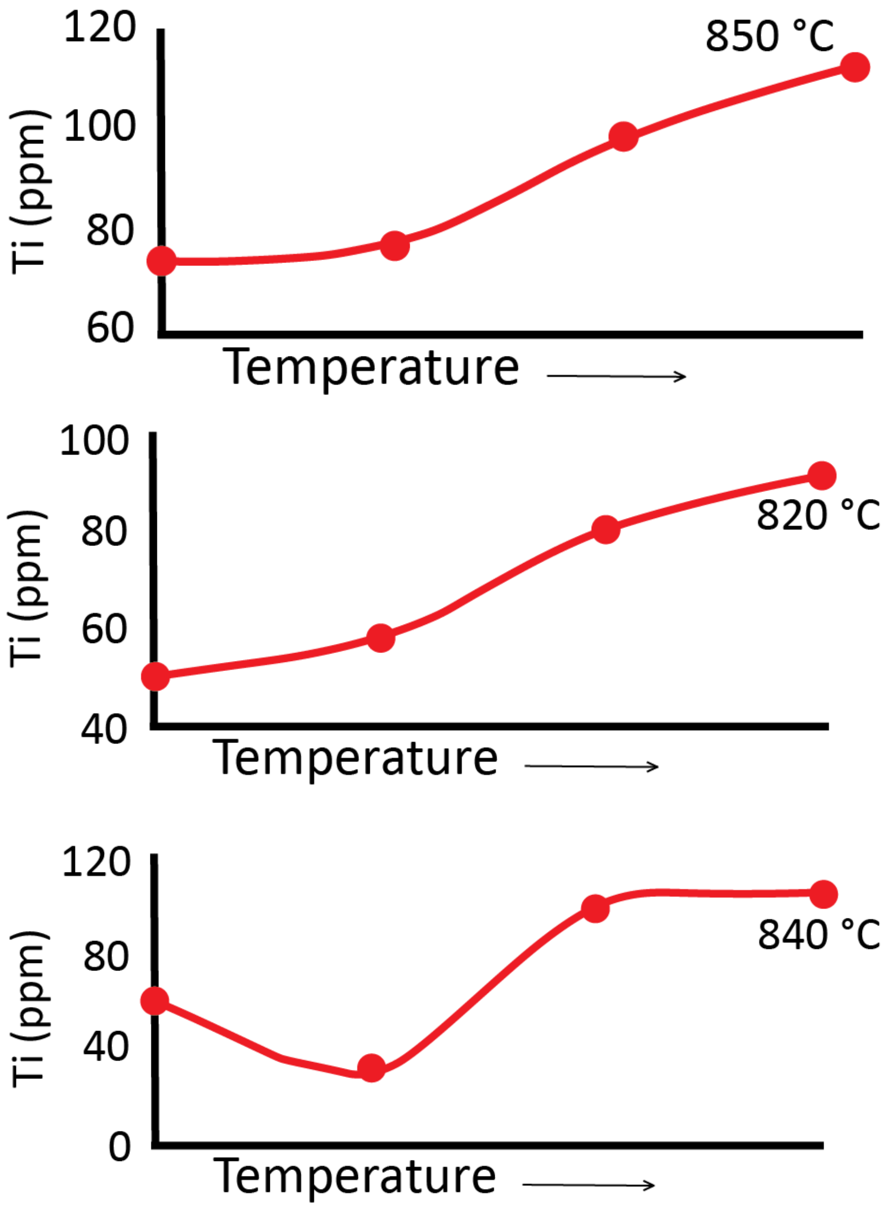
(Bindeman, 2008)




