



# Amplification of sub-lithospheric dynamics by melt migration during plume-lithosphere interaction

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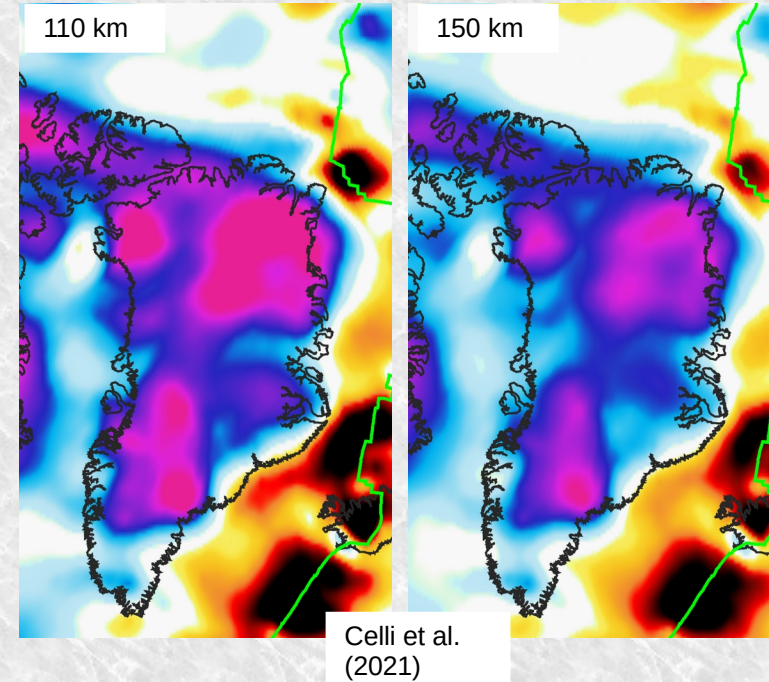
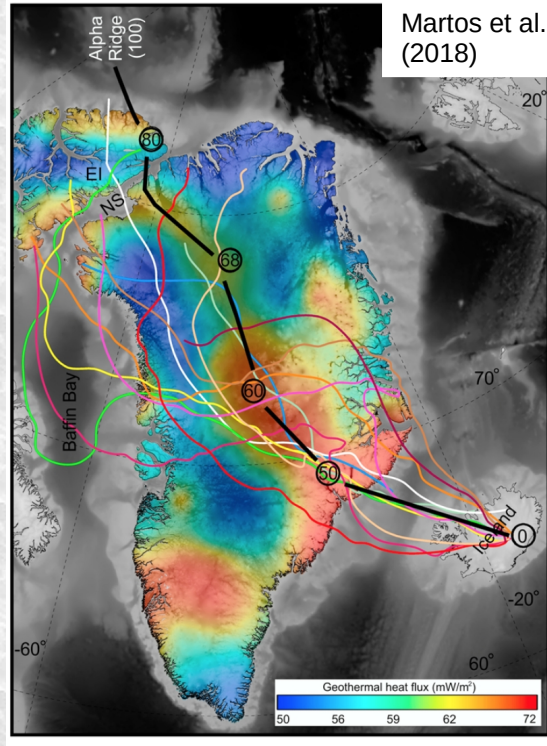
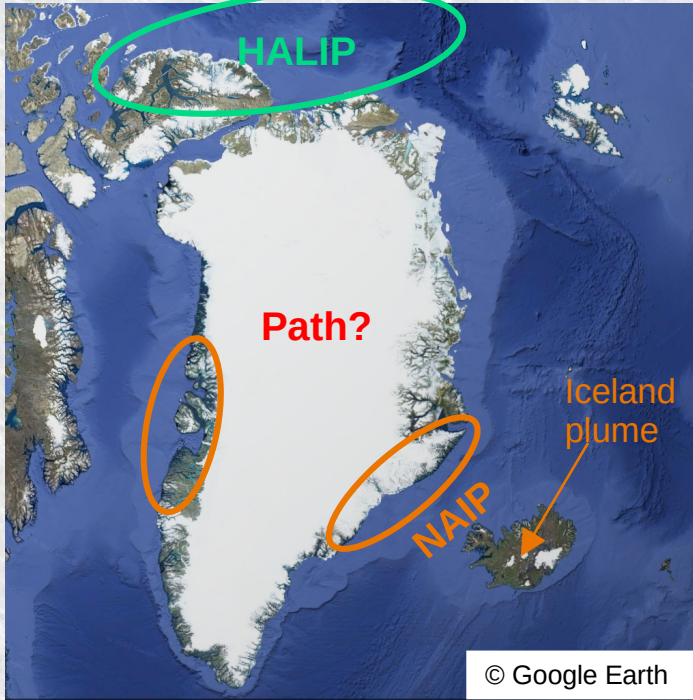
Centre for Earth Evolution and Dynamics (CEED),  
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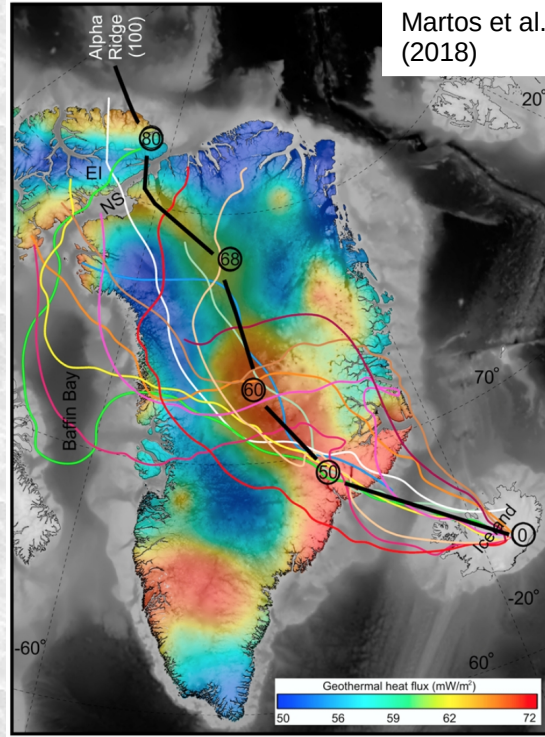
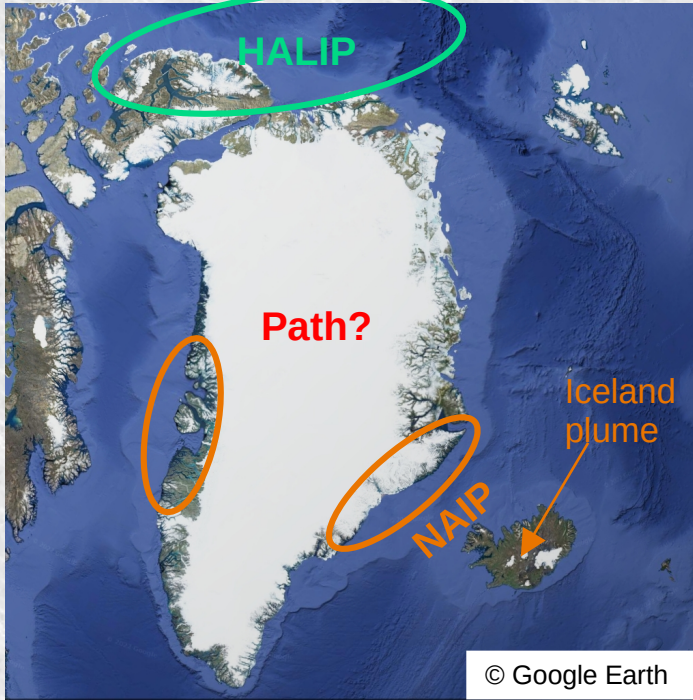
# Background



