

Englacial Lake Dynamics within a Pleistocene Ice Sheet, Kima' Kho Tuya, Canada

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Quaternary Science Reviews (2021)

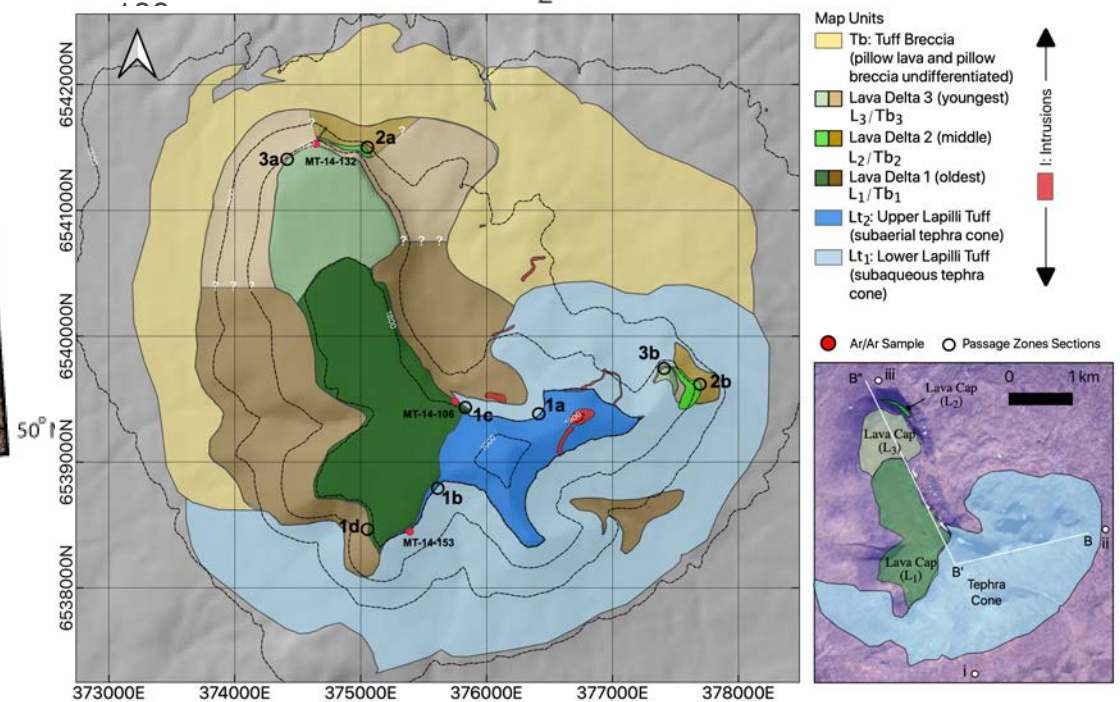
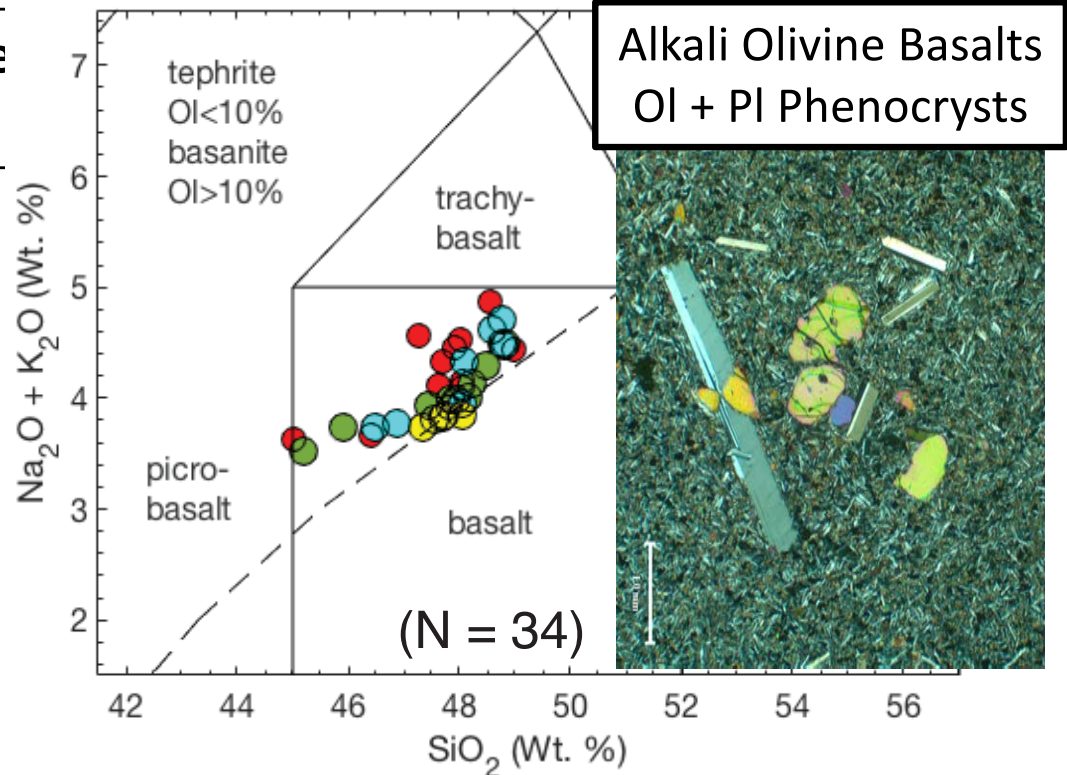
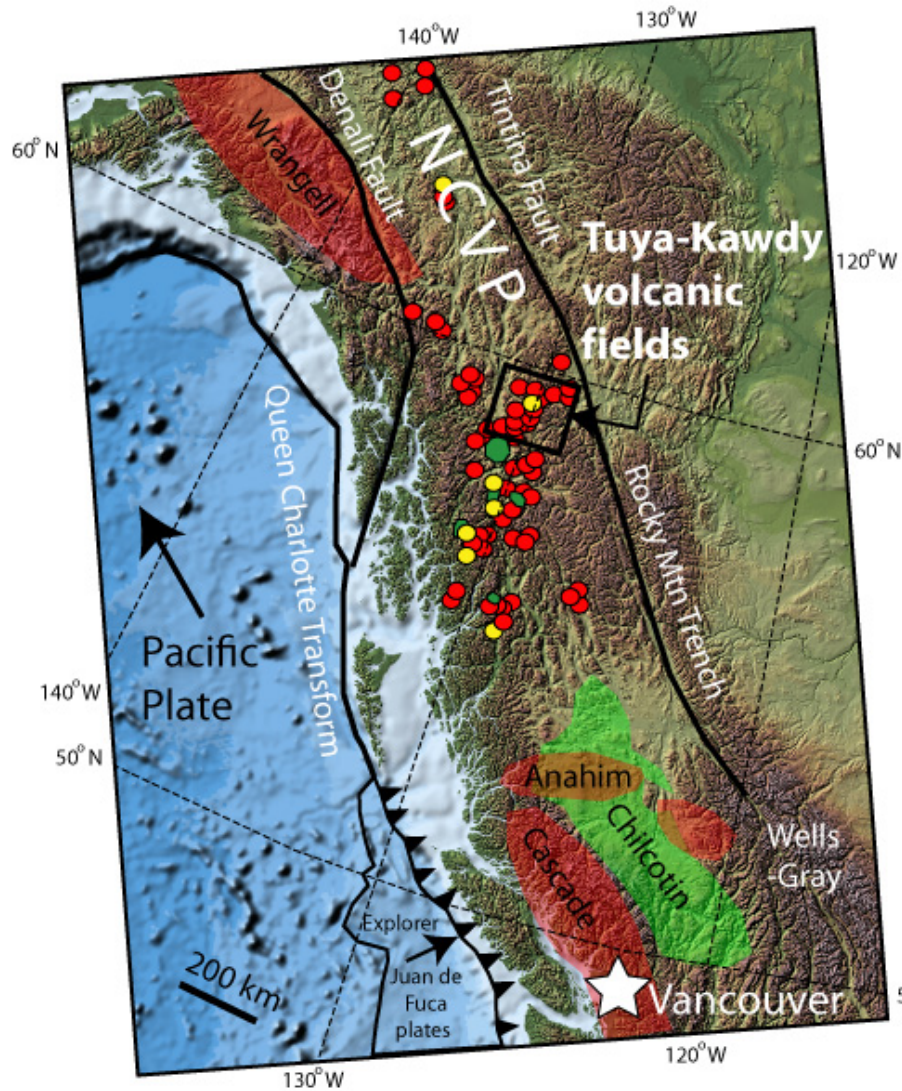




