

Prolonged multi-phase volcanism in the Arctic induced by plume-lithosphere interaction

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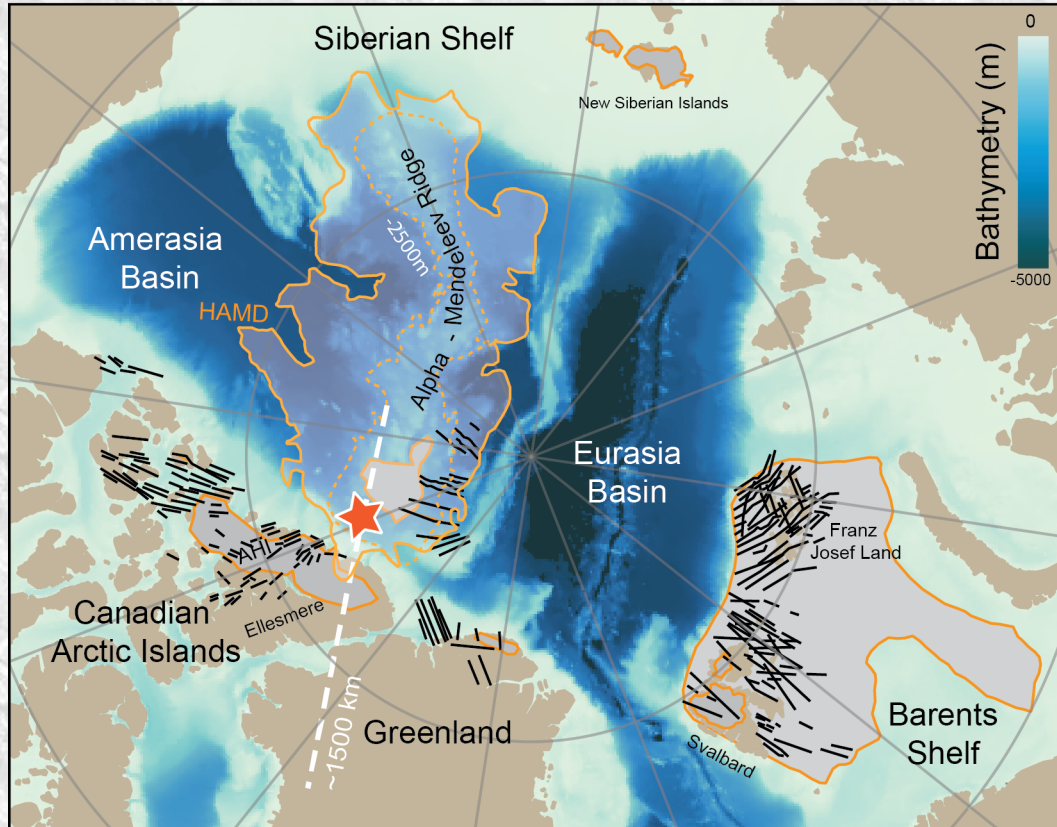
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The Arctic – a complex puzzle with LIP (?)



Heyn et al. (in review for G³)