Isom, 2017; Standhaft, 2017

# Results – Temperature



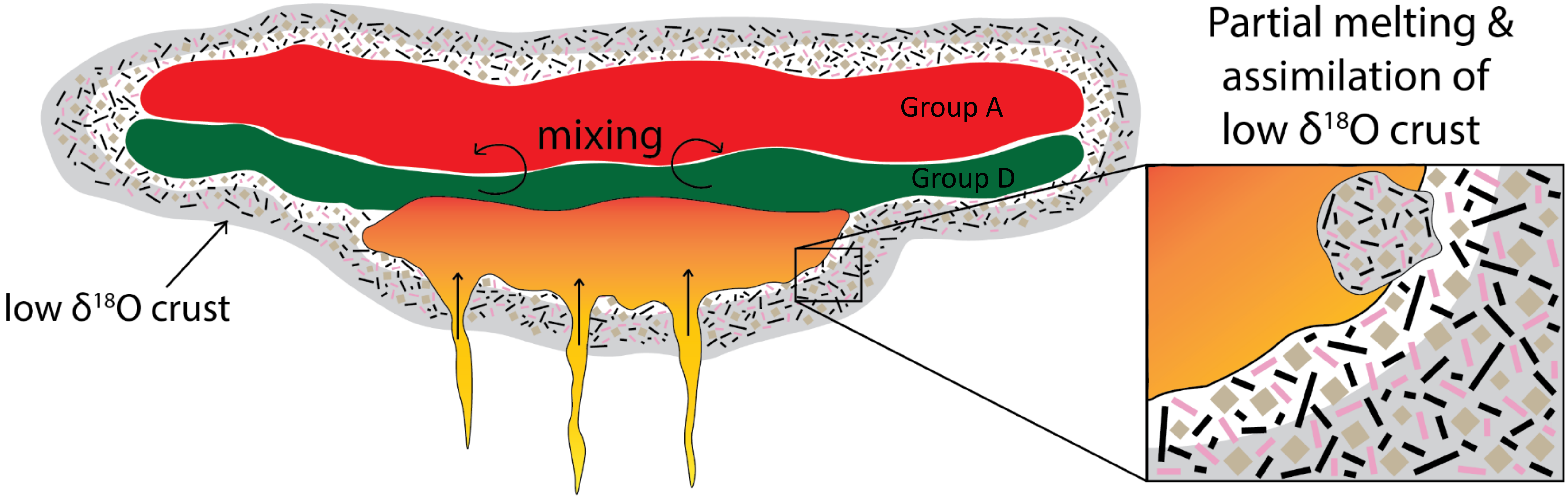

Isom, 2017

# Magmatic evolution model for the DCT

1. banded pumices exhibiting mingling of rhyolites and dacite magmas
2. decrease in crystallinity from E to A
3. greater than two-fold increase of incompatible trace elements
4. highest water concentration in rhyolite group A
5. two distinct, but overlapping feldspar and pyroxene groups
6. low and variable $\delta^{18}O_{magma}$ values for all groups (A-E)
7. increase in temperature, Ti-rich rims on all quartz phenocrysts (A-D)

*Simple Mixing Equation and Rayleigh Fractionation used when constructing evolution model for the Devine Canyon Tuff*