OUTLINE

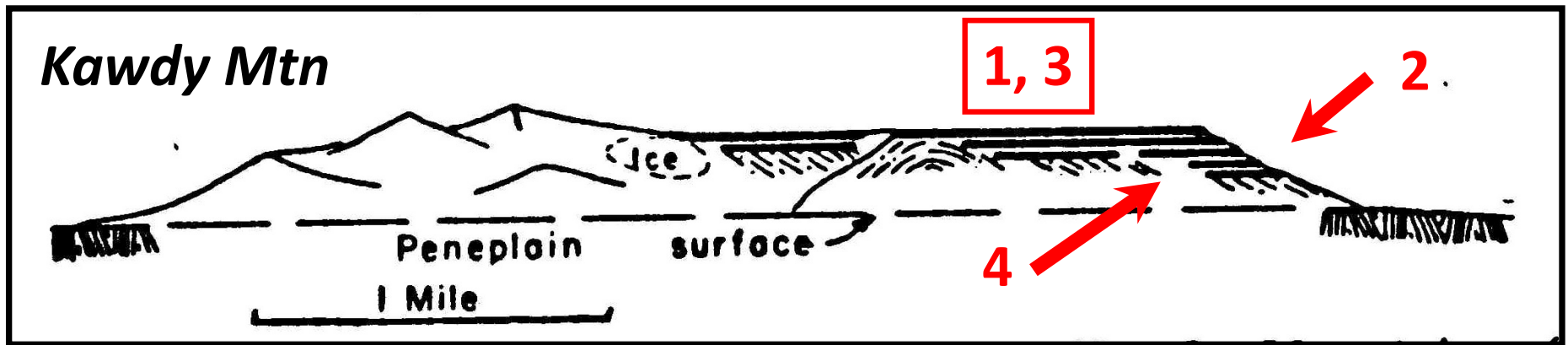
- A) Kima' Kho tuya (glaciovolcano) dated at 1943 ± 63 ka
- B) Basaltic tuya featuring explosive onset followed by effusion
- C) Multiple (3) & Diverse (4) "***Passage Zones***"
- D) Passage zones establish:
 - syn-eruptive englacial lake dynamics
 - minimum thickness of Pleistocene incarnation of CIS

Northern Cordilleran Volcanic Province Tuya-Teslin Area



Mathews, WH 1947. "Tuyas", Flat-Topped volcanoes in northern BC. Amer. J. Sci., V. 245, 560-570.

