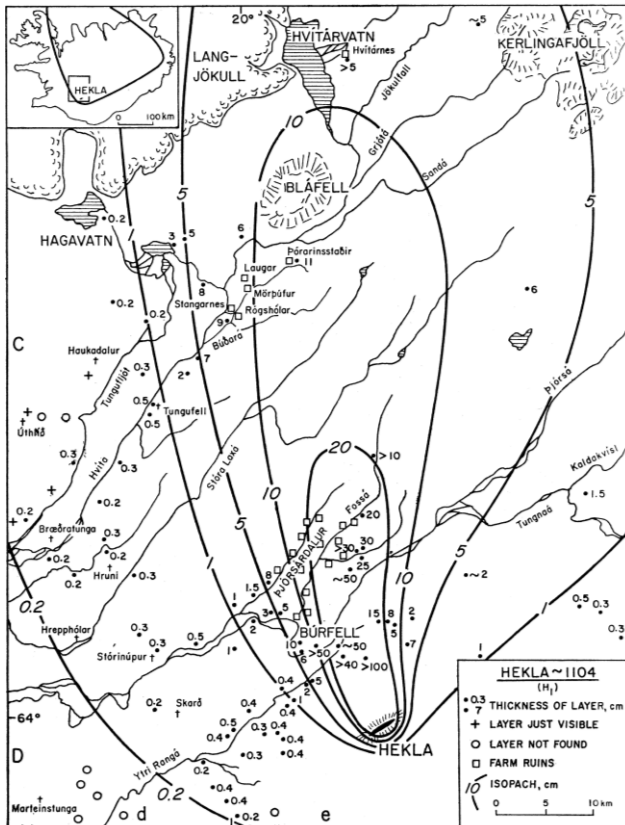


The preservation of the 1980 Mount St Helens tephra layer

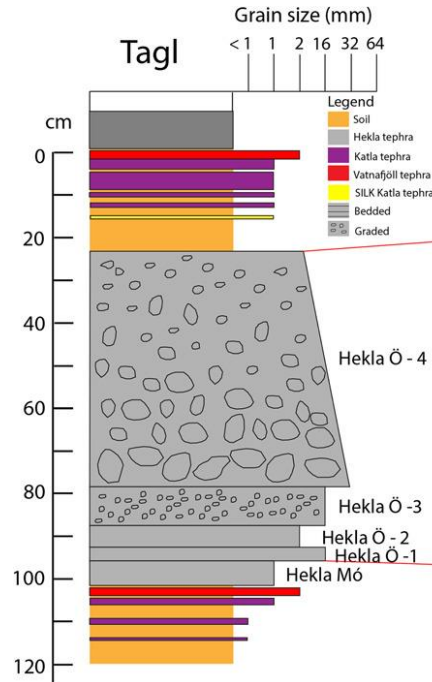


Nick Cutler (Newcastle University); Richard Streeter (University of St Andrews); Andy Dugmore, Anthony Newton & Polly Thompson (University of Edinburgh)

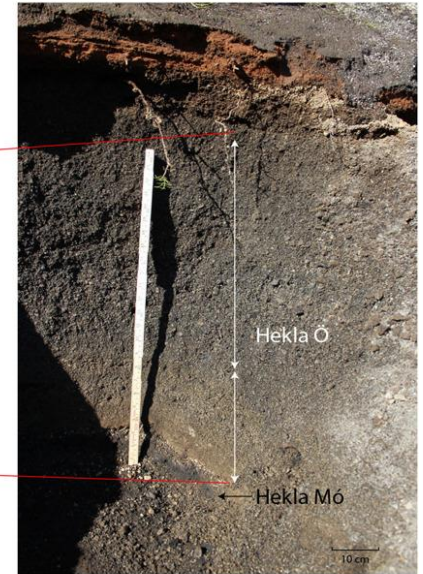
Context



Hekla 1104 CE
Thorarinsson (1967)