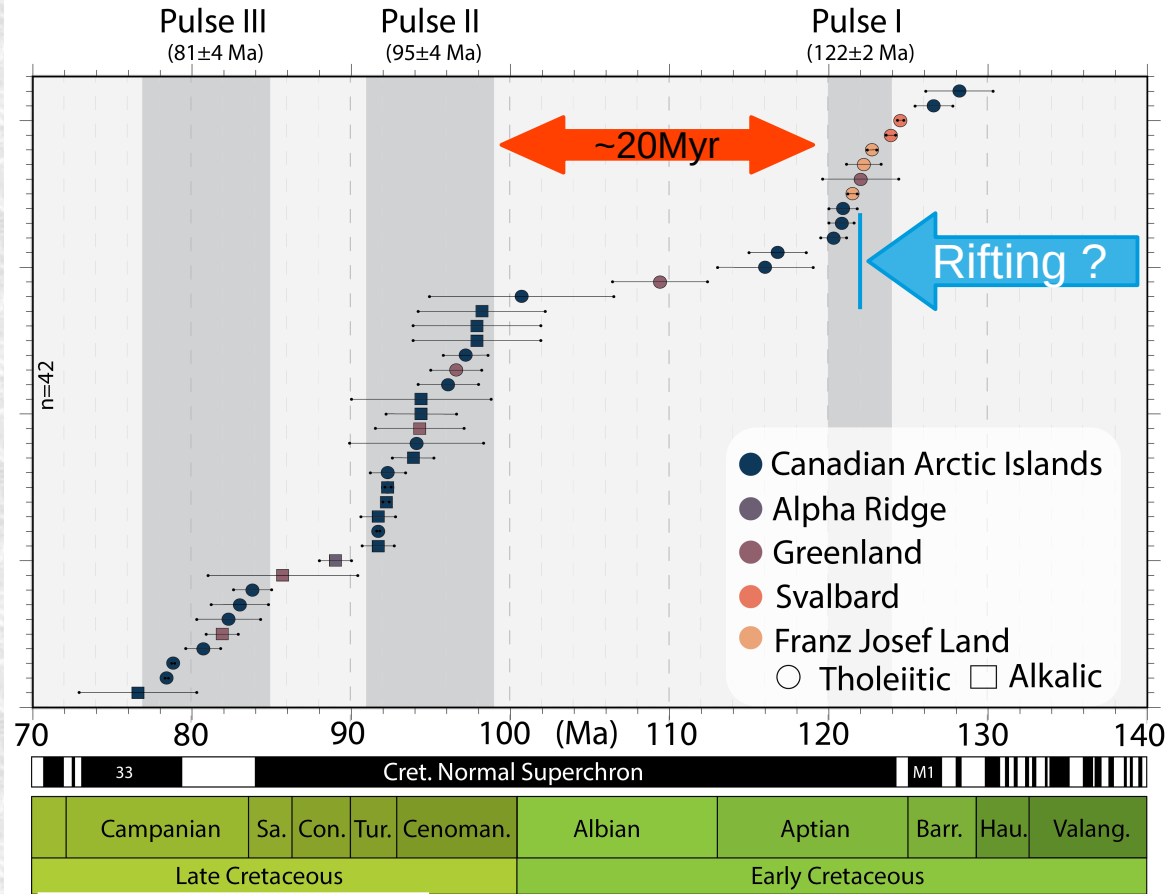
Tectonic setting:

- Eurasia basin rifting from ~53 Ma
- Amerasia basin opening 140-122 Ma (?)

High Arctic Large Igneous Province (HALIP):

- Canadian Arctic Islands
- Northern Greenland
- Svalbard
- Siberian Islands
- *Alpha-Mendeleev Ridge*