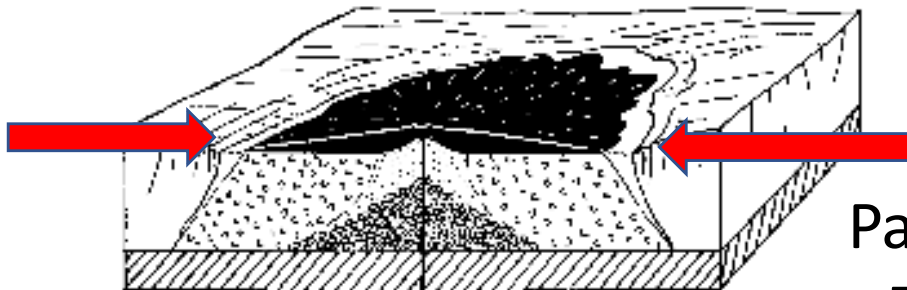
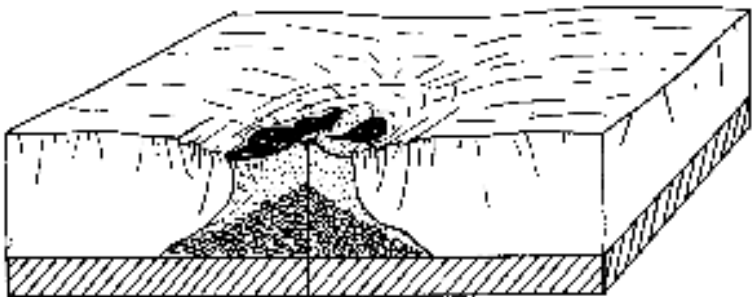
TUYAS: Flat-topped (1), steep sided (2) volcanoes comprising horizontal beds of basaltic lava (3) resting on outward dipping beds of fragmental rocks (4).



[+Tuya Butte, Isspah Butte, Ash Mtn, Mathew's Tuya, No. 1 & 3]



JONES
(1968)



Passage
Zone

"Passage zones"

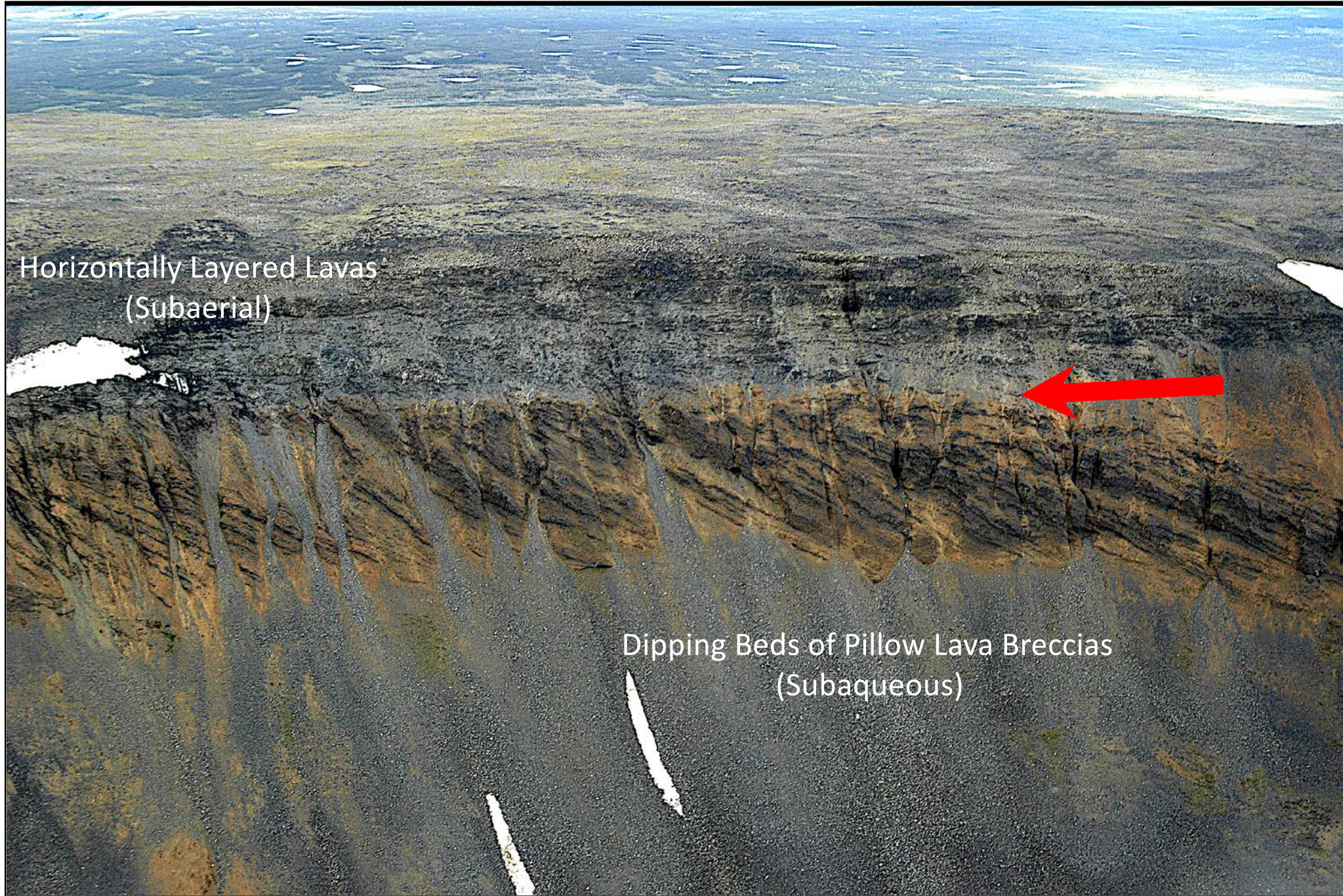
..... diachronous surfaces marking transitions between subaqueous and subaerial environments during volcanic eruptions.

..... the elevation of the passage-zone surface records the height and depth of the paleo-englacial lake.

