Flow directions and emplacement mode of a Middle Miocene subaqueous ignimbrite revealed by photo-statistics and anisotropy of magnetic susceptibility (AMS)

Tamás Biró[a],

Dávid Karátson[a], Emő Márton[b], Sándor Józsa[c], Balázs Bradák[d]

[a] Eötvös University, Institute of Geography and Earth Sciences, Department of Physical Geography, Pázmány Péter sétány 1/C, H-1117, Budapest, Hungary

[b] Geological and Geophysical Institute of Hungary, Paleomagnetic Laboratory, Columbus u. 17-23, H-1118, Budapest, Hungary

[c] Eötvös University, Institute of Geography and Earth Sciences, Department of Petrology and Geochemistry, (Pázmány Péter sétány 1/C, H-1117, Budapest, Hungary

[d] Geographical Institute, Research Centre for Astronomy and Earth Sciences, Budaörsi str. 45, H-1112, Budapest, Hungary

Introduction and goals

- Revealing the **directional fabric** of a subaqueously emplaced ignimbrite (Visegrád Mountains)

- ***Twofold approach***
  - Photostatistics
  - Anisotropy of magnetic susceptibility

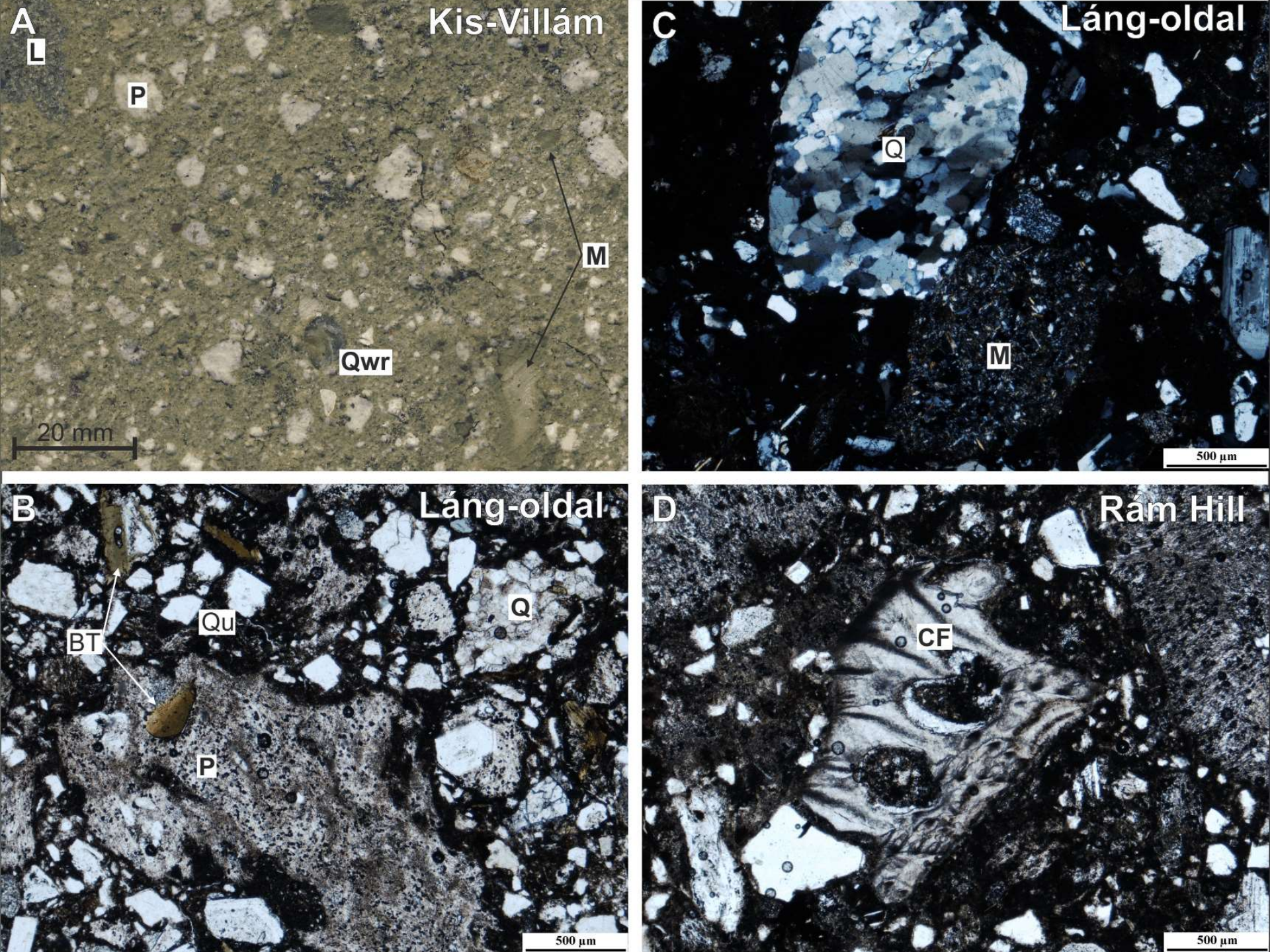
Flow paths

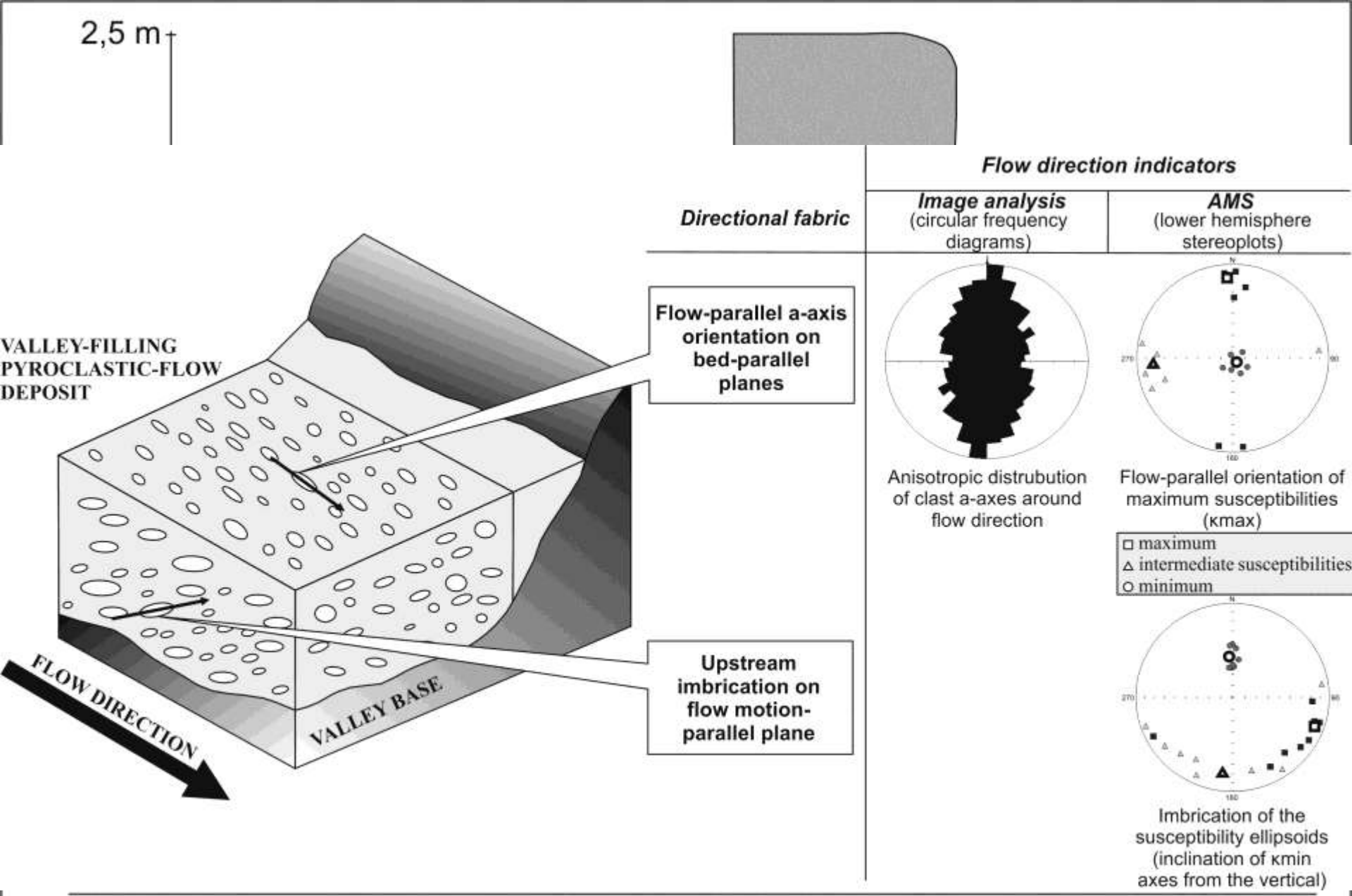
(deeply eroded study site)

