

# How did Venus' Lava Channels Form? Testing Lava and Substrate Compositions

M. E. Borrelli\*, D. A. Williams, and J. G. O'Rourke School of Earth and Space Exploration, Arizona State University, Tempe, AZ, \*meborrel@asu.edu

# Rille location: -56° N, 1° E

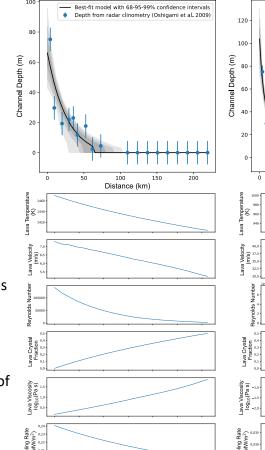
# Background

- Venus has >200 lava channels, including canali and rilles
- Carbonatite lava has been proposed to form canali. The lava type that formed rilles is unknown.
- Carbonatite has a very low viscosity, low temperature, high carbon content, and is rare on Earth.
- Recent studies show that large amounts of carbon could be present in Venus' crust even without plate tectonics

## Methods

- Model channel formation by thermal erosion to match depth profiles
- Test various lava and substrate compositions – (lunar-like basalt, tholeiitic basalt, komatiite, carbonatite).

### Thermal Erosion Models



Distance (km)

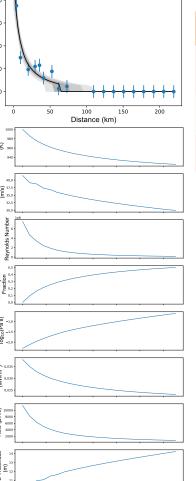
m (m)

Lunar-like Basalt

### Carbonatite

Best-fit model with 68-95-99% confidence intervals

Depth from radar clinometry (Oshigami et al. 2009)



Distance (km)

### **Preliminary Results**

Models assuming various lava types, including carbonatite, can match the depth profiles of rilles.

Lava Type	Flow Thickness (m)	Flow Duration (Earth months)	Total Lava Volume (km^3)
Tholeiitic Basalt	3.2 ± 0.7	4.5 ± 2.2	380 ± 77
Carbonatite	10.3 ± 1.6	0.01 ± 0	8 ± 1
Lunar-like Basalt	7.8 ± 1.6	0.6 ± 0.2	62 ± 11

## **Next Steps**

- Complete a database of rilles and canali
- Continue analysis for komatiite lava
- Incorporate mechanical erosion in models
- Benchmark 1D models with 2D and 3D simulations
- Estimate the production rate of carbonatite lava on Venus to assess new models of crustal (de)carbonation