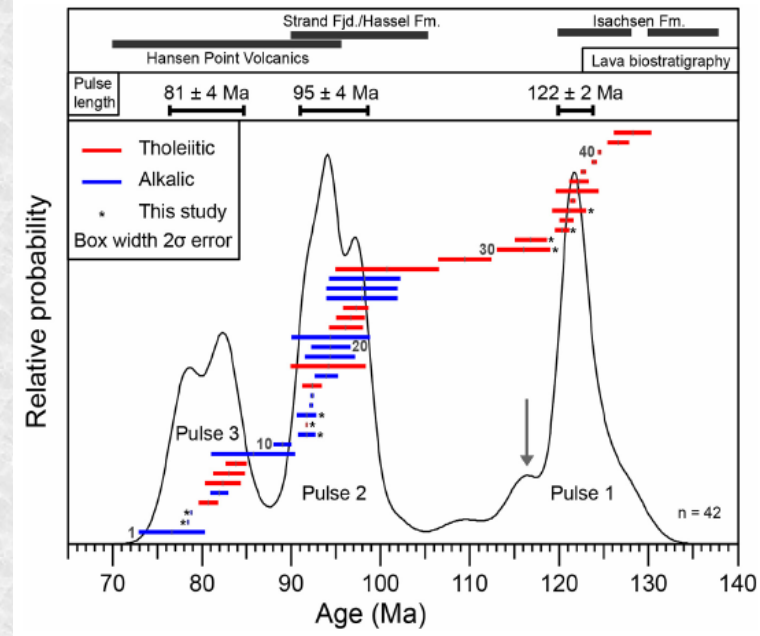
## Complex setting:

- 2 large igneous provinces (?)
- Several spreading centers
- Variable lithosphere thickness
- Different possible plume paths
- Heat flux anomaly ???

# Background



Dockman et al. (2018)



## HALIP

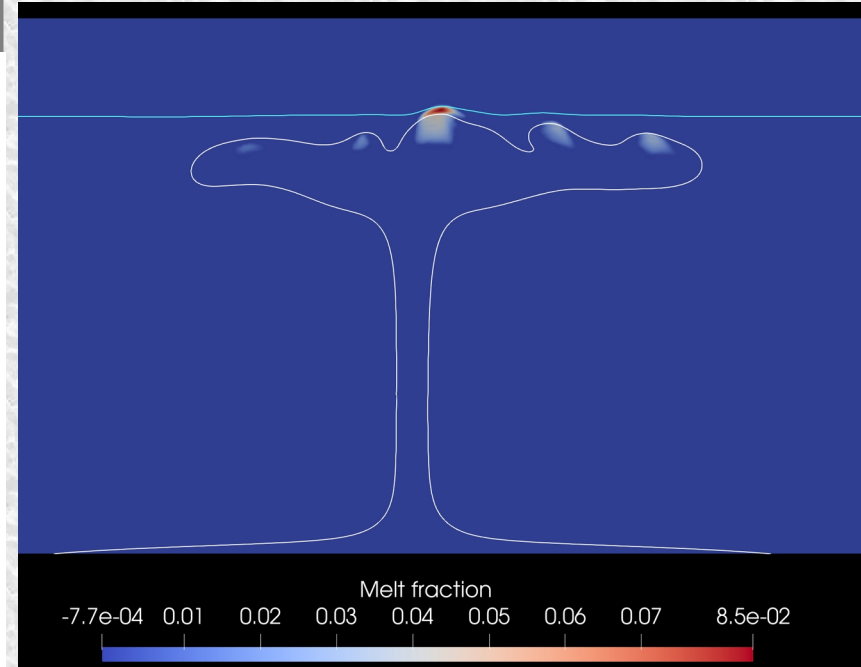
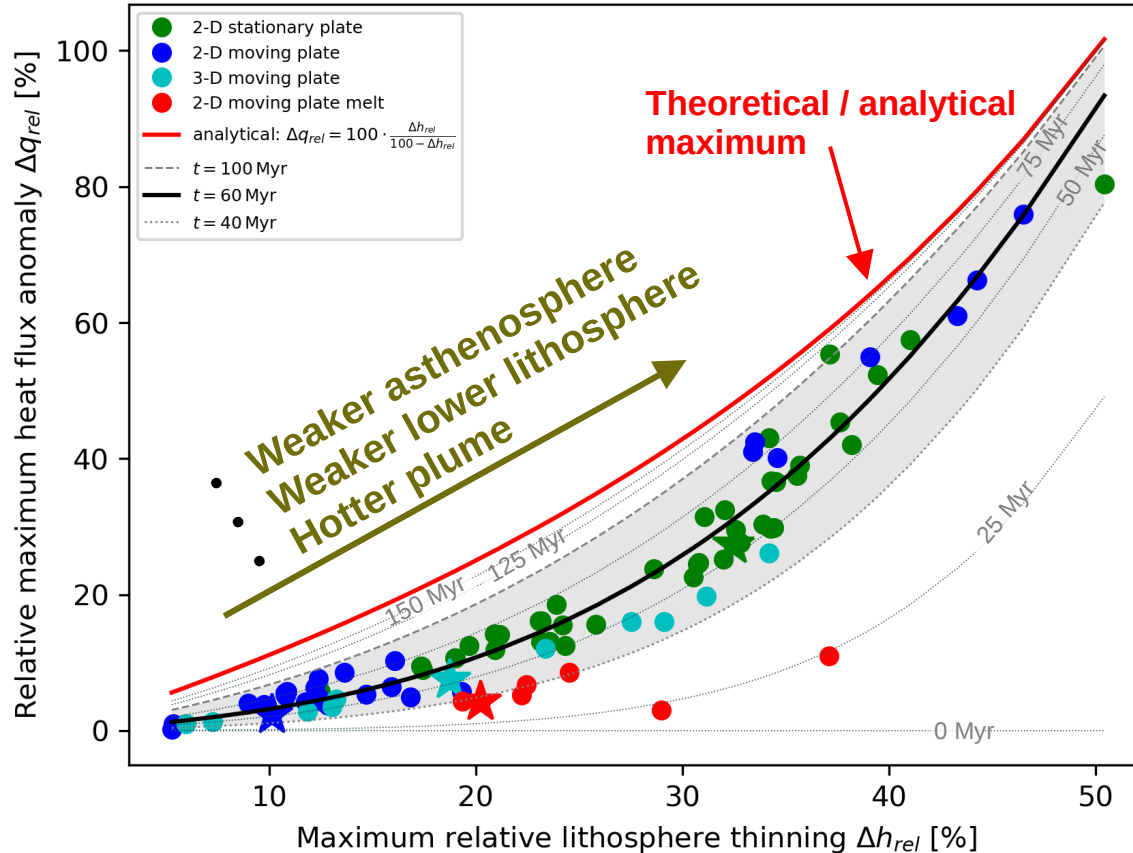
- HALIP is long-lived
- HALIP has pulses