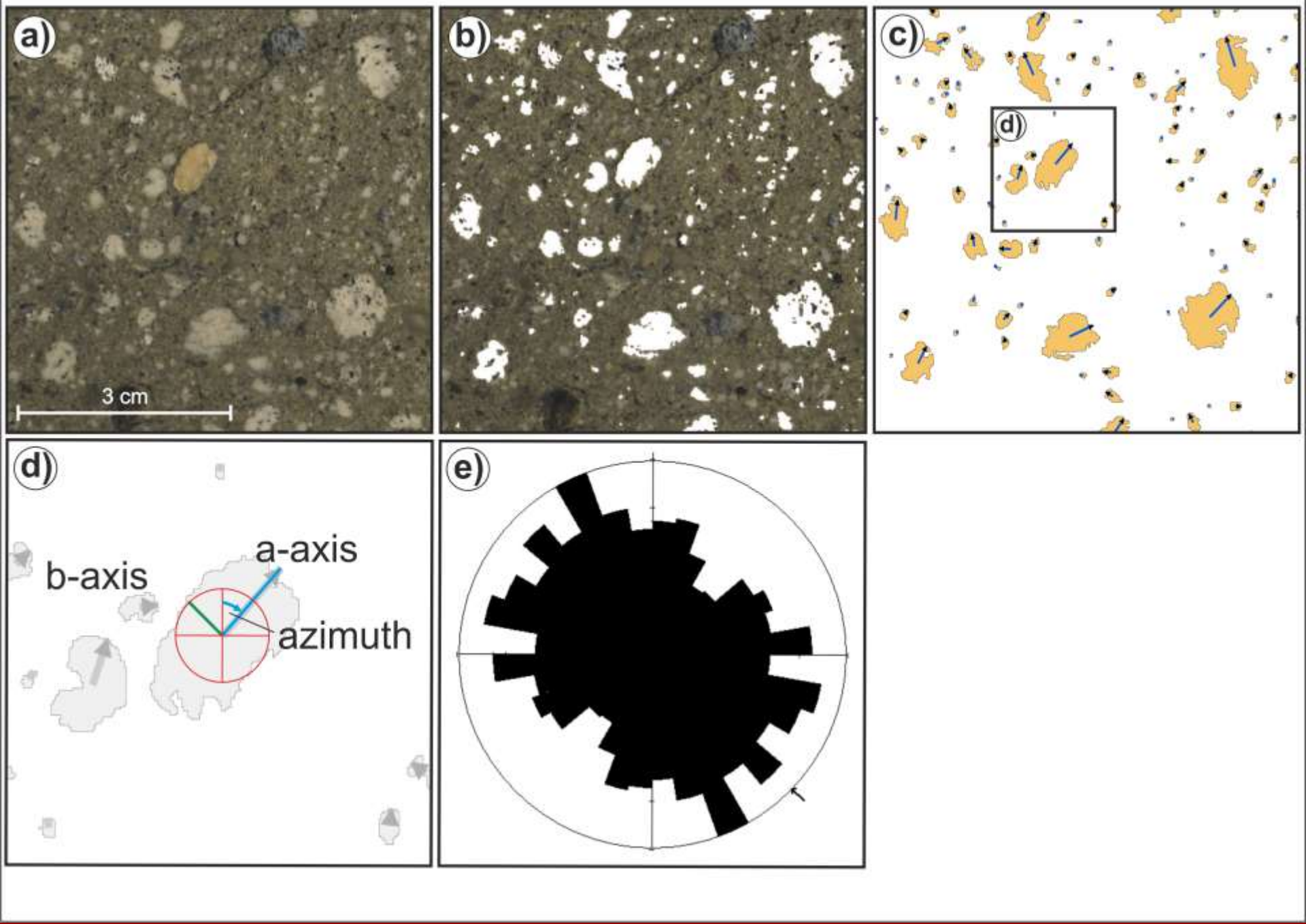
help in vent localization

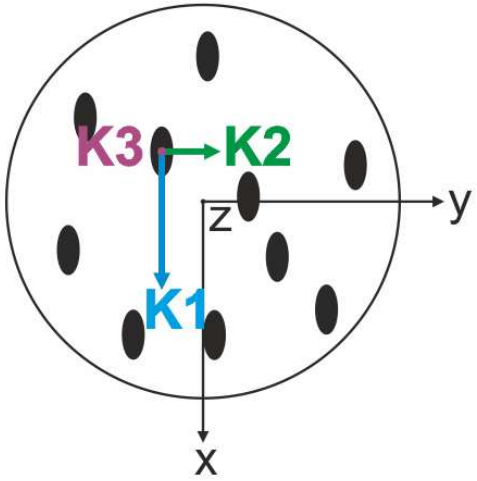
Emplacement processes

subaqueously emplaced ignimbrite

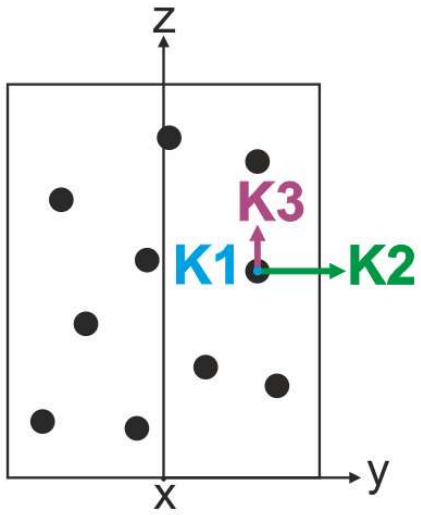

A
Kis-Villám
L
P
M
Qwr
20 mm
C
Láng-oldal
Q
M
500 µm
B
Láng-oldal
Qu
Q
BT
P
500 µm
D
Rám Hill
CF
500 µm


2,5 m
Flow direction indicators
Directional fabric
Image analysis
(circular frequency diagrams)
AMS
(lower hemisphere stereoplots)
VALLEY-FILLING PYROCLASTIC-FLOW DEPOSIT
Flow-parallel a-axis orientation on bed-parallel planes
Upstream imbrication on flow motion-parallel plane
FLOW DIRECTION
VALLEY BASE
Anisotropic distrubution of clast a-axes around flow direction
Flow-parallel orientation of maximum susceptibilities (κmax)
maximum
intermediate susceptibilities
minimum
Imbrication of the susceptibility ellipsoids (inclination of κmin axes from the vertical)
Samples
Photostatistics
Anisotropy of magnetic susceptibility (AMS)

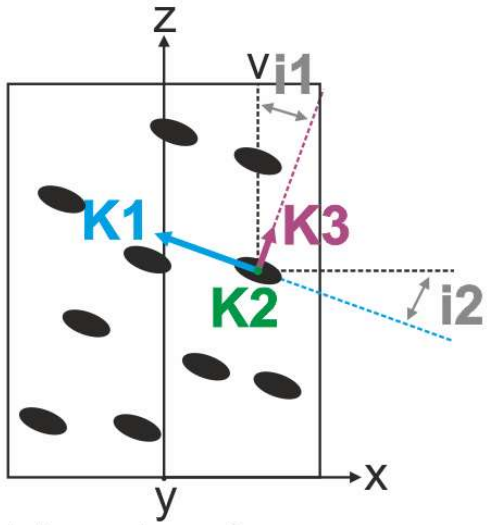

a)
3 cm
b)
c)
d)
d)
b-axis
a-axis
azimuth
e)