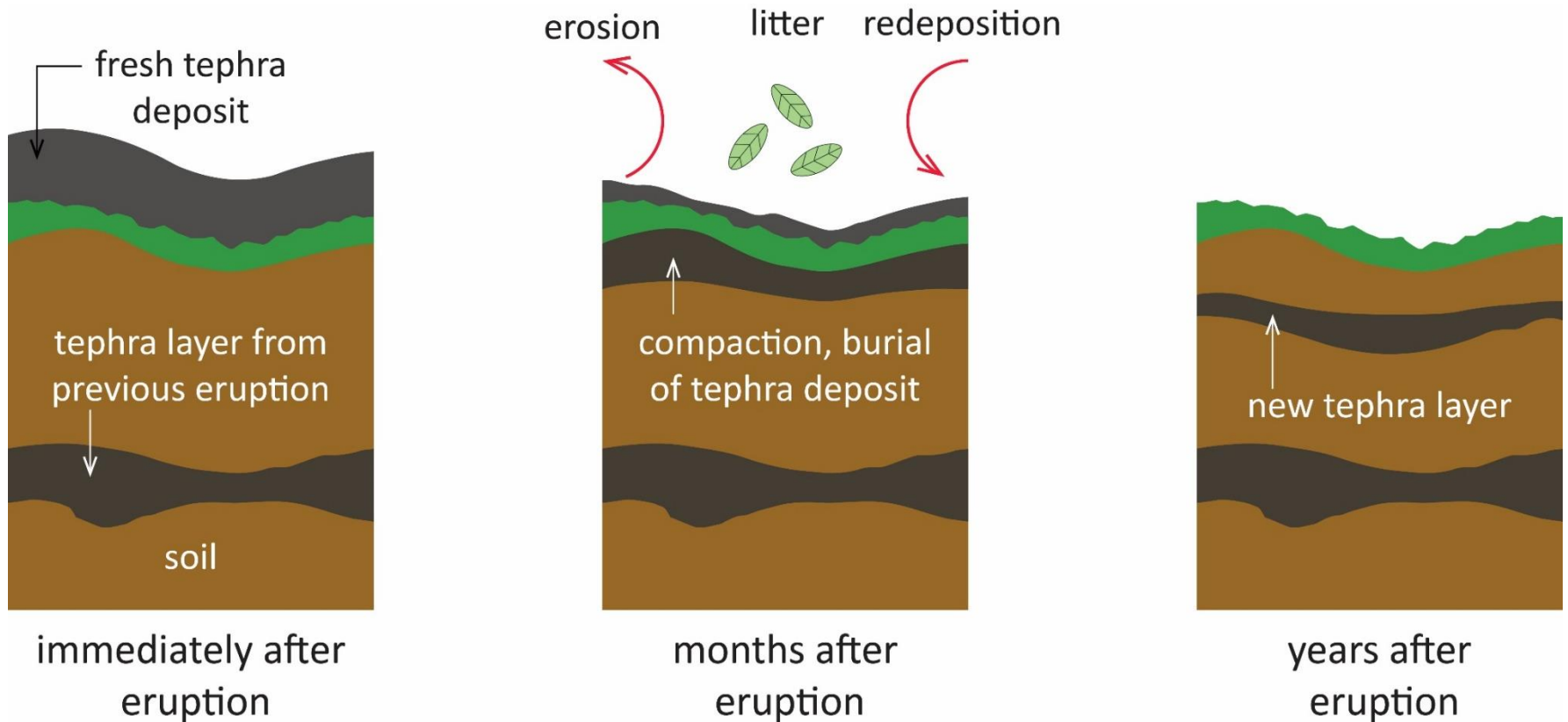


Tephra stratigraphy
Jónsson et al. (2020)