### Complex setting:

- 2 large igneous provinces (?)
- Spreading centers
- Variable lithosphere thickness
- Different possible plume paths
- Heat flux anomaly ???

# Melt enhances small-scale convection

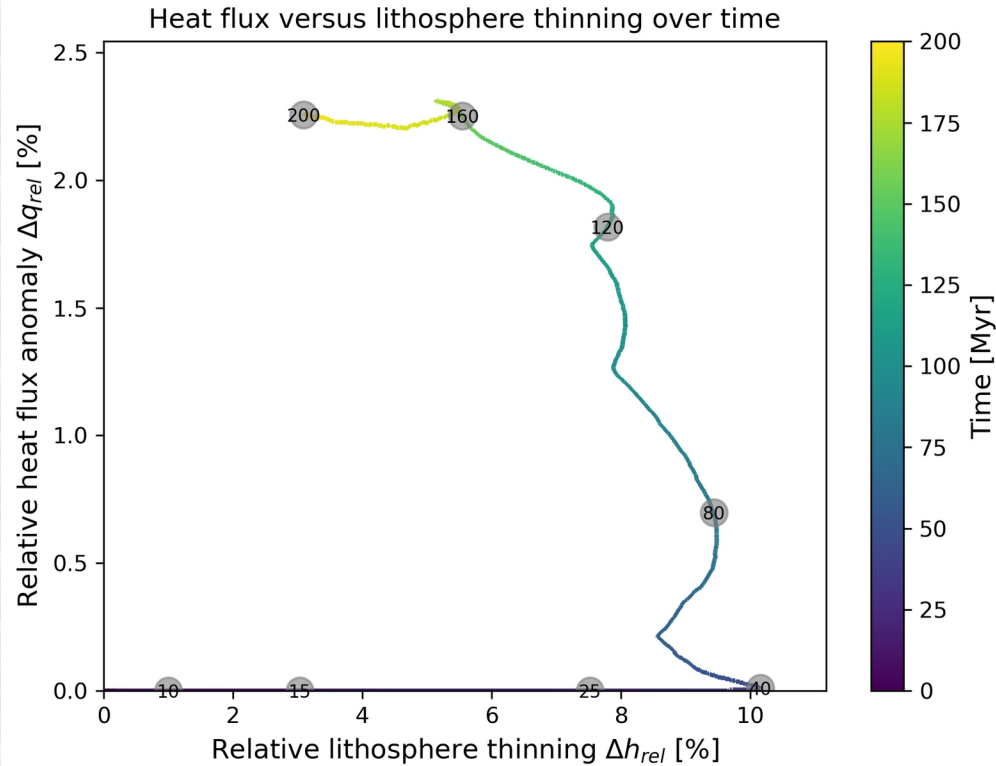
## Heat flux anomaly vs lithospheric thinning



