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Thermal Radiative Properties of Bardarbunga Basalts: Importance of Emissivity in Magma Rheology and Volcanic Hazard.

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Thermal Radiative Properties of Bardarbunga Basalts: Importance of Emissivity in Magma Rheology and Volcanic Hazard

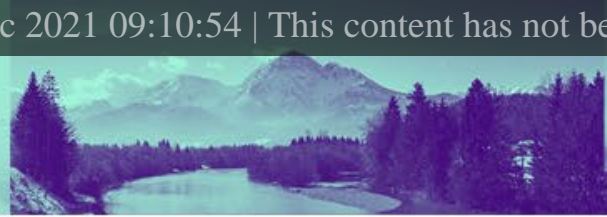


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V23A-04 - Properties of magmas- 14 December 2021



JONAS BIREN

**PhD student at ISTO, University of Orléans
- Orléans, France**





TEMPERATURE - KEY PARAMETER TO UNDERSTAND LAVA FLOW RHEOLOGY

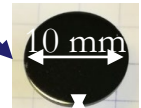
Lava flow T retrieved by remote sensing (RS) depends on **spectral emissivity (ϵ)**.

ϵ **poorly known**: considered constant or retrieved at RT

Only few studies of ϵ at relevant magmatic conditions:

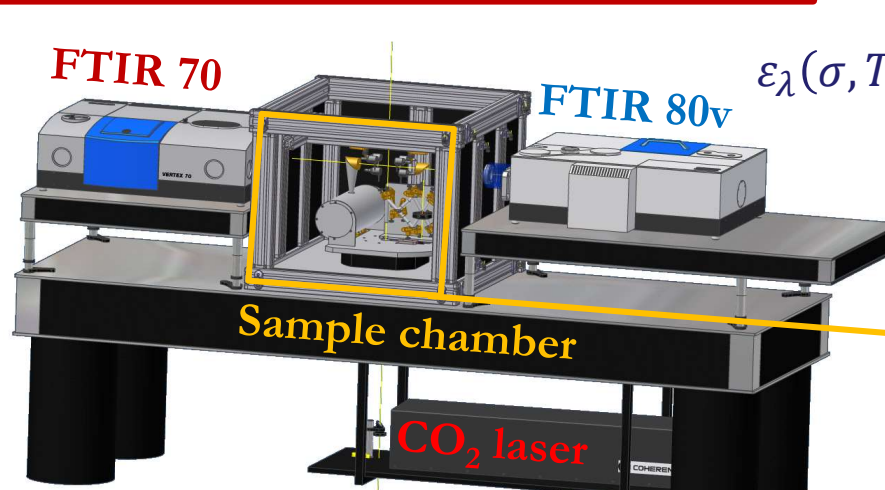
- **Limited** T range ($<T_g$) / spectral range (TIR) / composition (synthetic)

High Temperature and broad spectral range ϵ data are necessary!