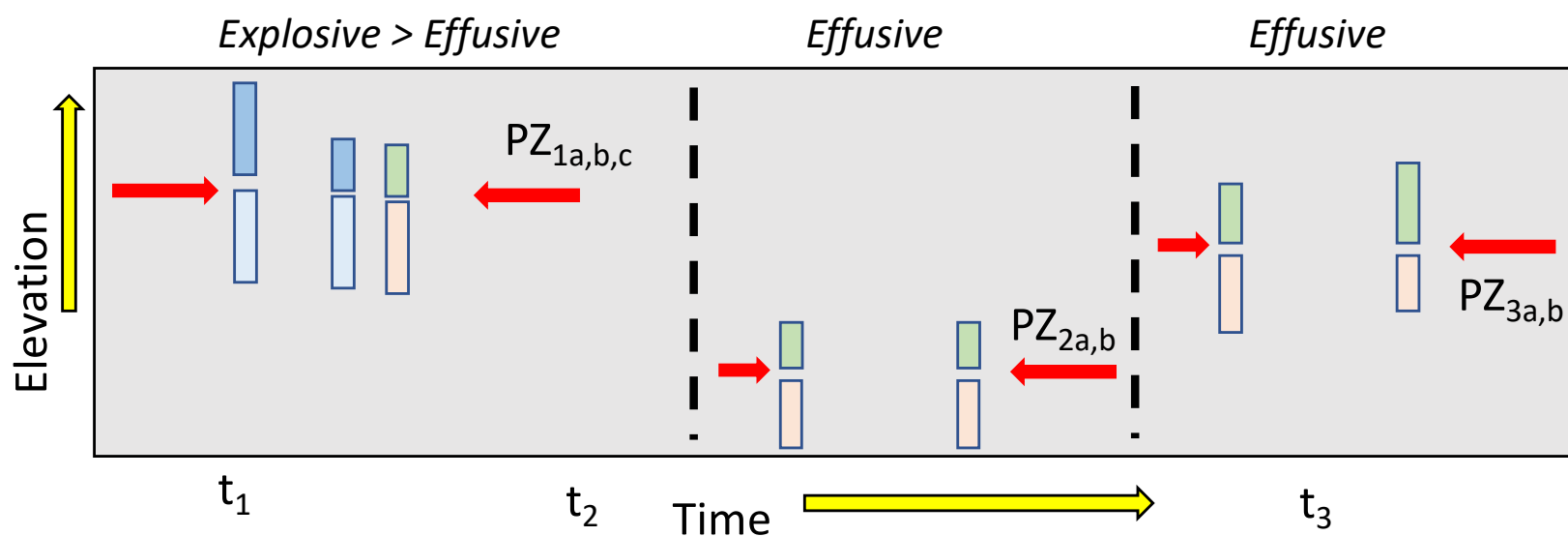
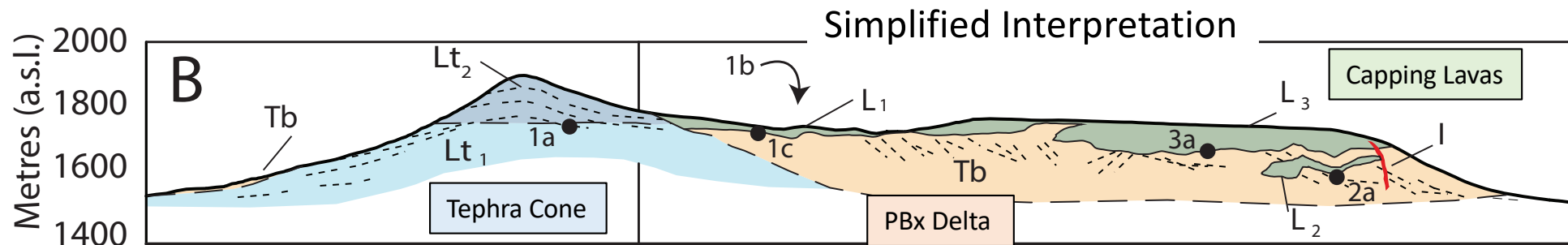
..... fixes the minimum thickness of the enclosing ice sheet

Russell et al. Nature Comm (2013)

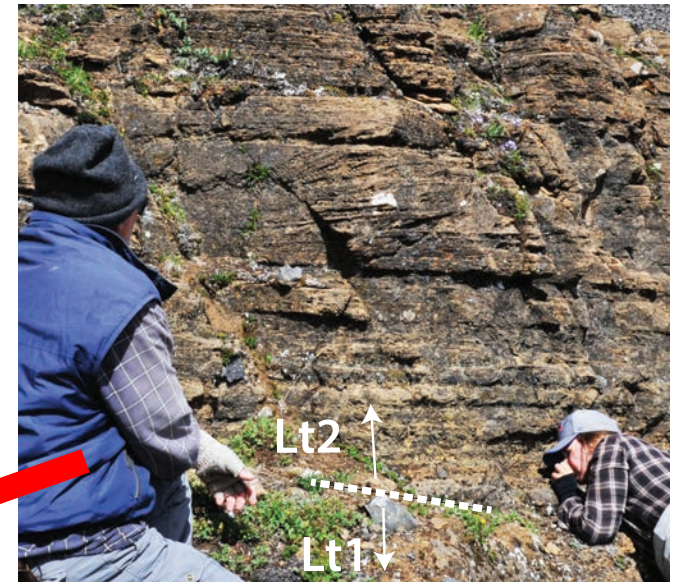
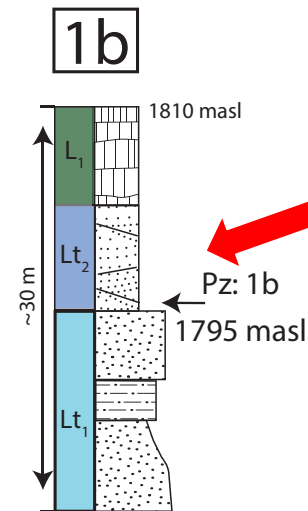
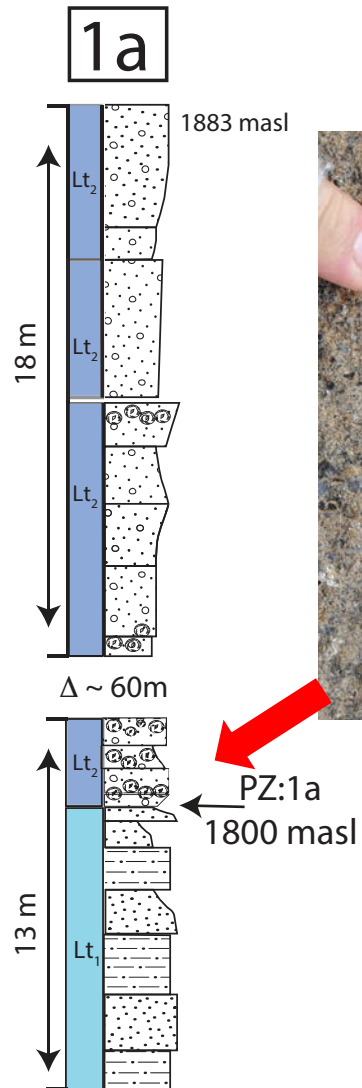
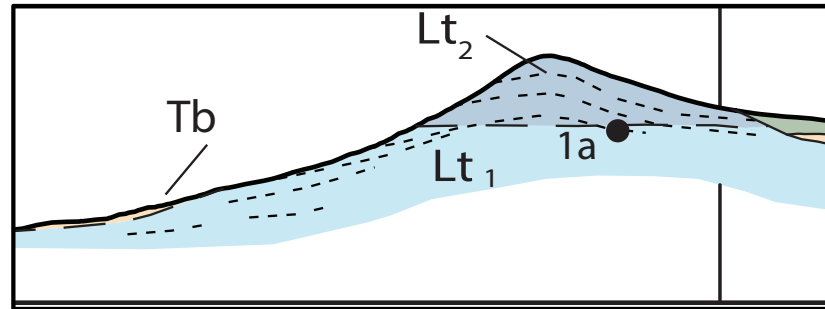
Passage Zone at Kima'Kho