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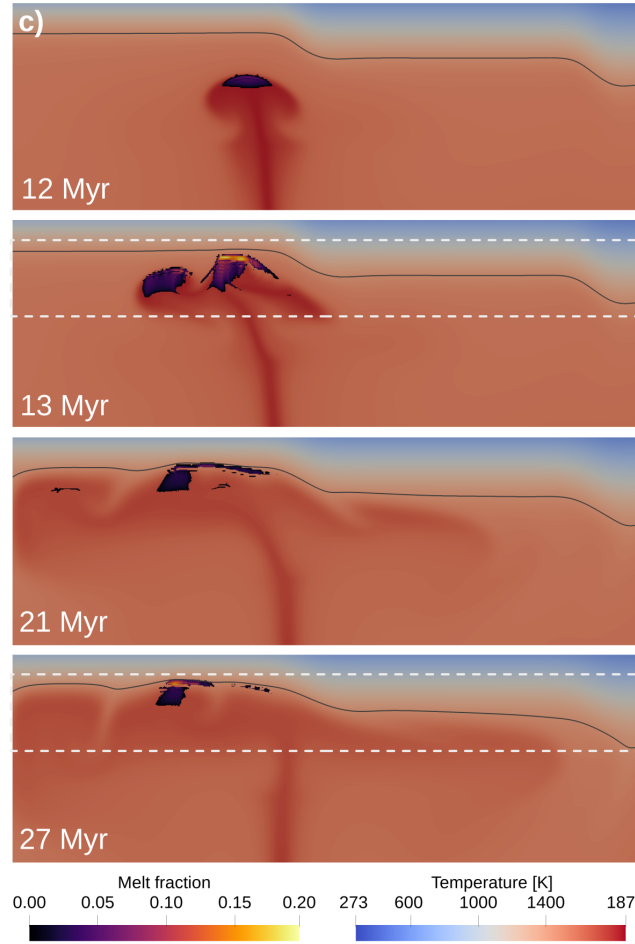
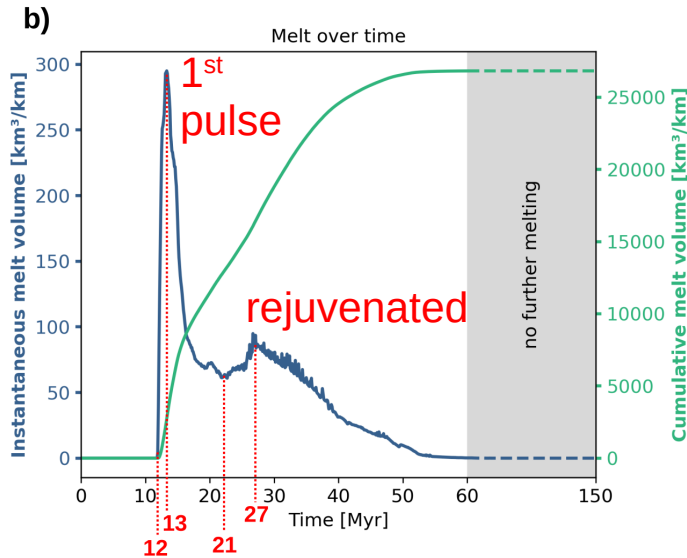
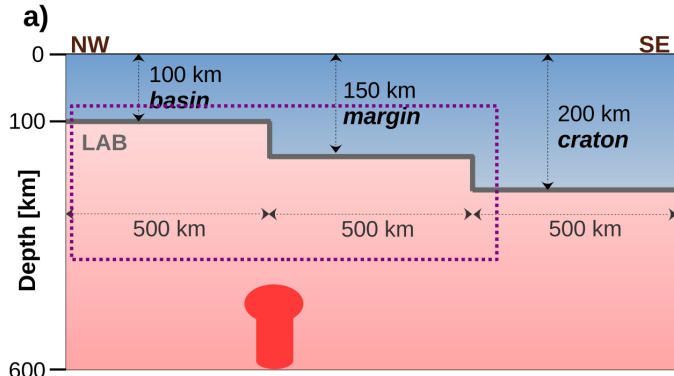
- Typical LIPs: >75% of volume in 1-5 Myr

HALIP magmatism:

- Long-lived: >50 Myr
- 3 Pulses:
 - 122 Ma
 - 95 Ma
 - 81 Ma
- Volumes ~21-30 x 10⁶ km³
 - *Alpha ridge* ~20 x 10⁶ km³