Tephra and volcanological inference

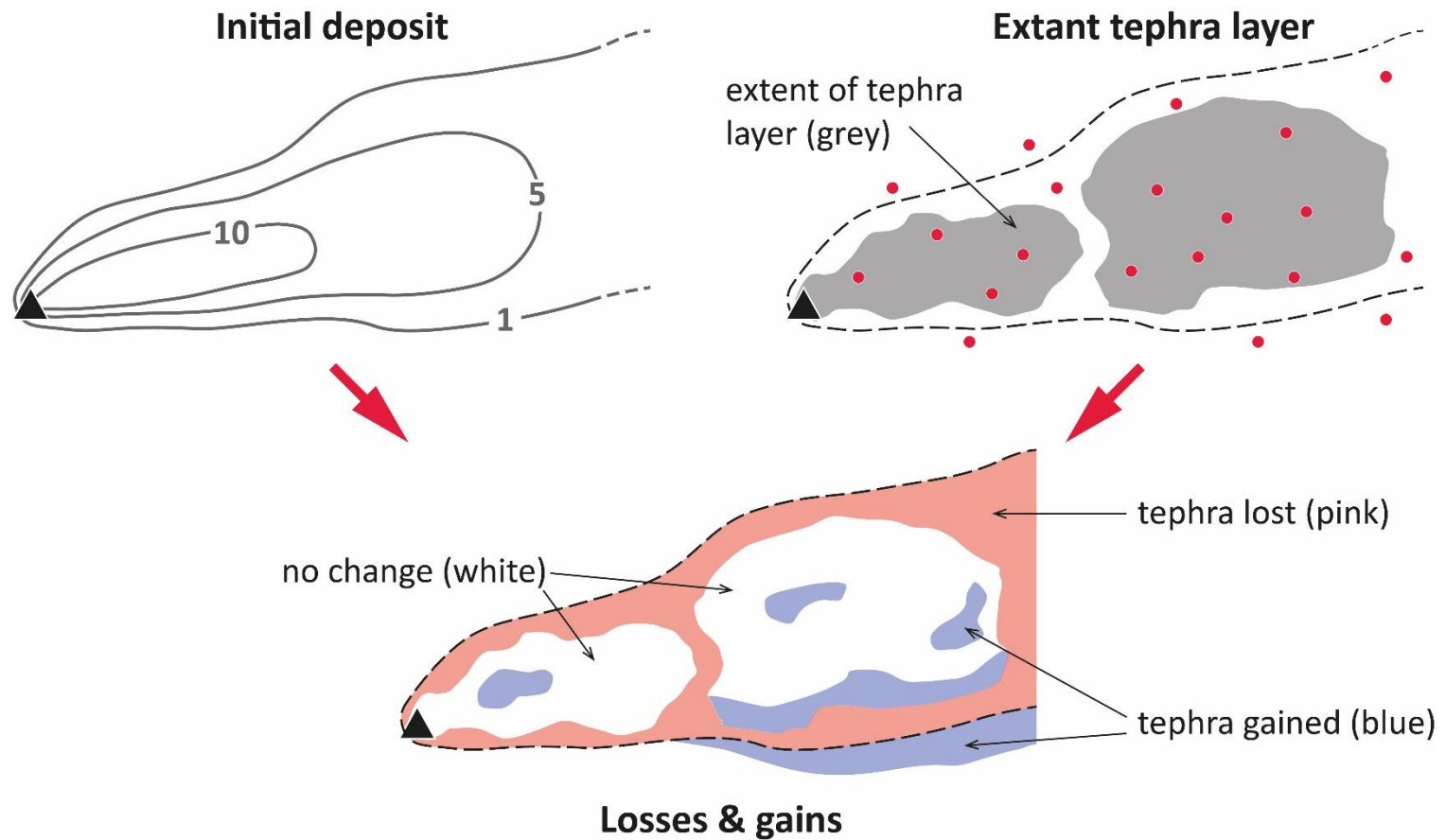
Context



Degree of preservation matters

- To what extent do terrestrial tephra layers resemble the deposit from which they are formed?