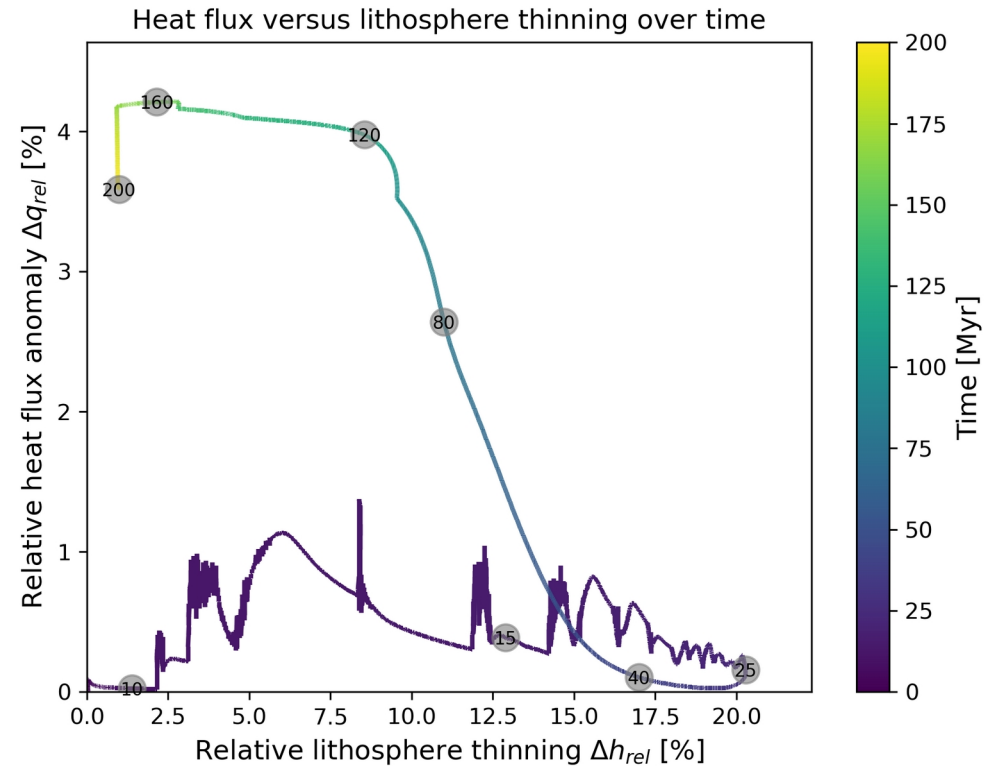
- Increased maximum thinning
- Heat flux slightly increased (but: no melt erupted!)
- Apparent (?) shorter equilibration time