Stagnant plate - Prolonged time-variable magmatism



2-D model

- No relative motion
- Plume hits at first lithosphere step

~40 Myr melting
no separate pulses



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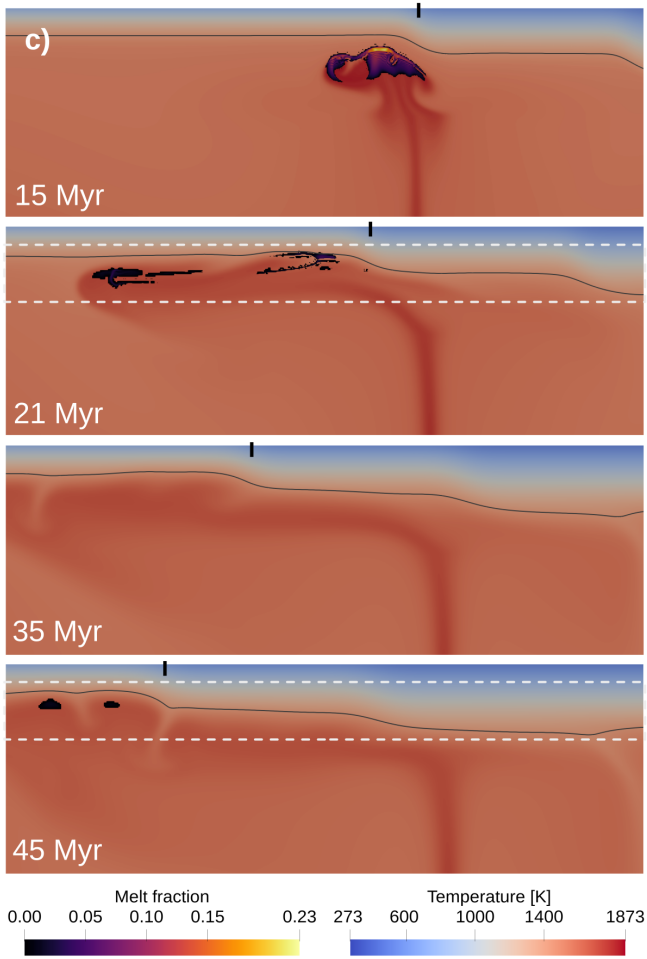
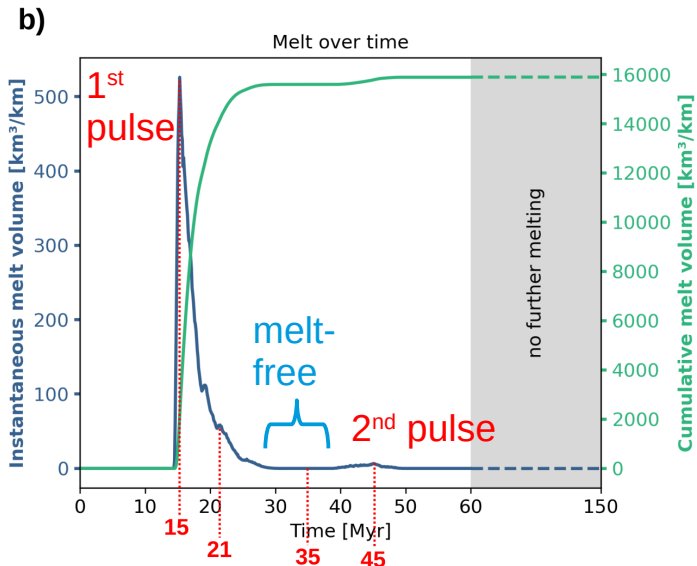
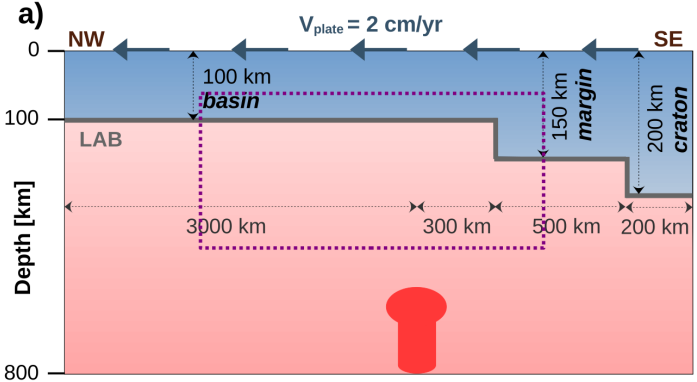
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Moving plate - Pulses in magmatism



Heyn et al. (in review for G^3)