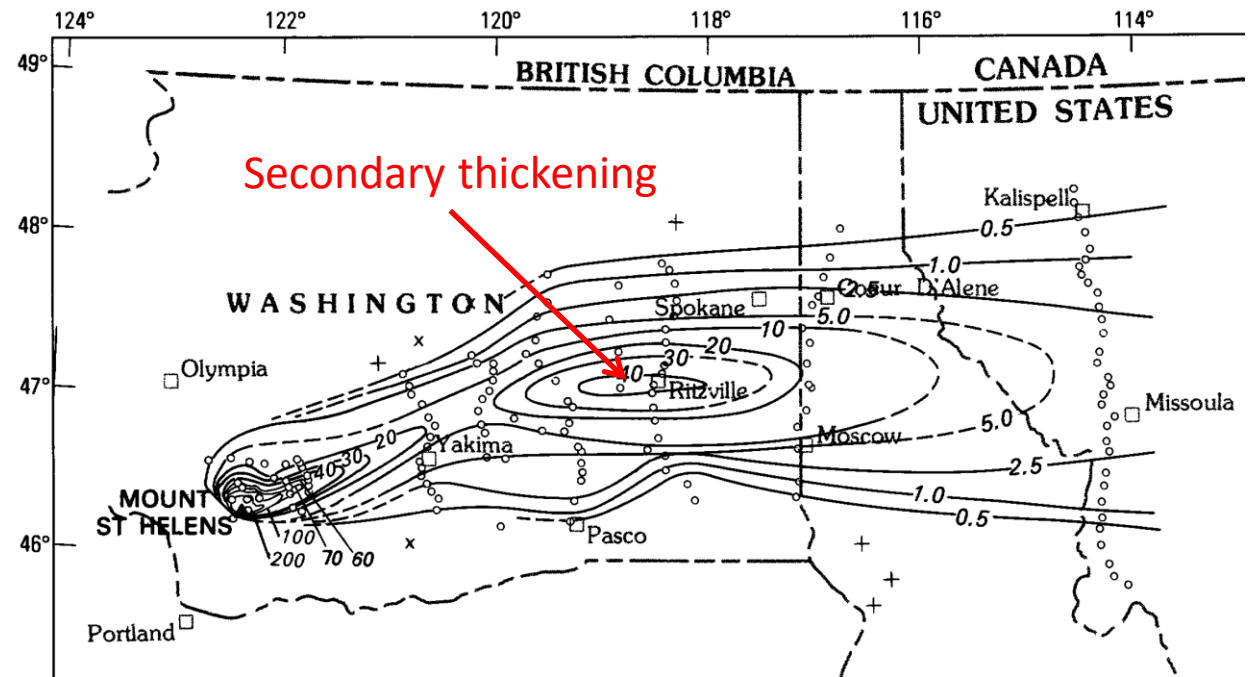
Methods



Research strategy

- Re-survey of well known, recent tephra layer

Methods

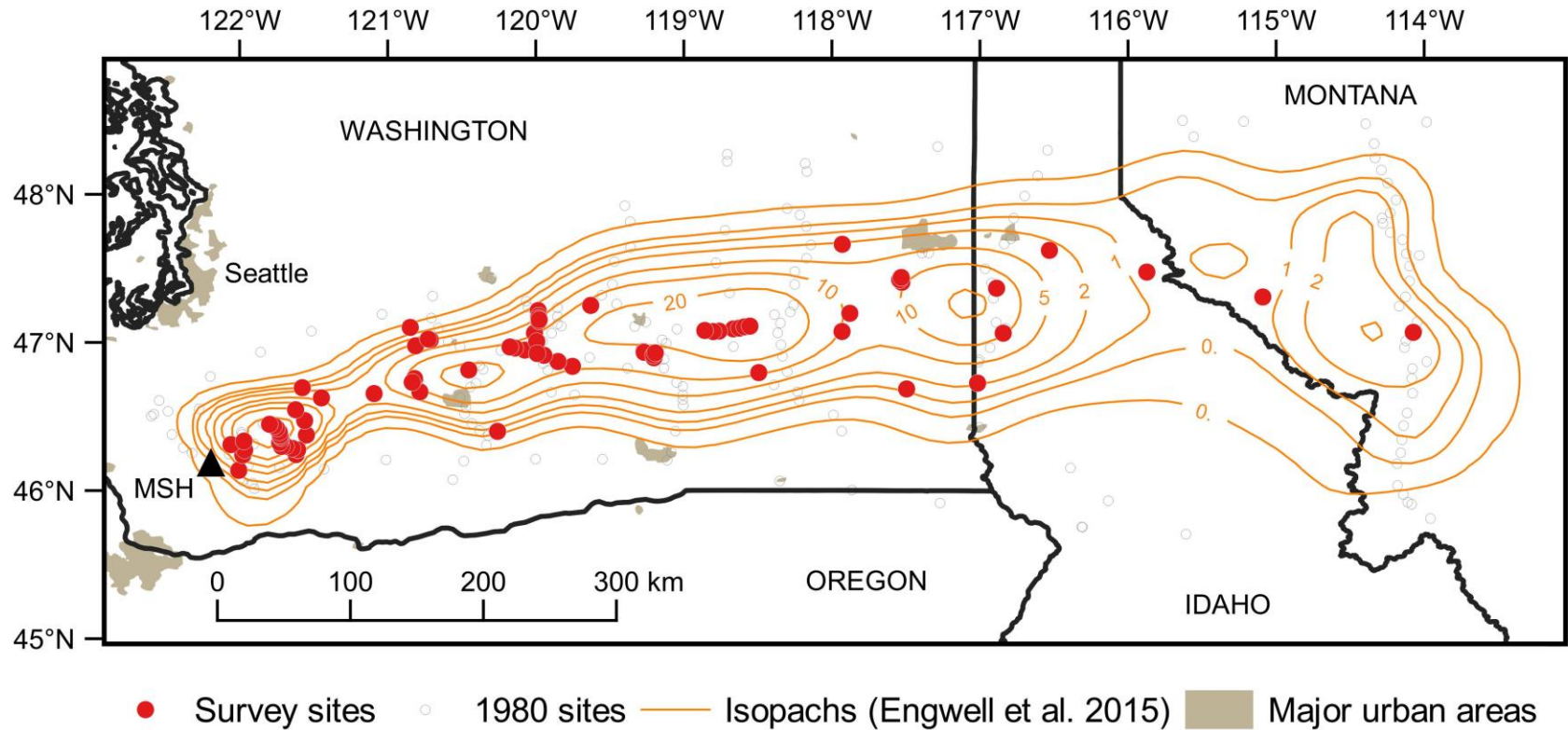


Sarna-Wojcicki et al. (1981)