# Melt enhances small-scale convection

Melt free 2-D model



2-D model *with melt*

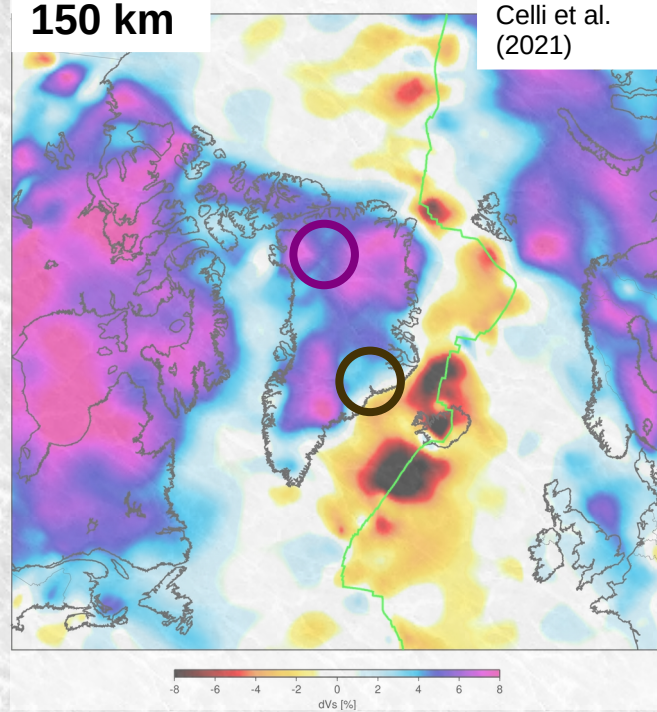
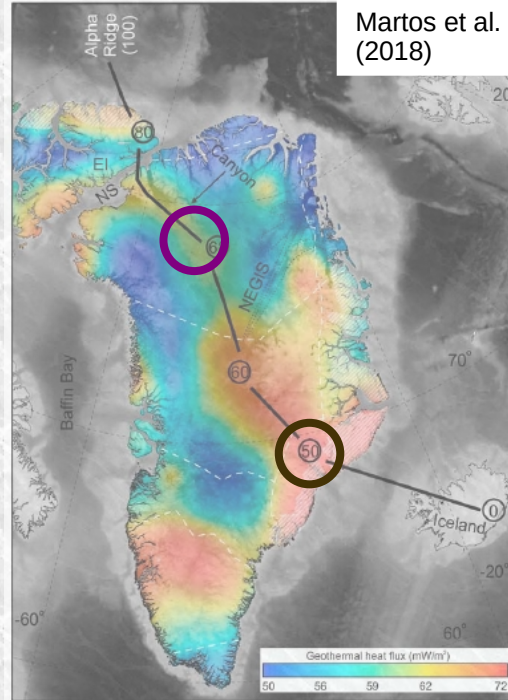
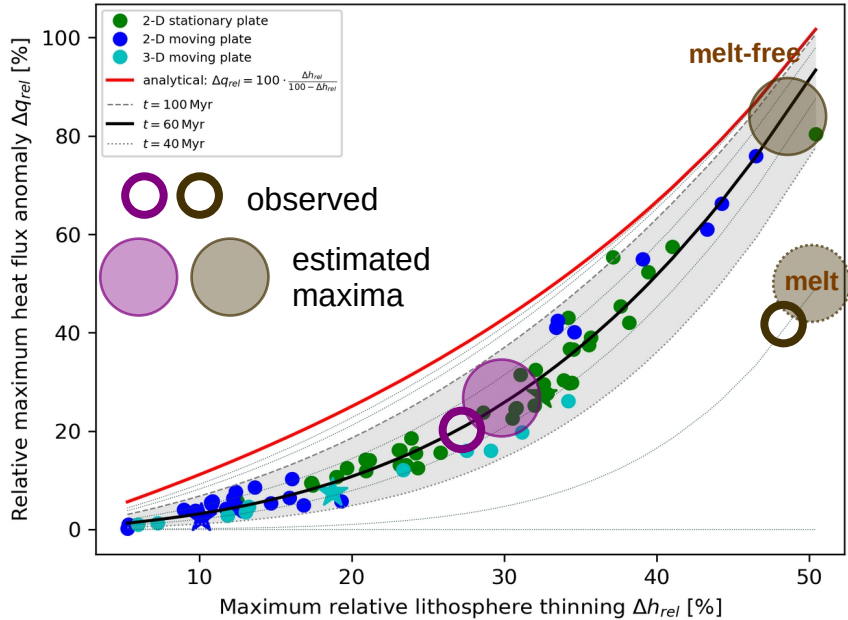