2nd pulse

- Melting beneath basin
- Plume is >500 km away**



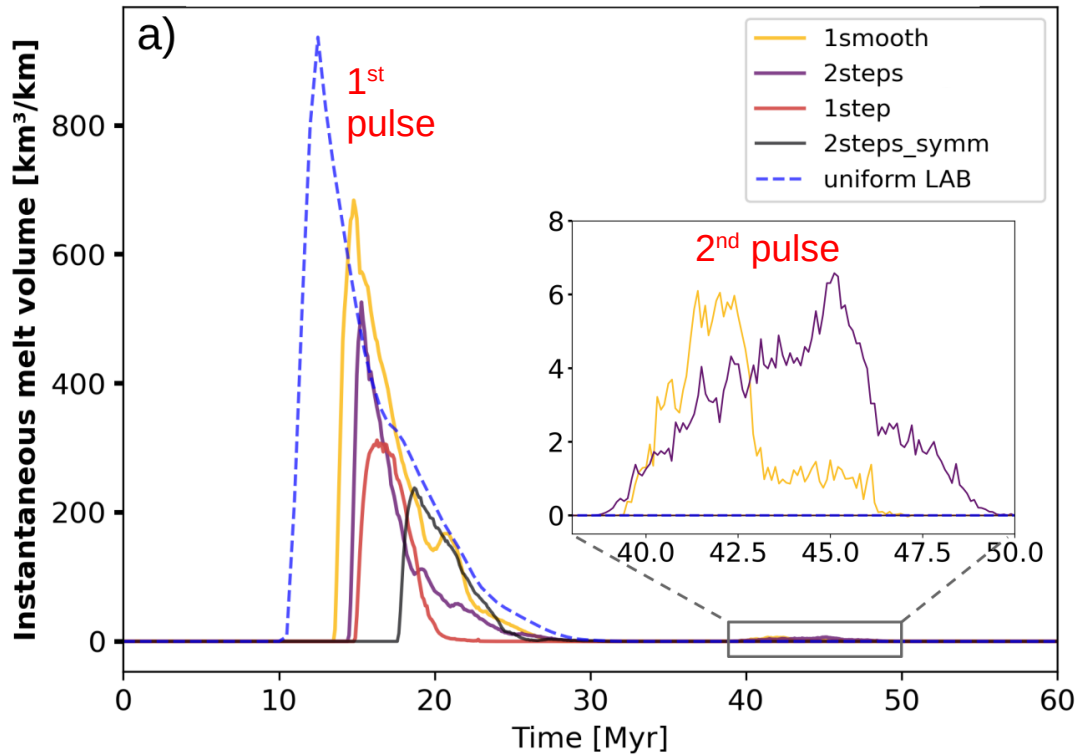
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Summary

Melt over time for moving plate cases



	Model	HALIP	
Pulse spacing	~25-30 Myr	~27 Myr	✓
melt-free	10-15 Myr	15-20 Myr	✓
Duration 1 st pulse	10-15 Myr	4-12 Myr	?
Duration 2 nd pulse	8-10 Myr	8-10 Myr	✓
No. pulses	2	3	✗
Relative volumes (1 st vs 2 nd)	100x	0-100x	?

Heyn et al. (in review for G³)