Research location: Mount St Helens

- Study focussed on tephra from 1980 eruption

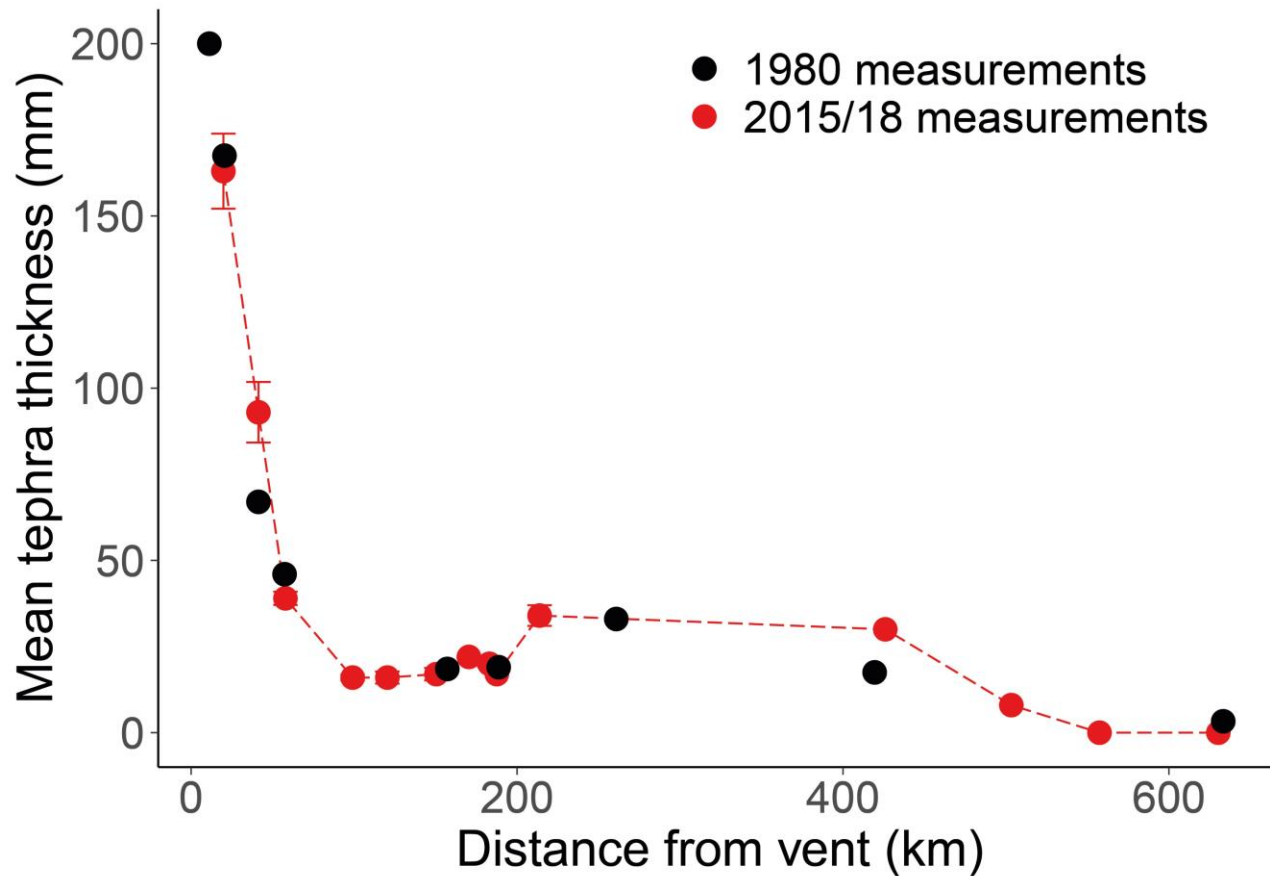
Methods



Fieldwork

- 86 Sampling locations, 13 to >600 km from volcano

Findings

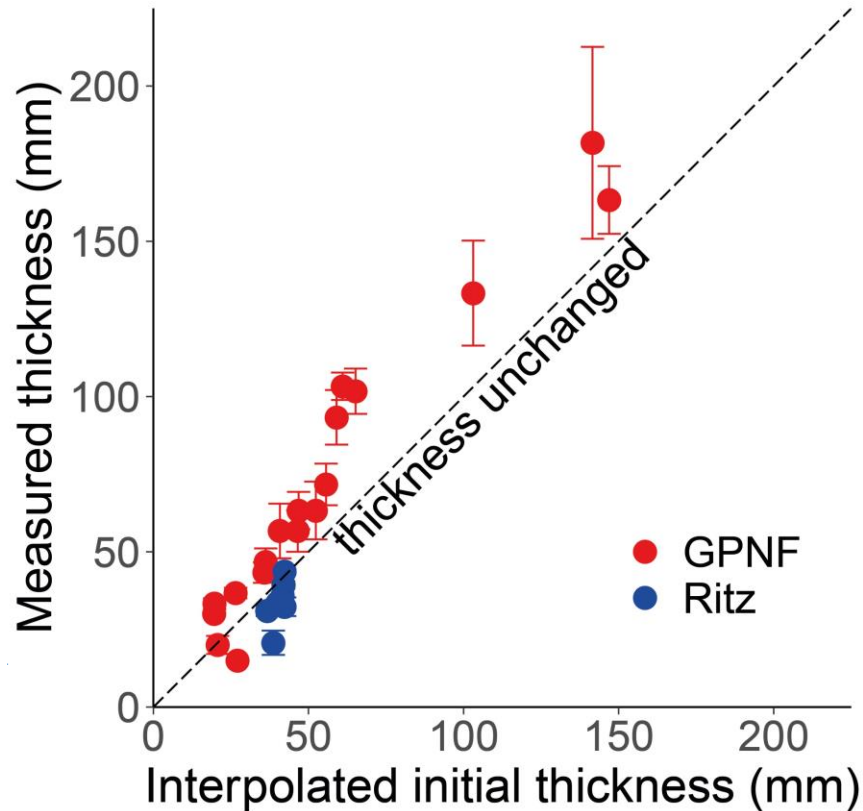


*Tephra thickness along
plume axis
Cutler et al. (2020)
J. Volcanol. Geotherm. Res.*