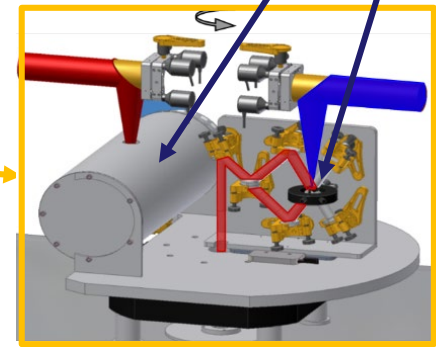


1.5 mm

In situ measurements of ϵ with FTIR spectrometers up to 1800 K, in SWIR-MIR-TIR



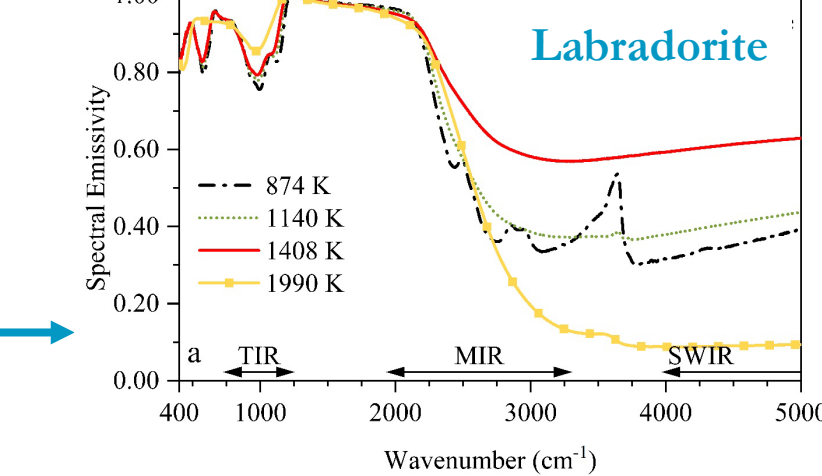
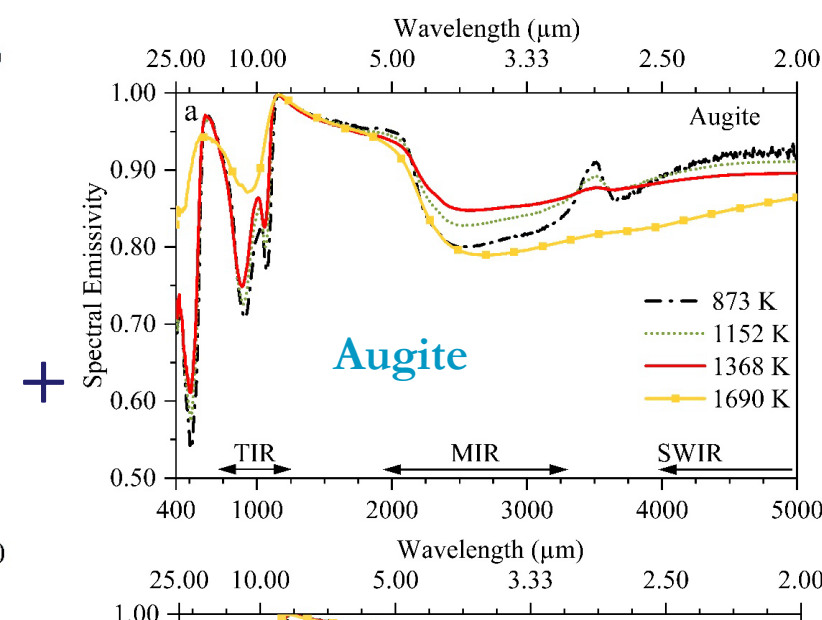
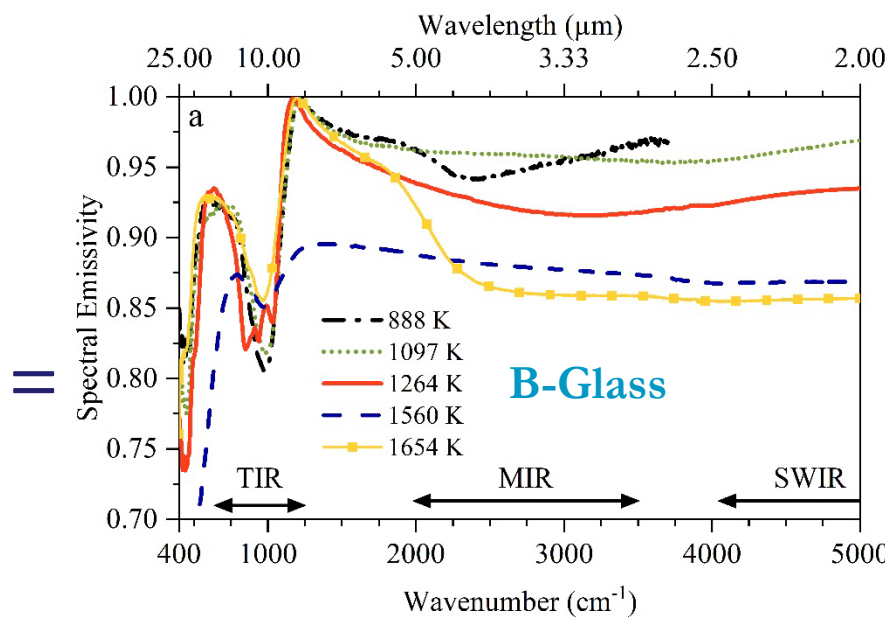
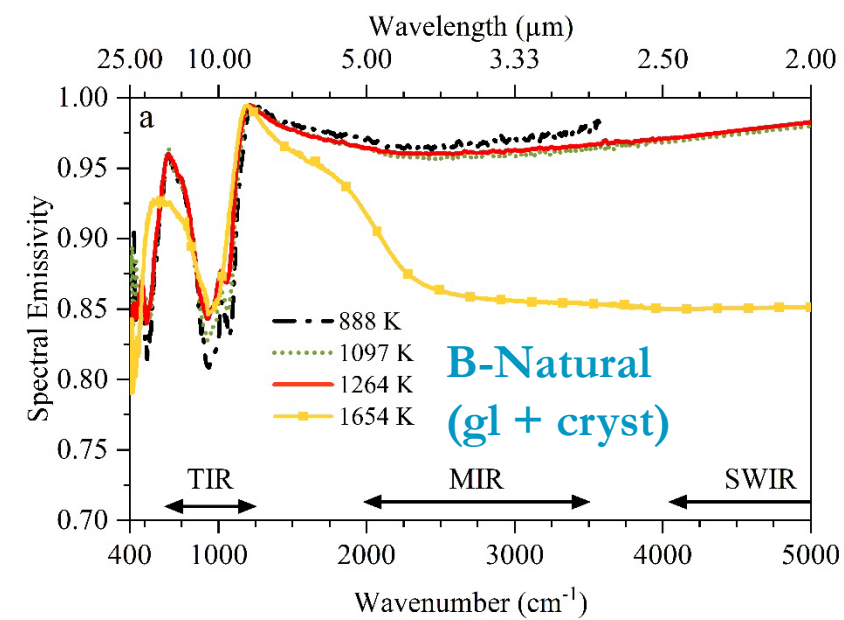
$$\epsilon_{\lambda}(\sigma, T, \theta) = \frac{L_{\lambda}(\sigma, T, \theta)}{L_{\lambda}^0(\sigma, T, \theta)} = \frac{\text{Sample}}{\text{BB}}$$