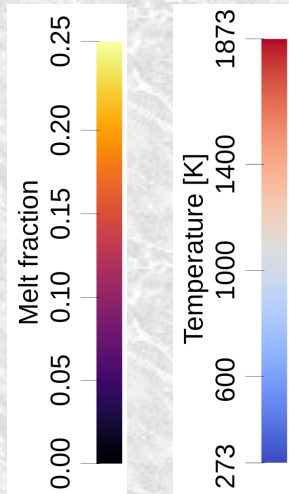
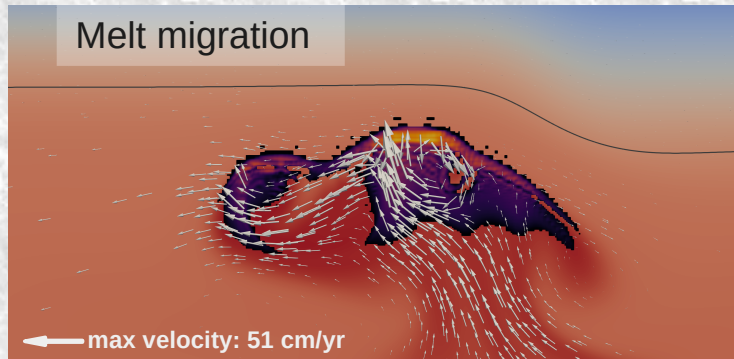
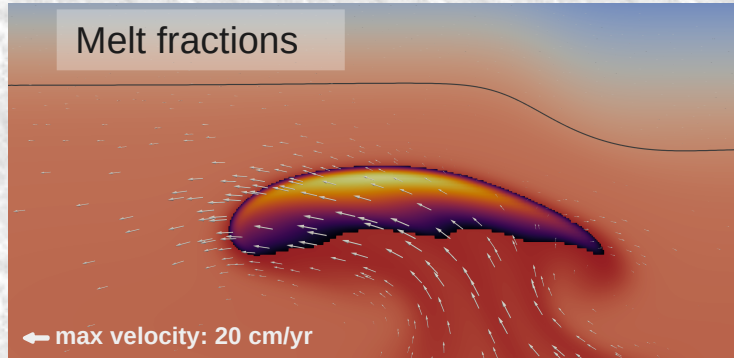
★ Prolonged ★ Multi-pulse

★ Rejuvenated

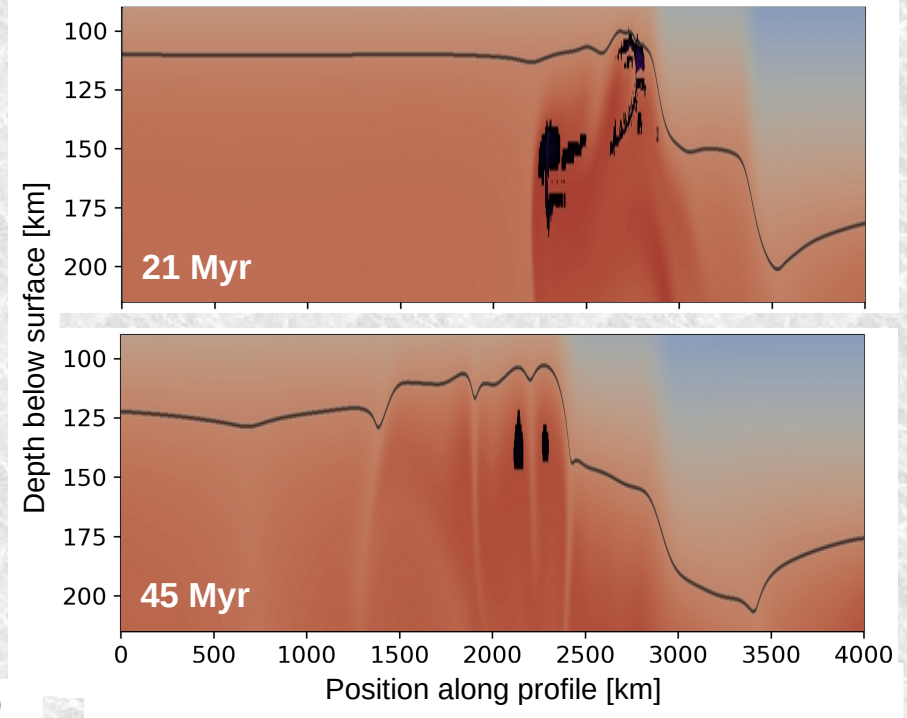
★ Plume >500 km away from melting region



Melt fractions versus melt migration



Heyn et al. (in review for *G³*)



- Melt dynamics enhances lithosphere thinning

- Rejuvenated magmatism in thinnest regions