Tephra thickness

- Tephra layer thickness closely resembles initial deposit

Findings

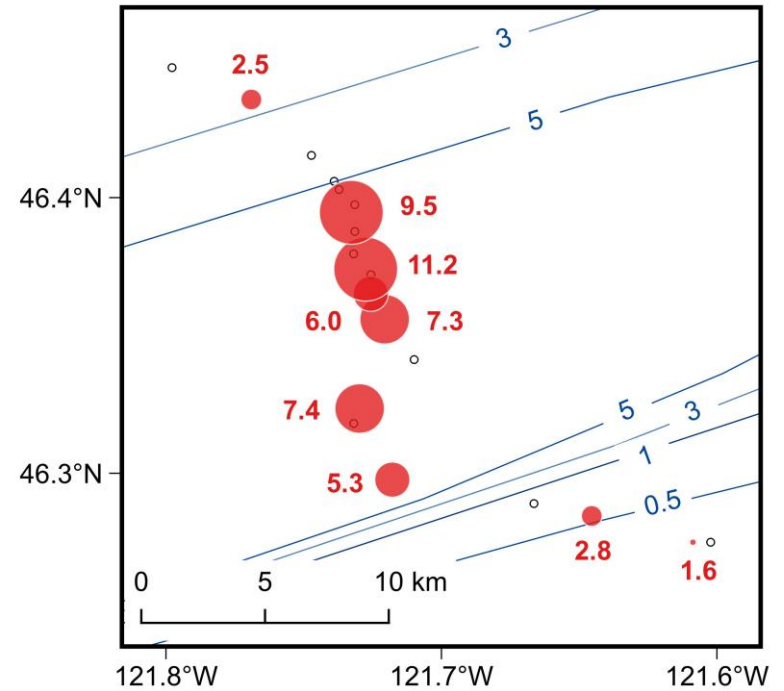
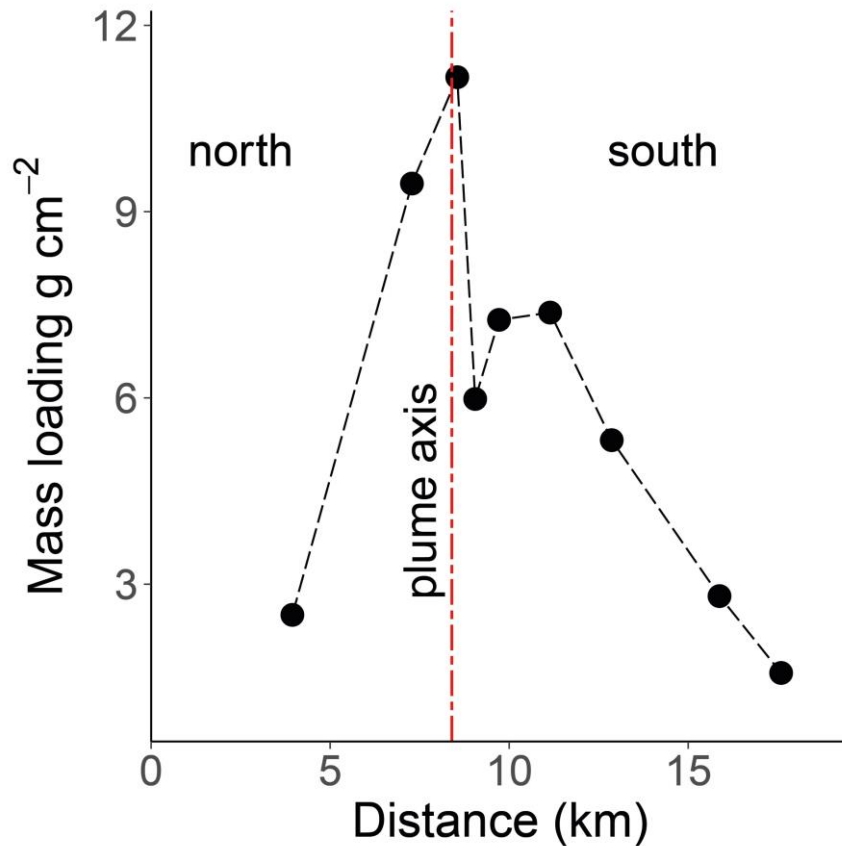


Comparison of a) interpolated deposit & b) tephra layer thickness
Cutler et al. (2018) Bull. Volcanol.

Tephra thickness

- Tephra layer thickness closely resembles initial deposit

Findings



MSH1980 mass loading (g cm^{-2})
1980 in blue, 2015 in red
Cutler et al. (2018) Bull. Volcanol.