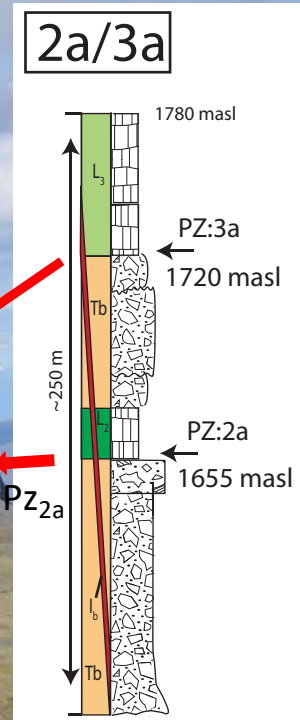
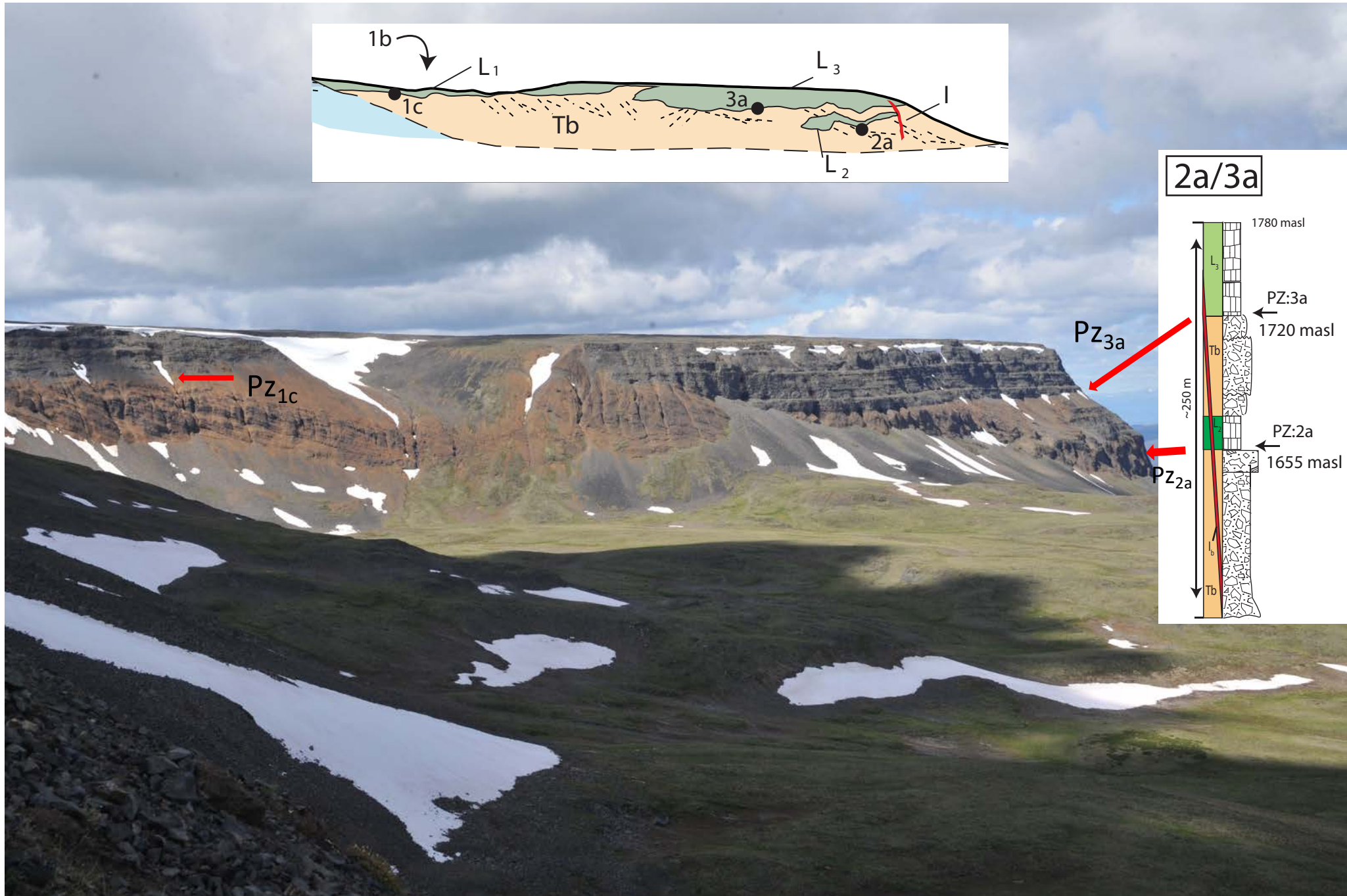
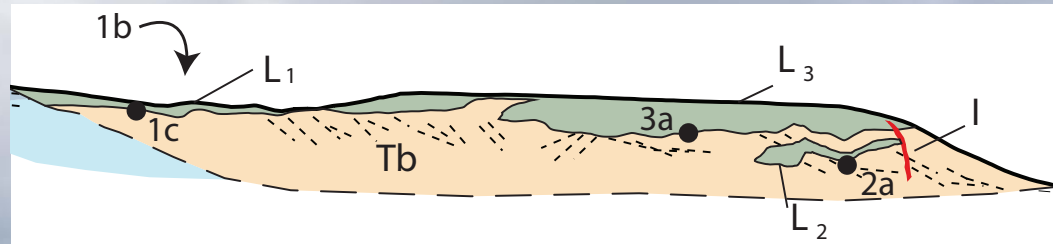
Multiple (3) & Diverse (4) “*Passage Zones*”