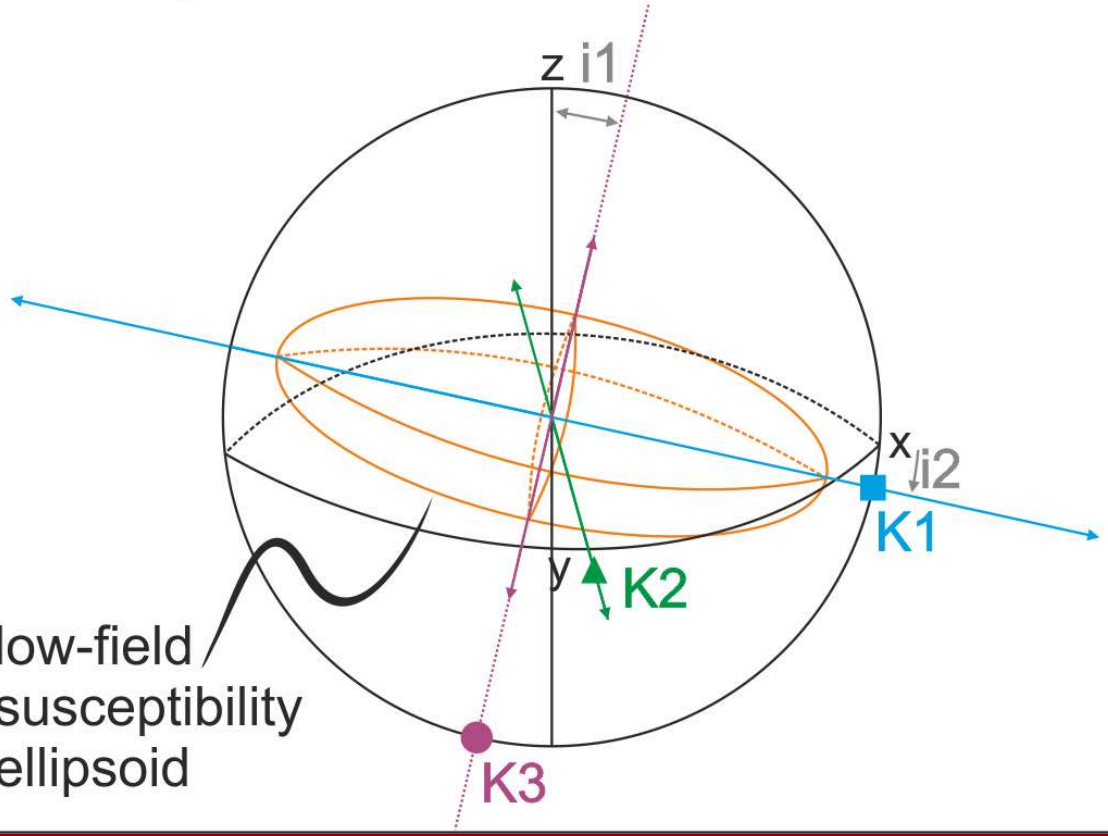
top wiev



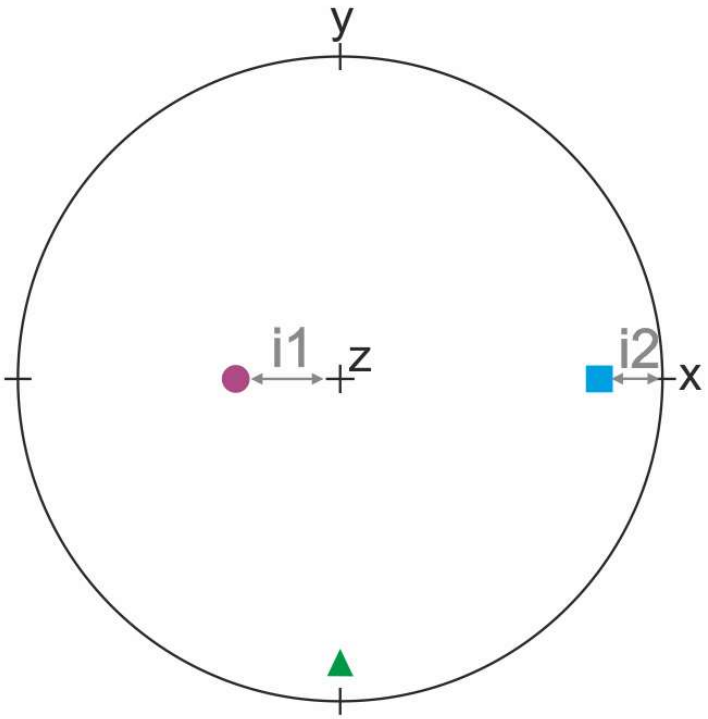
side-wiev from x

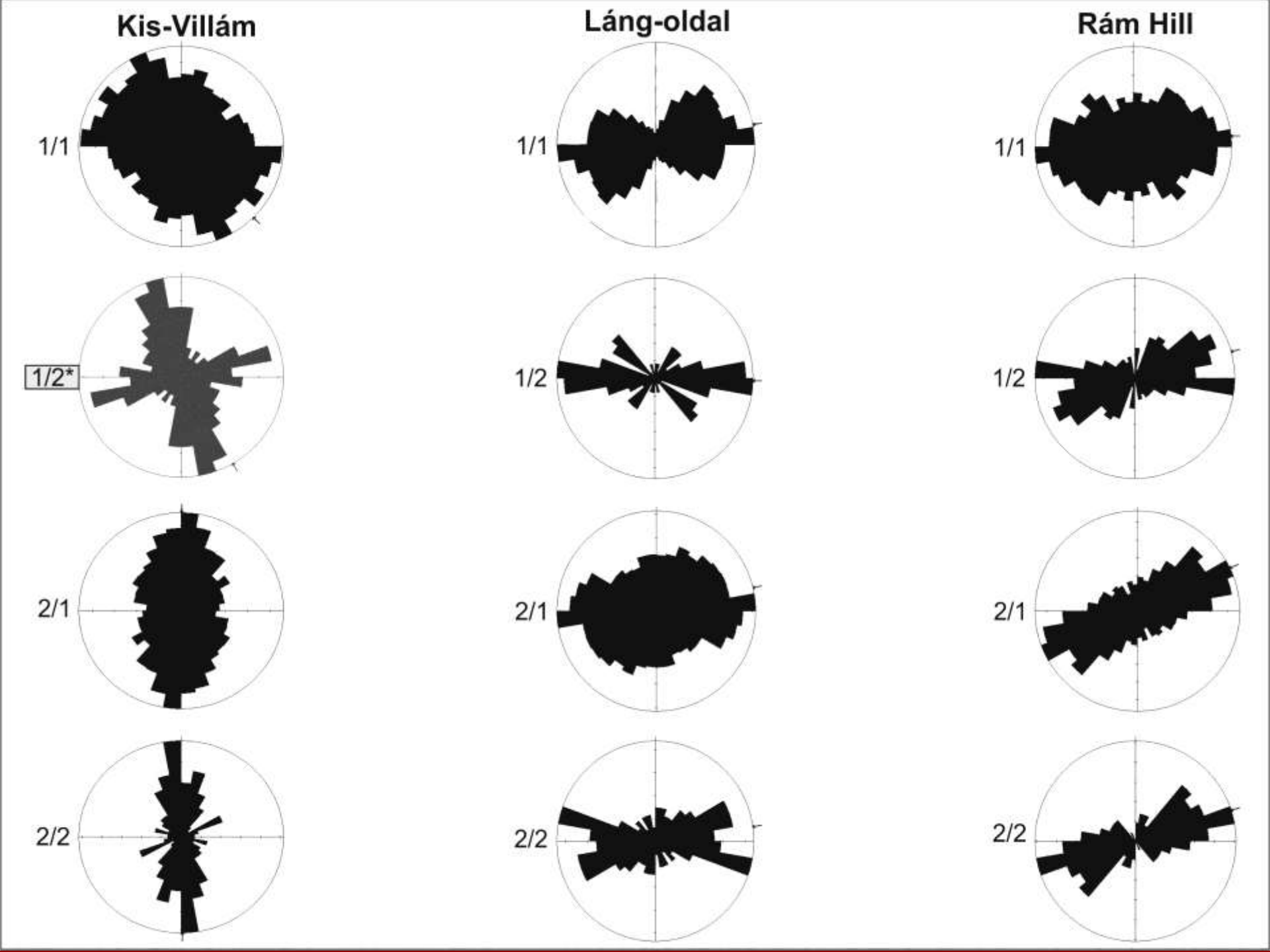


side-wiev from y

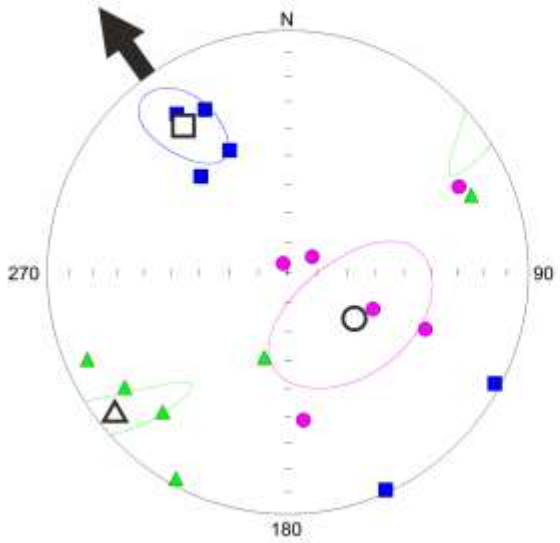


low-field
susceptibility
ellipsoid

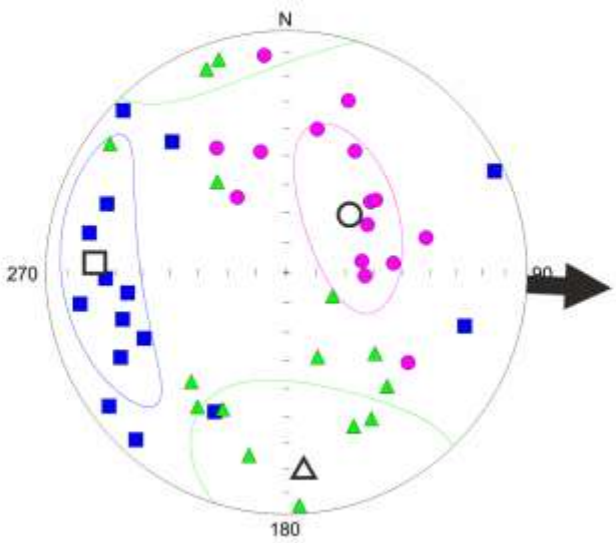



Kis-Villám
Láng-oldal
Rám Hill
1/1
1/2*
2/1
2/2
1/1
1/2
2/1
2/2
1/1
1/2
2/1
2/2

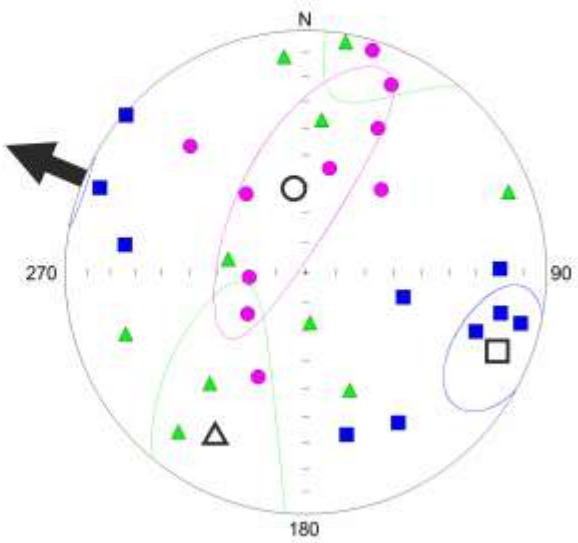
Kis-Villám

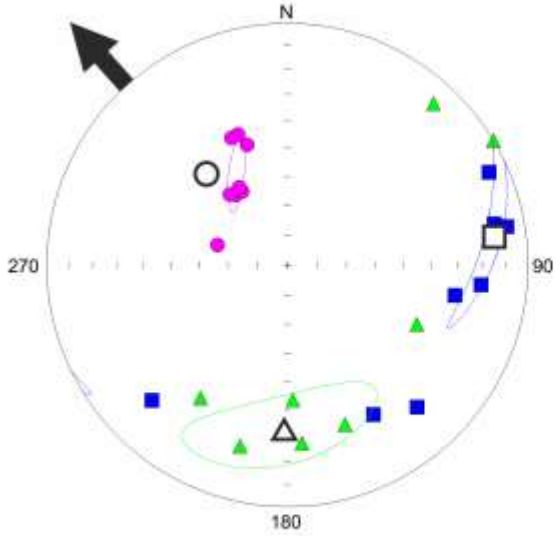


Láng-oldal

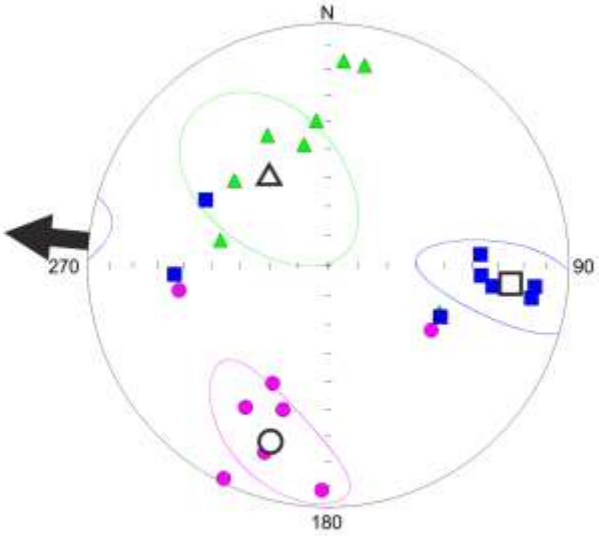


Rám Hill Site 1

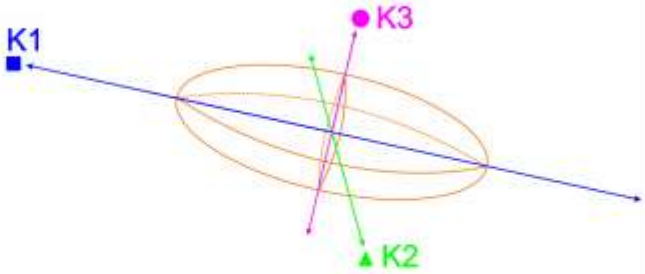