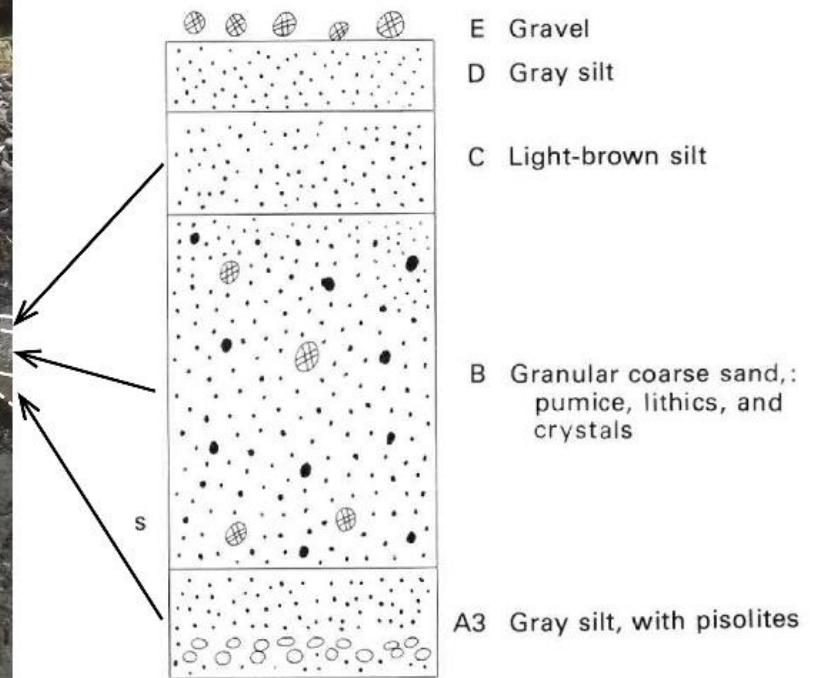
Tephra mass loading

- Follows thickness, i.e., close to 1980 values

Findings



A typical section from 2018

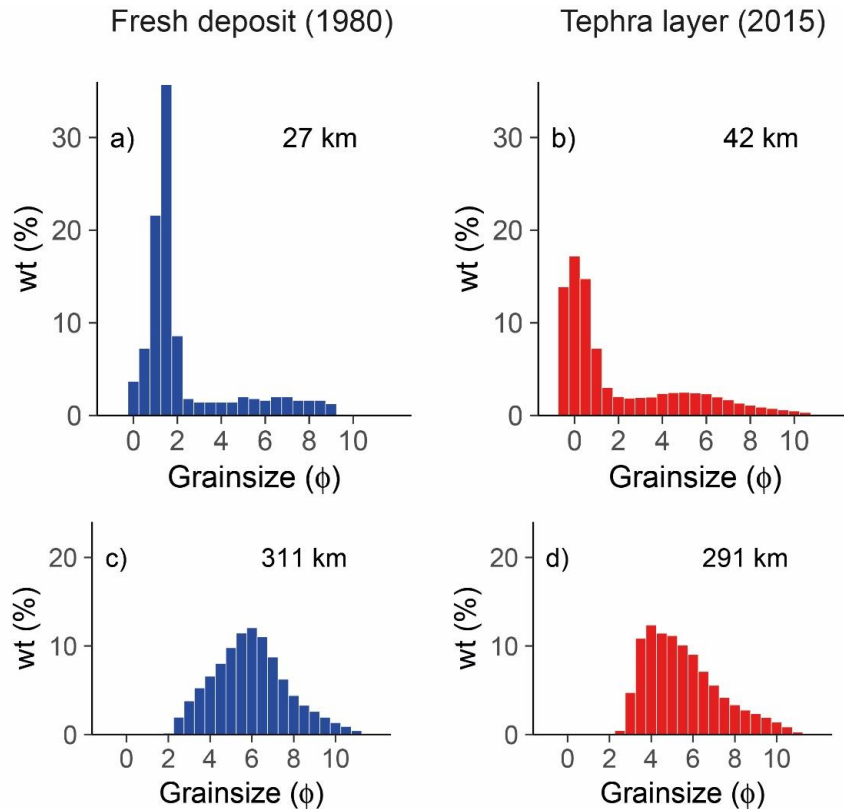


Waitt & Dzurisin (1981)