**Melt causes:** ● local, short-lived thinning ● earlier maximum thinning ● shorter delay

# Application to Greenland

Reference values:  
Lithosphere thickness 150 km, heat flux 50 mW/m<sup>2</sup>

Heat flux anomaly vs lithosphere thinning

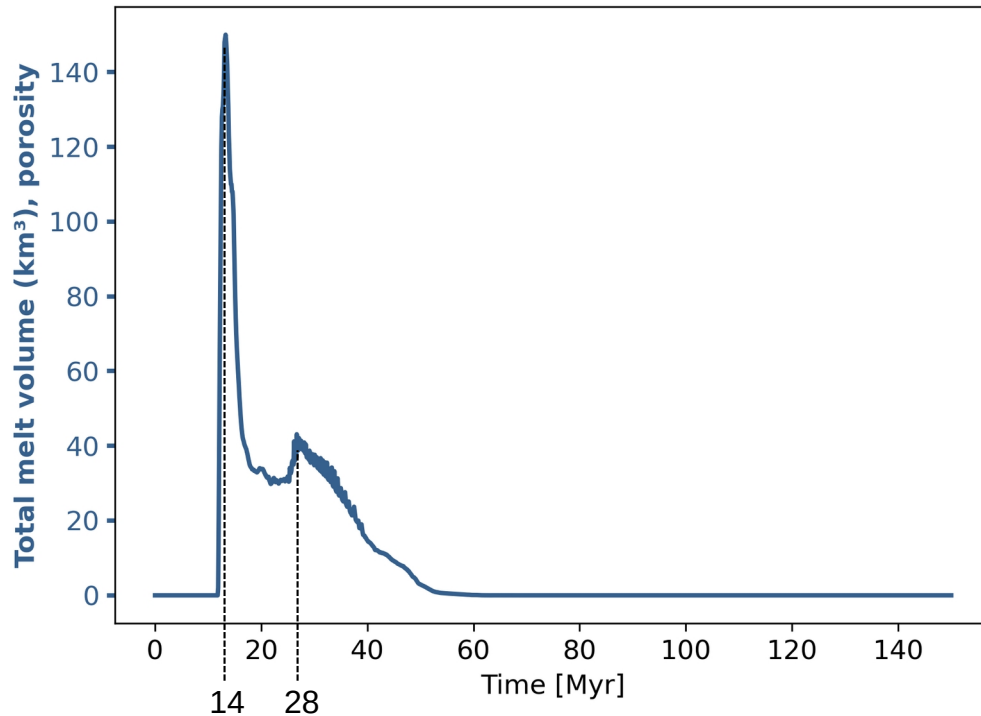


- Northern part (healing started):**
- Heat flux anomaly ~20% (~10 mW/m<sup>2</sup>)
  - Lithosphere thinning ~27% (~40 km)

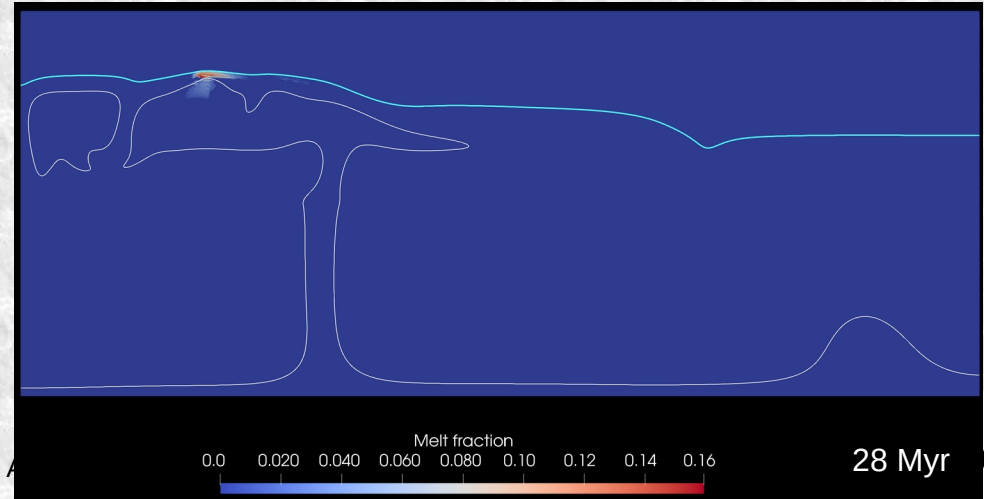
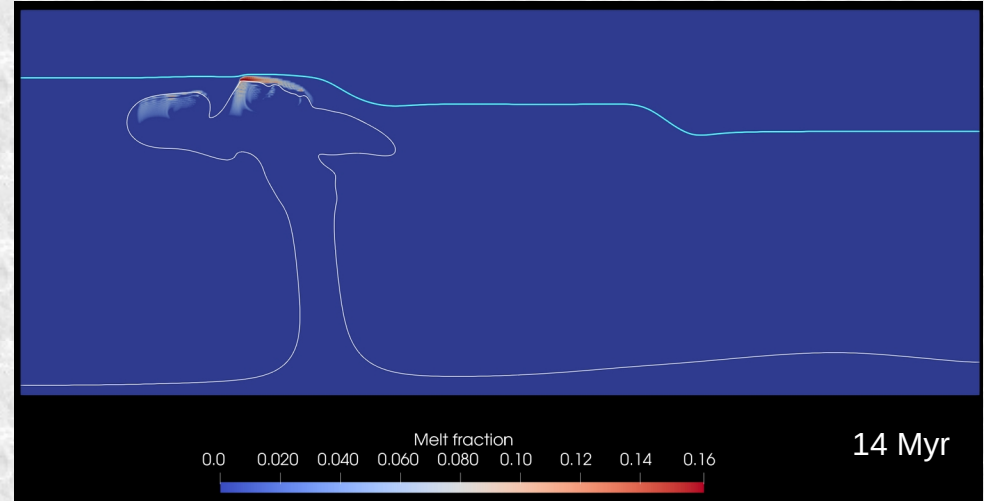
- Southern part (at maximum thinning):**
- Heat flux anomaly ~40% (20 mW/m<sup>2</sup>)
  - Lithosphere thinning ~47% (~70 km)