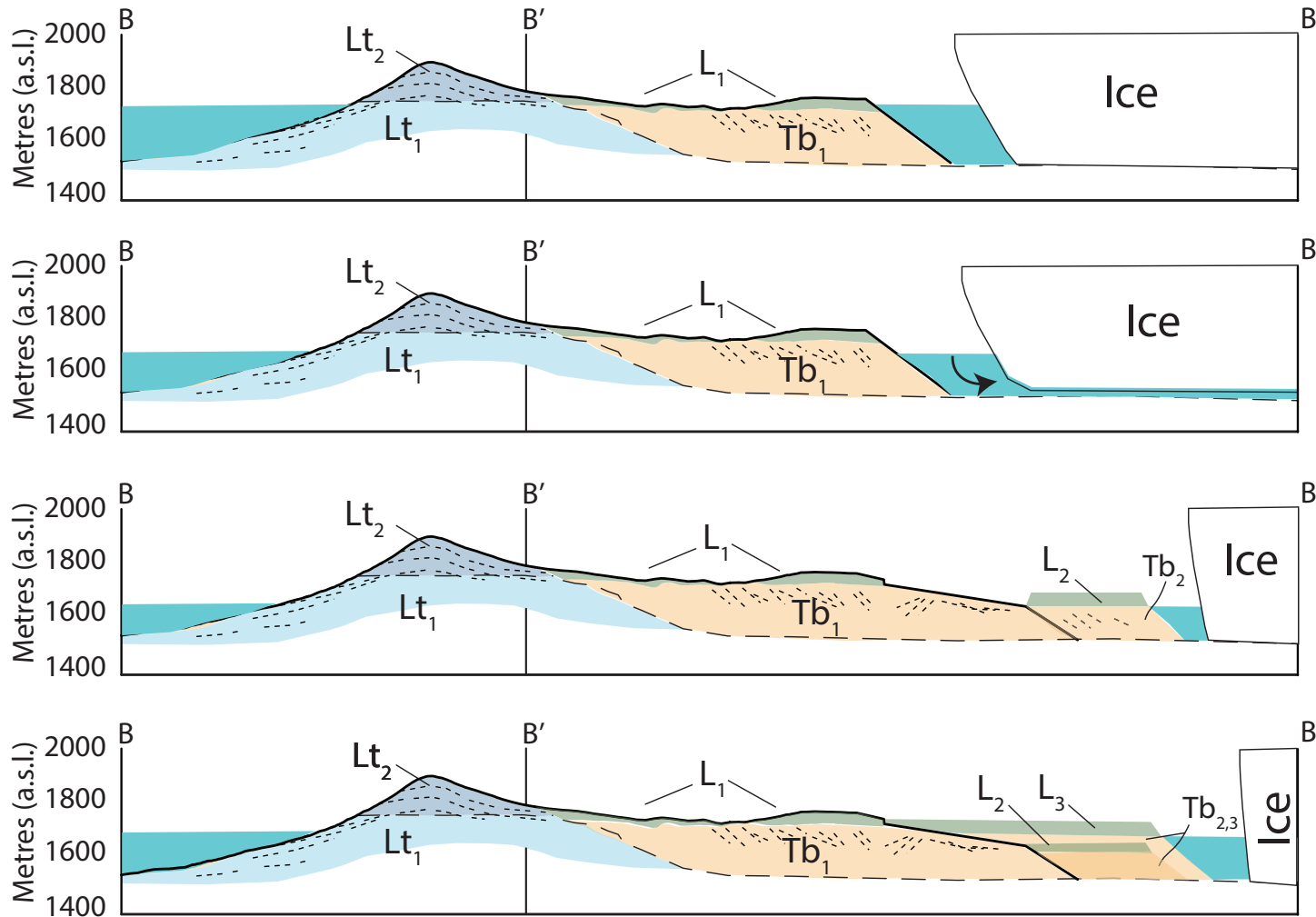
Passage Zones (1a, 1b) Defined by Pyroclastic Lithofacies



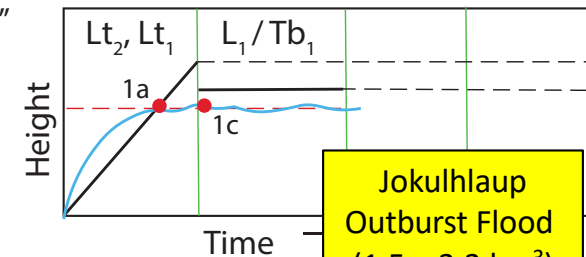
Passage Zones (2 & 3) Defined by Lava – Pillow lava Bx