Stratigraphy

- Units observed by USGS in 1980 preserved

Findings



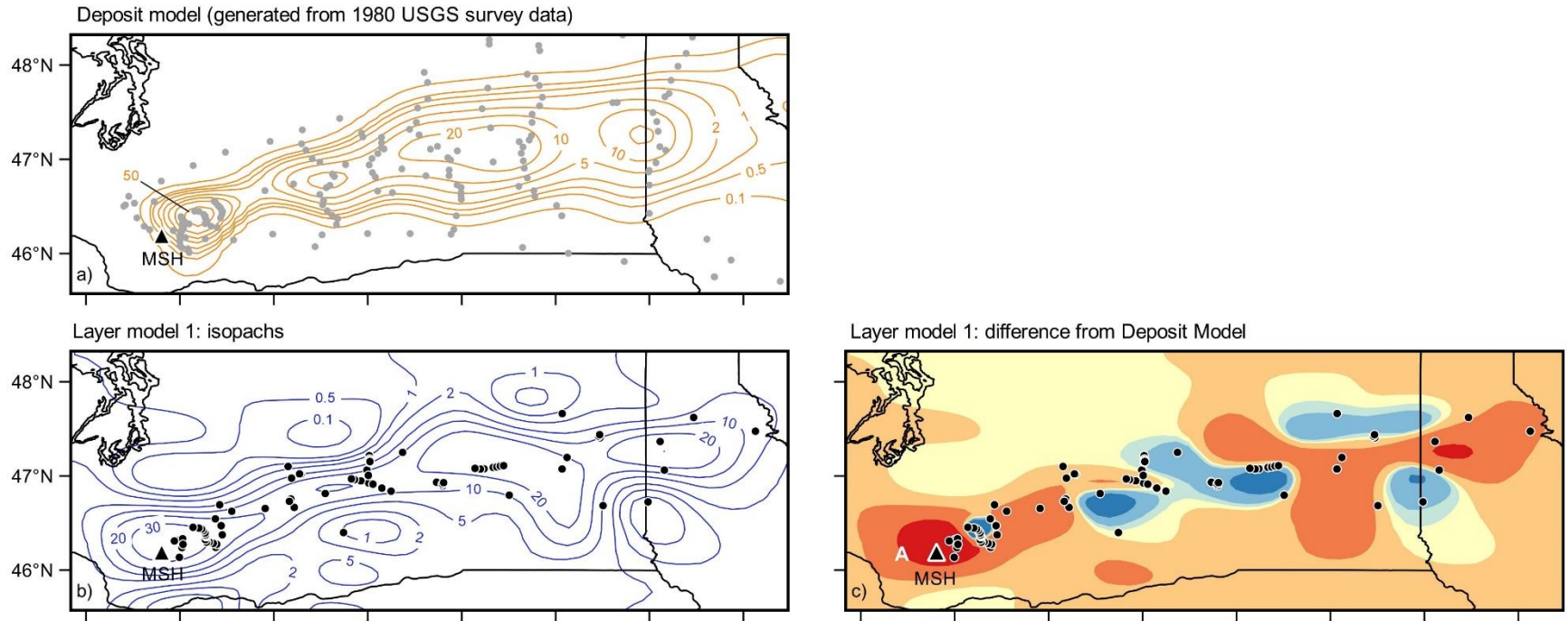
MSH1980 in Ritzville, with biocrust

MSH1980 grain size distributions
Cutler et al. (2021) Bull. Volcanol.

Grain size

- Distinctive patterns in grain size distributions preserved

Findings

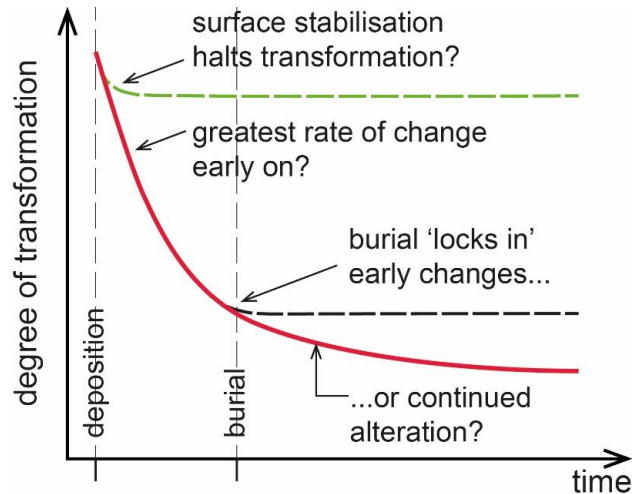


Modelled tephra layer thickness
Cutler et al. (2020) J. Volcanol. Geotherm. Res.

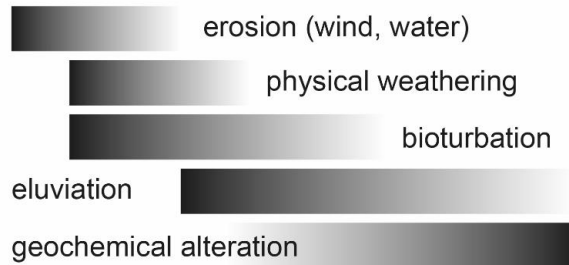
Reconstruction of fallout

- Our model overestimated fallout volume

Next steps



Processes



Conceptual model

$$s = f(cl, o, r, p, t)$$

Hans Jenny's soil forming factors (1941)

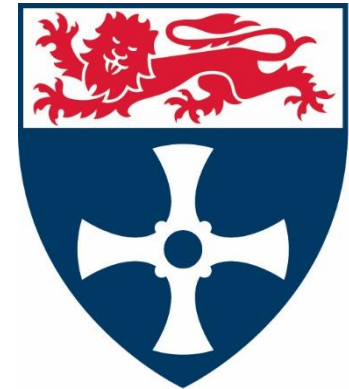


Somewhere in a warehouse...

The value of experimental applications

- We need long-term experiments

Thank you for listening!



Thanks to:

- Britta Jensen, Matt Bolton (Alberta)
- Will Hiles (St Andrews)
- Sam Engwell (BGS)
- Richard Waitt (USGS)