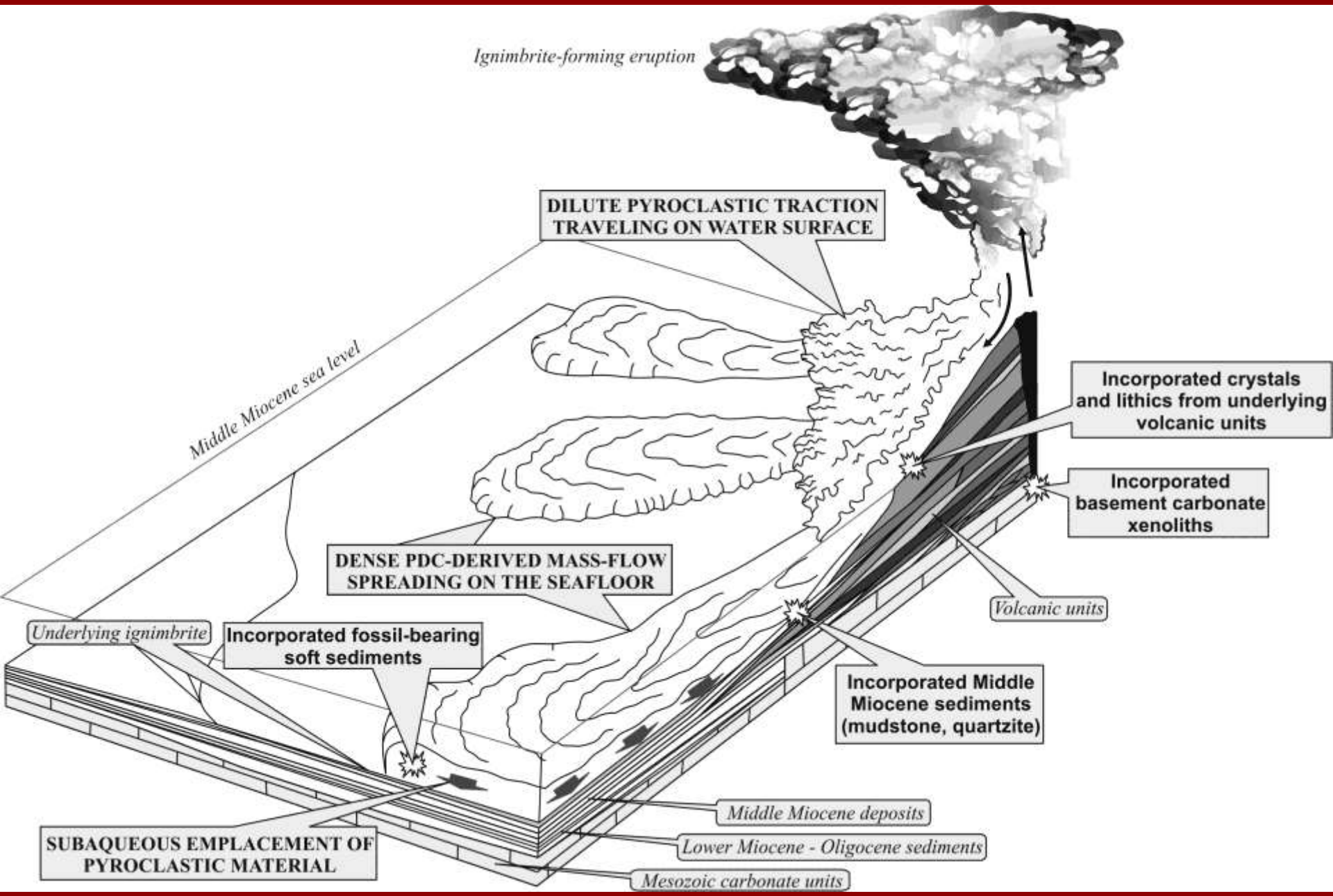
Rám Hill Site 2



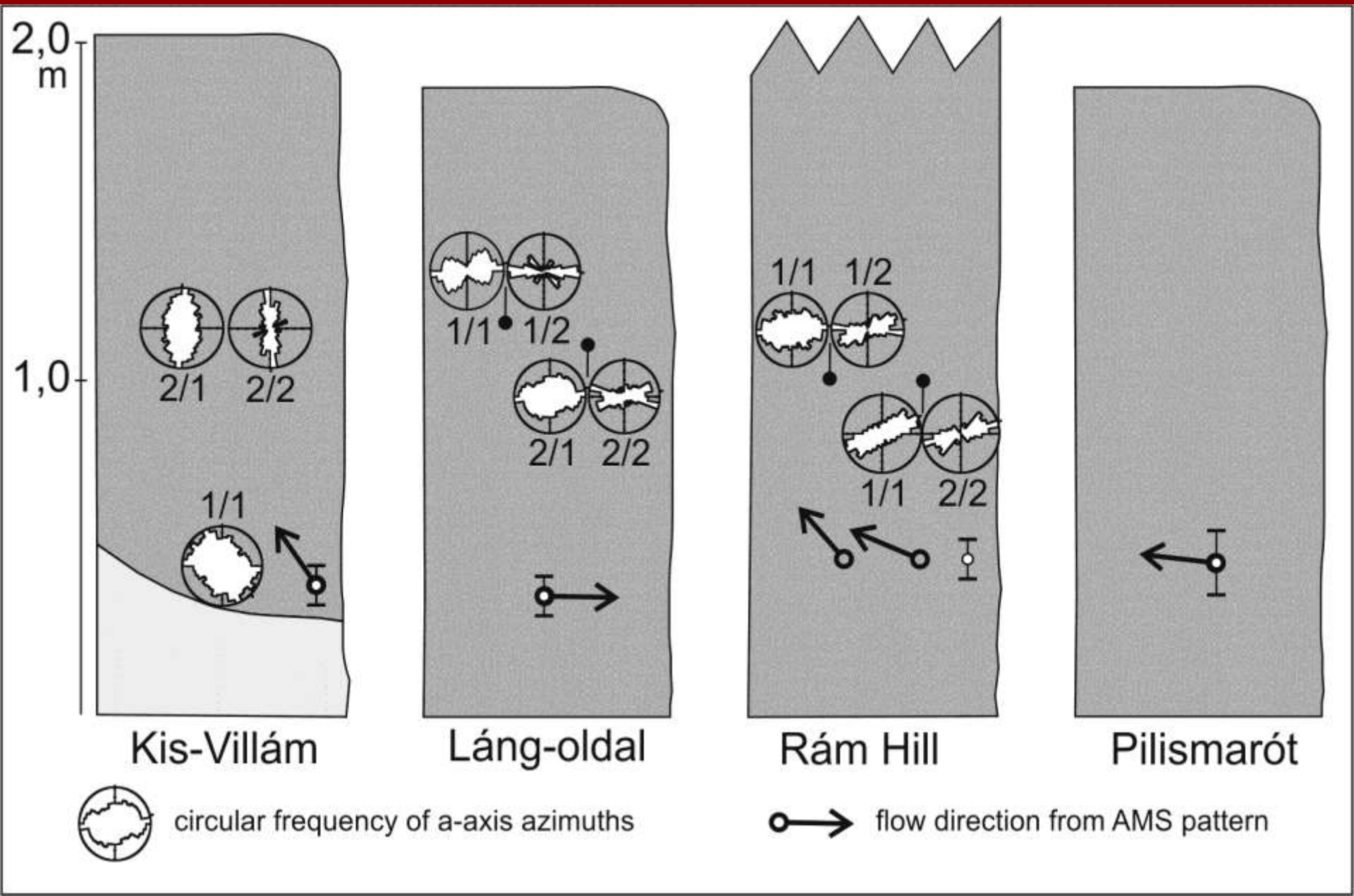
Pilismarót

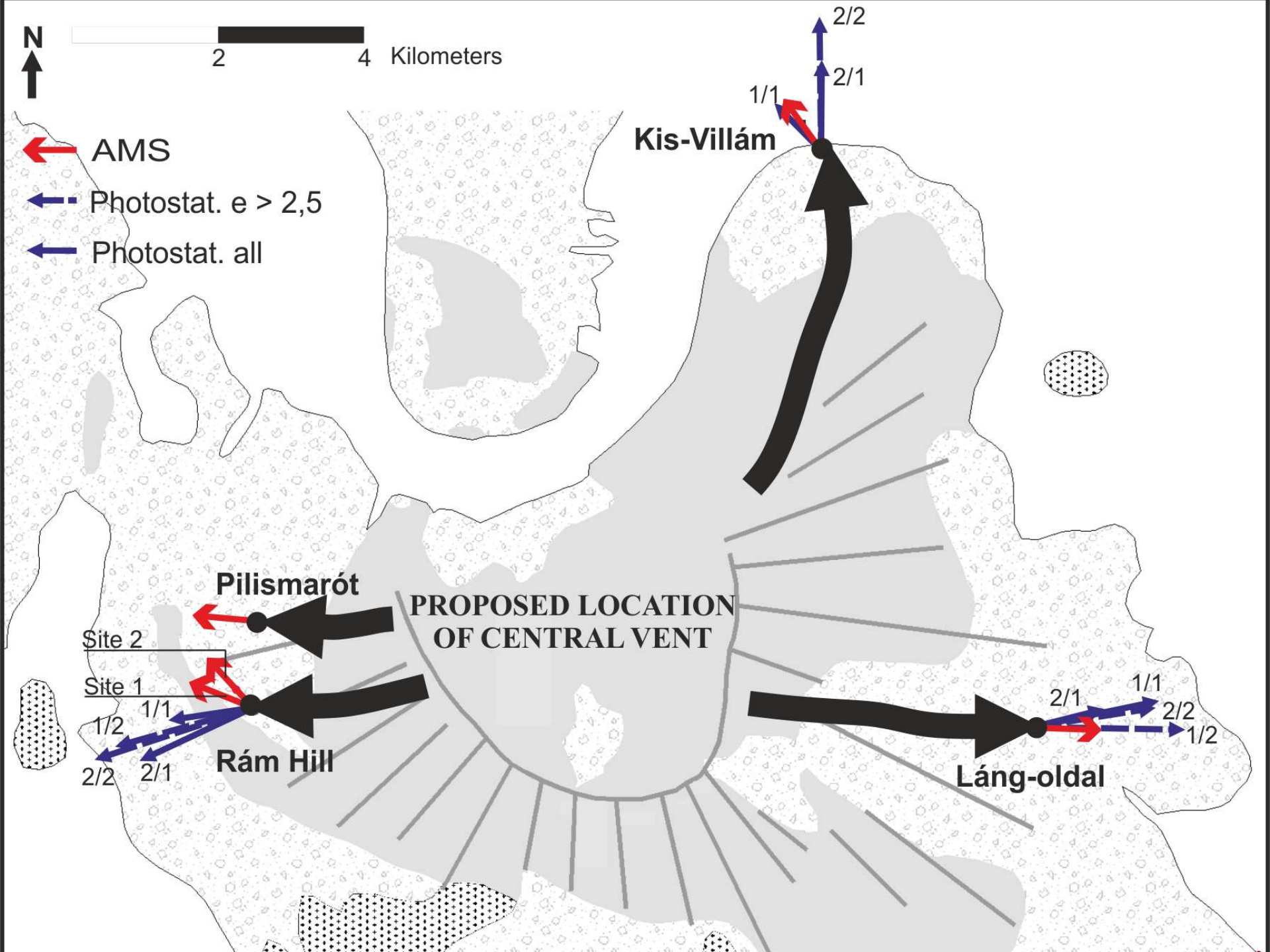


Reconstructed volcanic processes



Implications on flow motion and on emplacement mode




N
2
4
Kilometers
AMS
Photostat. e > 2,5
Photostat. all
2/2
2/1
1/1
Kis-Villám
PROPOSED LOCATION
OF CENTRAL VENT
Pilismarót
Site 2
Site 1
1/1
1/2
2/2
2/1
Rám Hill
2/1
1/1
2/2
1/2
Láng-oldal

Conclusion

- **Areal and vertical pattern of flow directions** from a subaqueously emplaced ignimbrite were revealed using a **twofold methodology** (photostatistics, AMS)