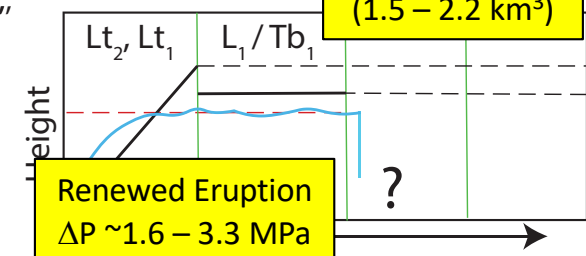
Volcano-Lake Growth & Dynamics



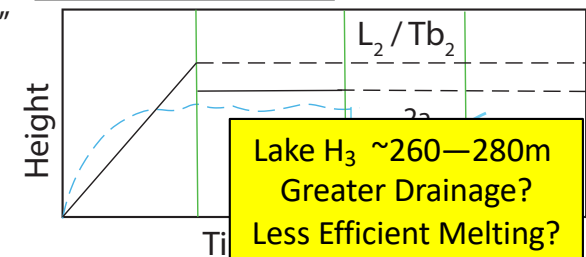
Lake H₁ ~340m
Ice H_{min} ~ 400-425 m



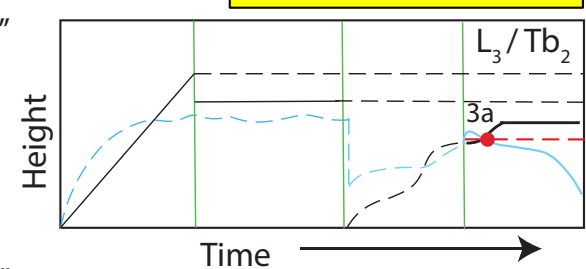
Jokulhlaup
Outburst Flood
(1.5 – 2.2 km³)



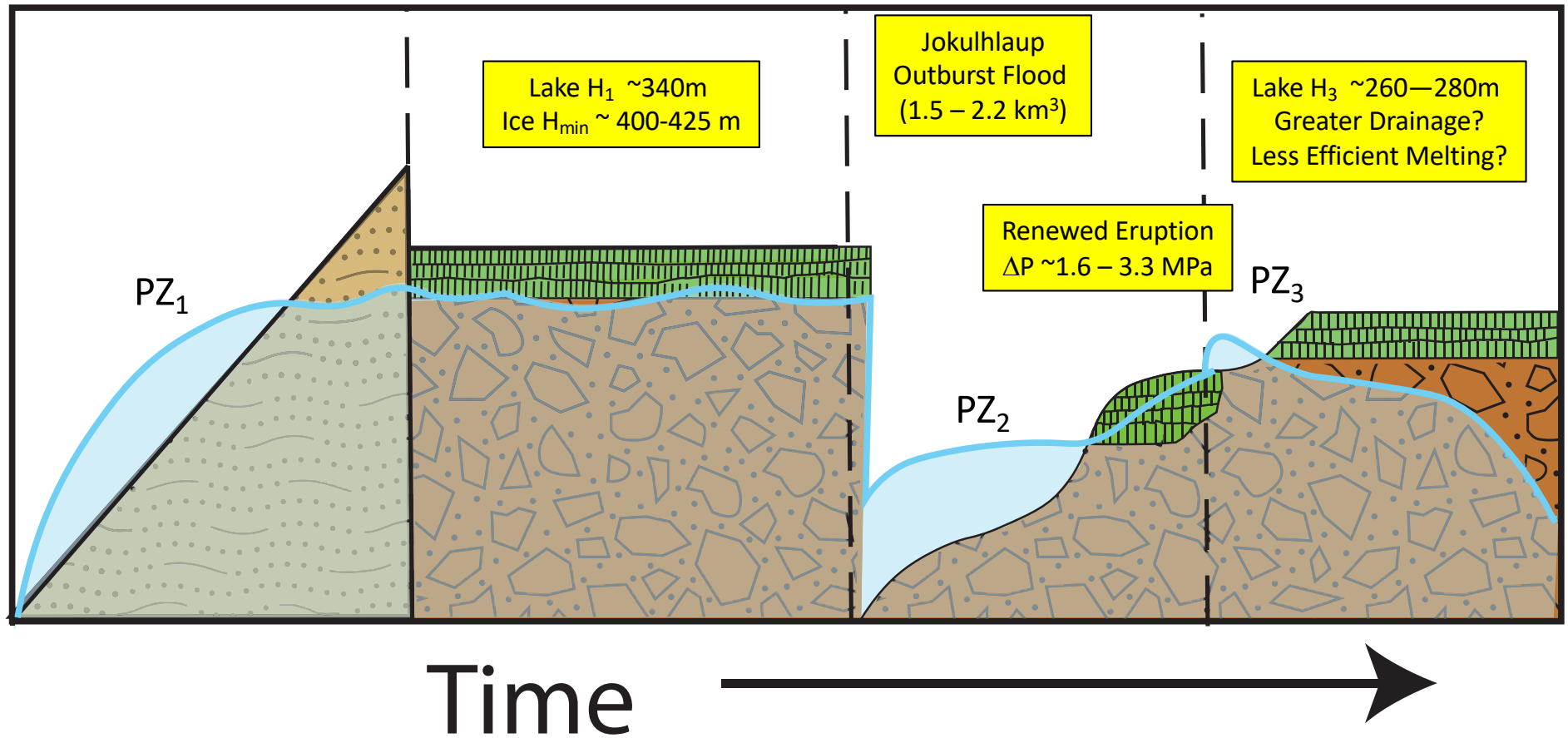
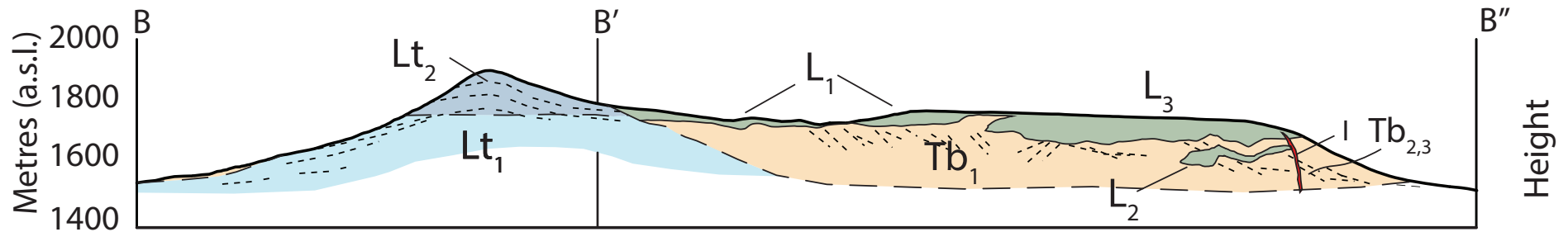
Renewed Eruption
 $\Delta P \sim 1.6 - 3.3 \text{ MPa}$