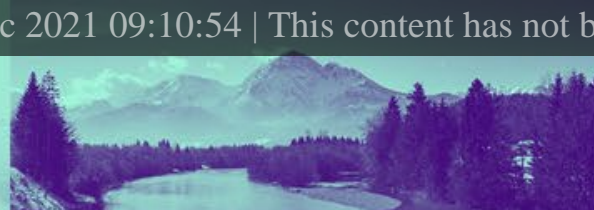
De Sousa Meneses et al. (2015)



SPECTRAL EMISSIVITY BEHAVIOR OF BASALT WITH CRYSTALS



- ϵ increases linearly with T in TIR
- ϵ changes non-linearly with T in SWIR, MIR
- ϵ highly impacted by crystals content, composition \longrightarrow



IMPLICATION

Andújar and Scaillet (2012)

ϵ behavior is highly complex

- depends on λ , T, composition, and crystal content

Better constrain on surface radiance

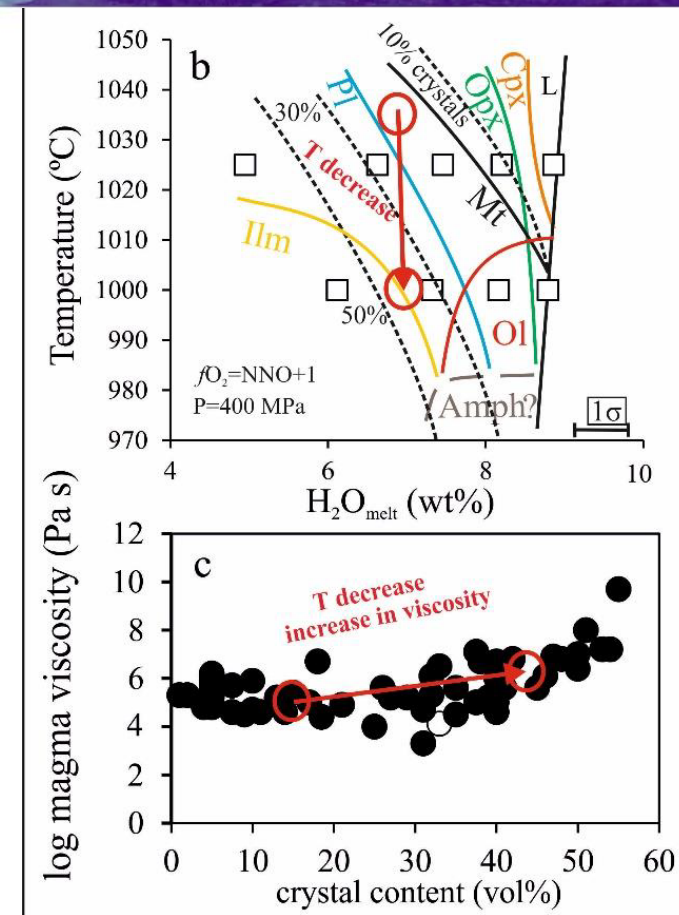
- Refine T by ~ 50 degrees with RS

More appropriate rheological evolution

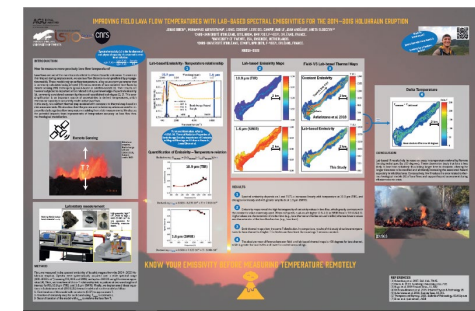
- lava flow behavior: from liquidus to subsolidus

Reduce uncertainty in lava flow modeling

- improve hazard assessment



Poster Hall D-F: Improving field lava flow temperatures with lab-based spectral emissivities for the 2014–2015 Holuhraun eruption, J. Biren et al., NH25A-0528, *Advances in modelling for natural hazards and risk*. 16:00–18:00



THANK YOU

Looking for a postdoc fellow?

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La Palma eruption (2021), credit: IGME

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