# Prolonged melting period with variable amounts

Melt over time

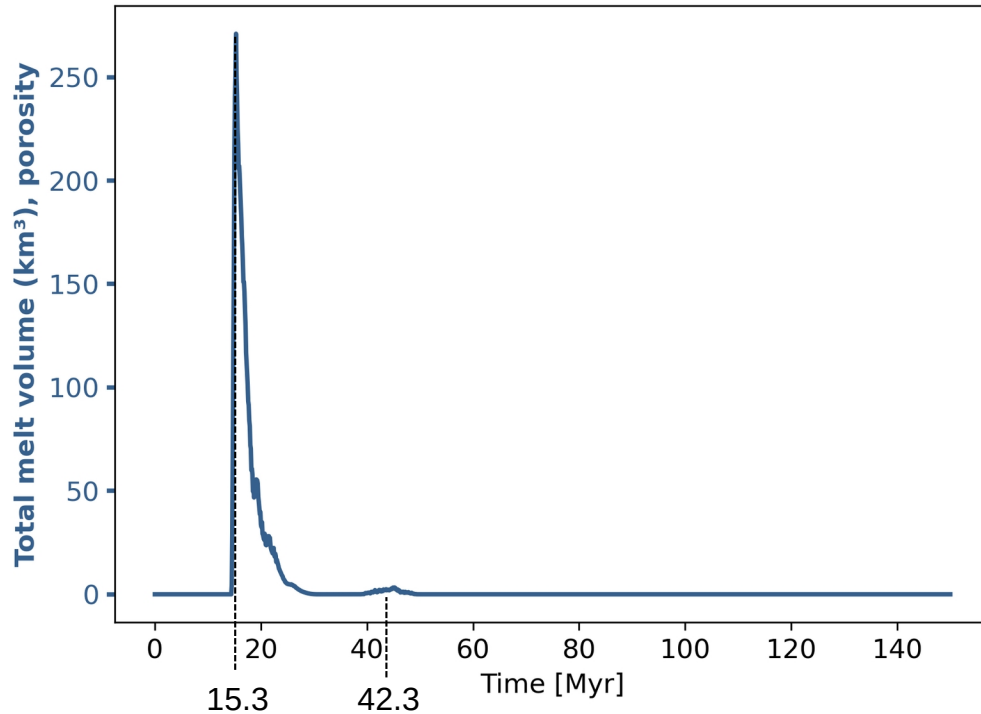


- Stagnant lid, 2 steps in LAB
- Prolonged melting with 2 peaks, slight offset



# Multiple melting events

Melt over time



- 1 moving plate, 2 steps in LAB
- 2 melting events, in same region