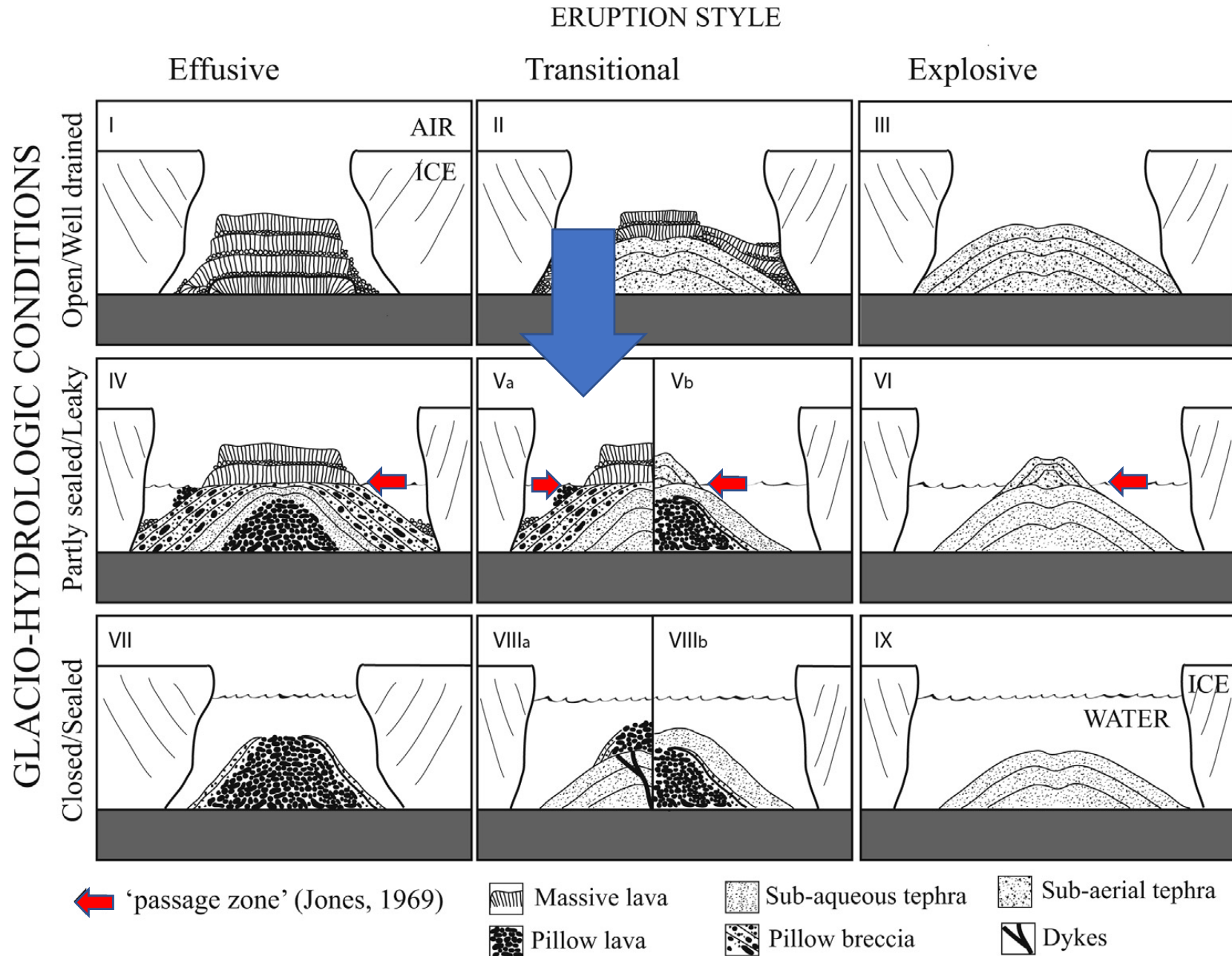
Lake H₃ ~260—280m
Greater Drainage?
Less Efficient Melting?



Volcano-Lake Growth & Dynamics in Paleo-CIS (1.9 Ma)



Descriptive Genetic Classification of Tuyas



SUMMARY

- Kima Kho is a Pleistocene (1949 ± 63 ka) tuya in the northern Canadian Cordillera
- Multiple “*passage zones*” track transient depth of syn-volcanic paleo-englacial lake
- Peak lake depth (~ 340 m) constrains the minimum ice thickness (> 400 m)
- Passage zones record a massive, catastrophic deluge (i.e. jökulhlaup) of $1\text{--}2 \text{ km}^3$
- Glaciovolcanism records Cordilleran-scale ice sheet at ~ 1.9 Ma

Thank-you