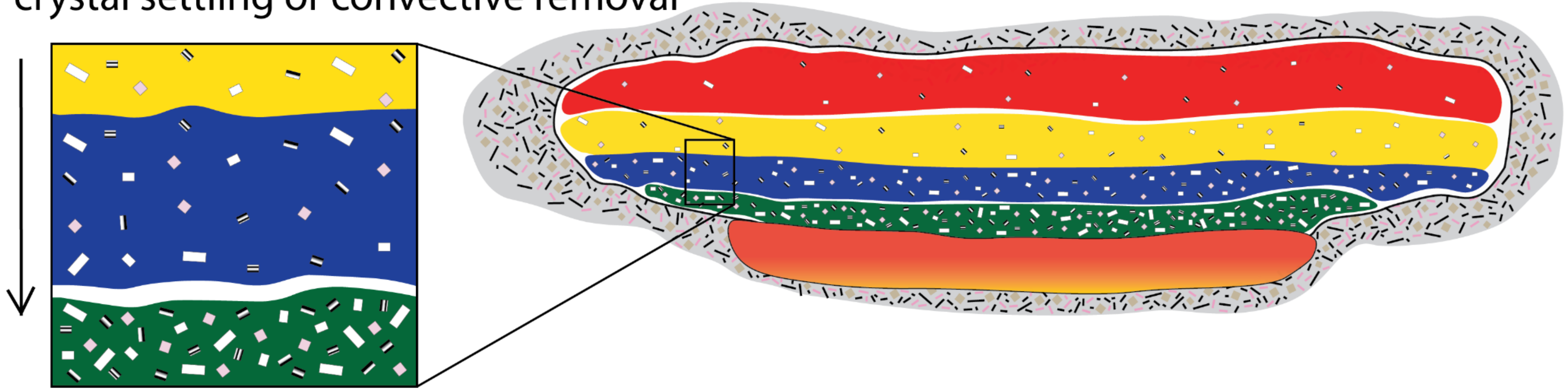
# Magma evolution model for the DCT




Isom, 2017

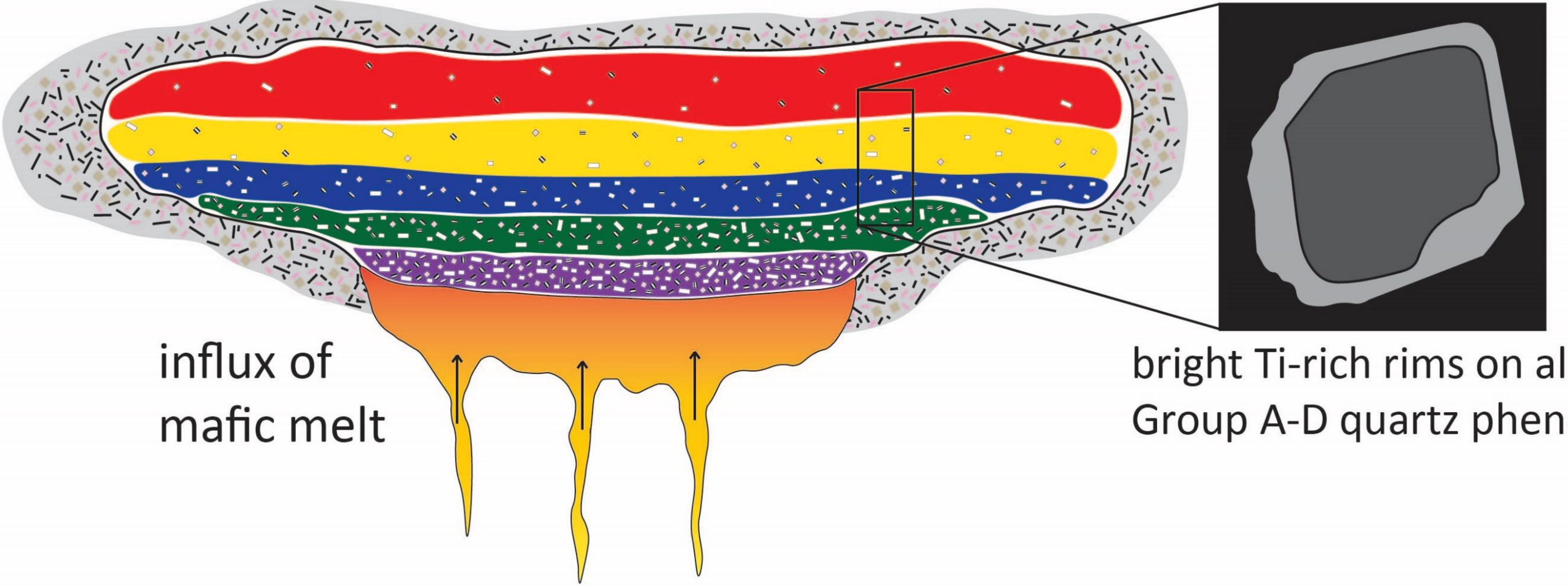
# Magma evolution model for the DCT

Increase in crystallinity due to crystal settling or convective removal



Isom, 2017

# Magma evolution model for the DCT




Isom, 2017

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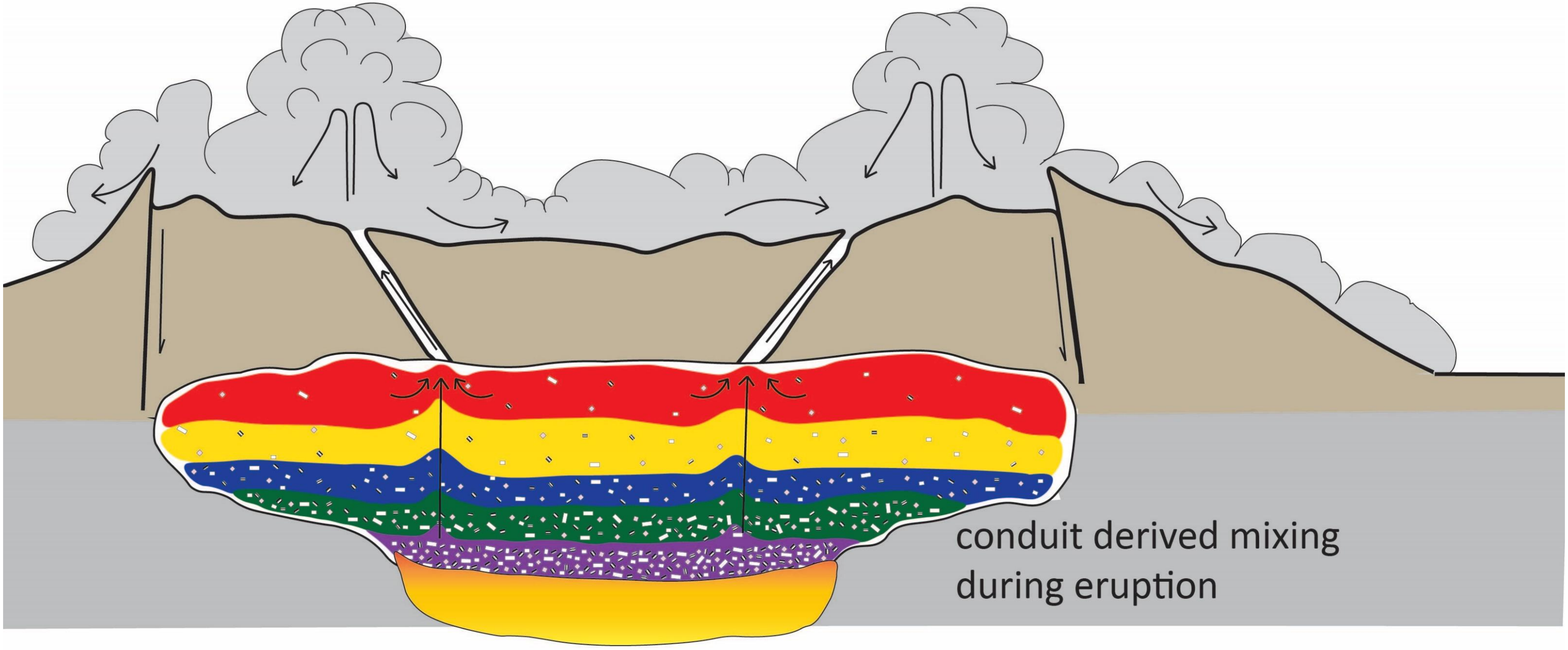


Isom, 2017

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