- The **Rám Hill Pumiceous Sandstone** were originated from phreatomagmatic eruptions and were **emplaced under submarine conditions** around the Keserűs Hill lava dome group
- **Laminar flowage** is indicated in spite of the presumable subaqueous dilution
- **Progressive aggradation** as emplacement mode is proposed on the basis of **vertical variation of flow directions**
- According to the areal pattern of flow directions one, **central vent-dominated volcanic structure** is confirmed

Future research opportunities

- Expanding the **directional fabric studies** to different kind of **subaqueously emplaced ignimbrites**

- Investigating the **flow directions** of subaqueously emplaced mass-flow deposits **around deeply eroded centers**

References

- **Jelinek, V. 1977**: The Statistical Theory of Measuring Anisotropy of Magnetic Susceptibility of Rocks. *Geofyzik Brno n. p,* Brno. 77 p.

- **Jelinek, V., 1981**. Characterization of the magnetic fabric of rocks. *Tectonophysics*. 79. pp. 63-67.

- **Karátson D., Oláh I., Pécskay Z., Márton E., Harangi Sz., Dulai A., Zelenka T., Kósik Sz., 2007**: Miocene volcanism in the Visegrád Mountains (Hungary): an integrated approach to regional volcanic stratigraphy. *Geologica Carpathica*. 58. pp. 541-563.

- **Capaccioni, B., Valentini, L., Rocchi, M. B.L., Nappi, G., Sarocchi, D. 1997**: Image analysis and circular statistics for shape-fabric analysis: applications to lithified ignimbrites – *Bulletin Of Volcanology*. 58. pp. 501–514.

Thank you for paying attention!

Entrance of pyroclastic density current into shallow sea

Soufrière Hills, Montserrat

Biró Tamás: Flow directions and emplacement mode of a Middle Miocene subaqueous ignimbrite revealed by photo-statistics and anisotropy of magnetic susceptibility (AMS)