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

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► **To cite this version:**

Jonas Biren, Lionel Cosson, Leire del Campo, Cécile Genevois, Emmanuel Veron, et al.. Thermal Radiative Properties of Bardarbunga Basalts: Importance of Emissivity in Magma Rheology and Volcanic Hazard.. AGU 2021 Fall Meeting, Dec 2021, Online, France. 10.1002/essoar.10509907.1 . insu-03559137

HAL Id: insu-03559137

<https://insu.hal.science/insu-03559137v1>

Submitted on 6 Feb 2022

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



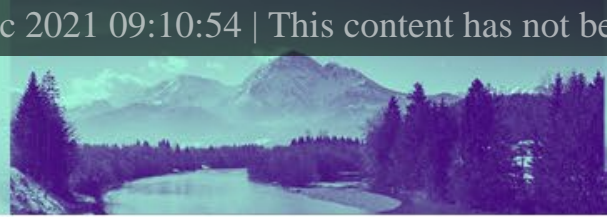
Jonas Biren^{1*}, Aneta Slodczyk^{1,2}, Lionel Cosson², Leire del Campo²,
Cécile Genevois², Emmanuel Veron², Sandra Ory², Hao Li¹, Joan Andújar¹

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V23A-04 - Properties of magmas- 14 December 2021





JONAS BIREN

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- Orléans, France**





TEMPERATURE - KEY PARAMETER TO UNDERSTAND LAVA FLOW RHEOLOGY

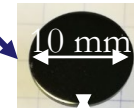
Lava flow T retrieved by remote sensing (RS) depends on **spectral emissivity (ϵ)**.

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

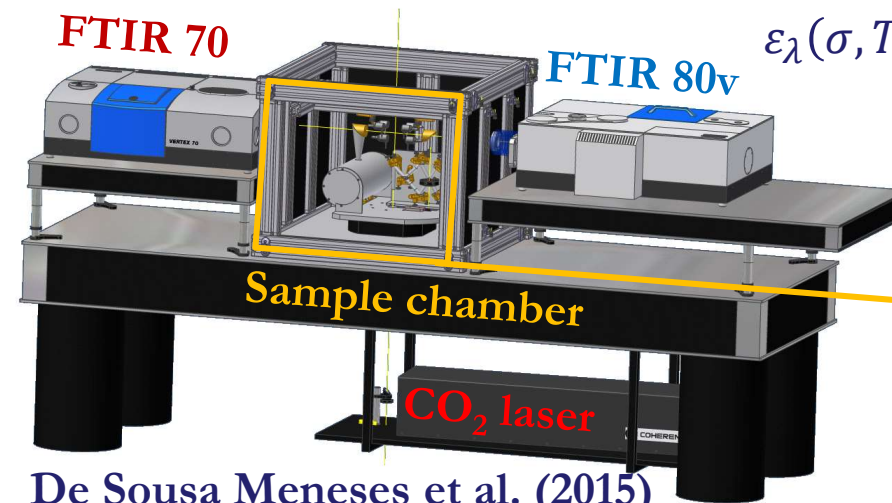
Only few studies of ϵ at relevant magmatic conditions:

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

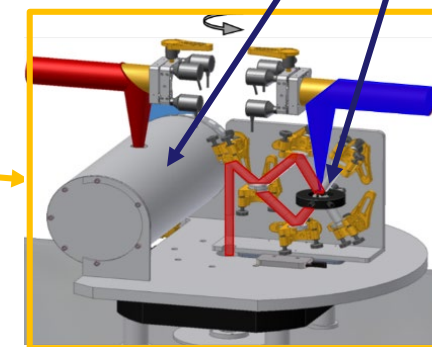
High Temperature and broad spectral range ϵ data are necessary!



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



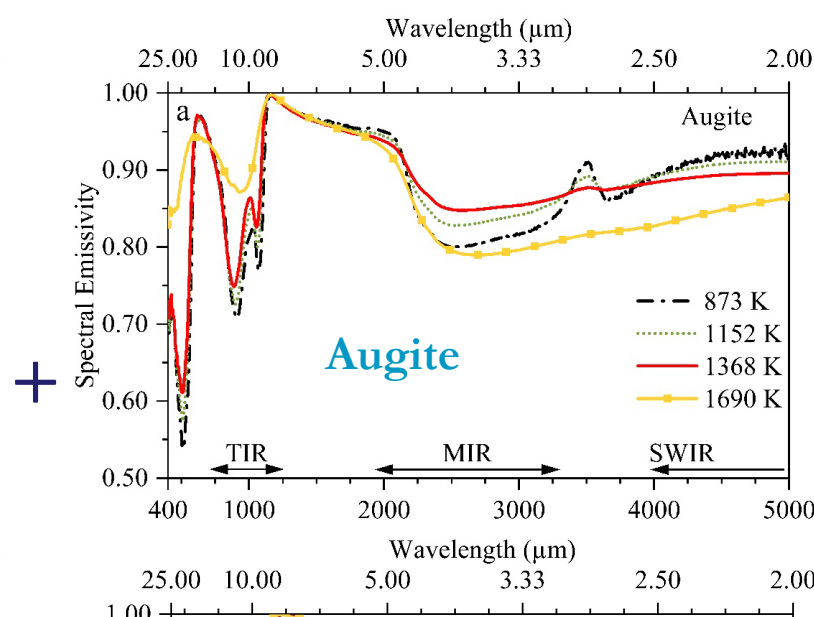
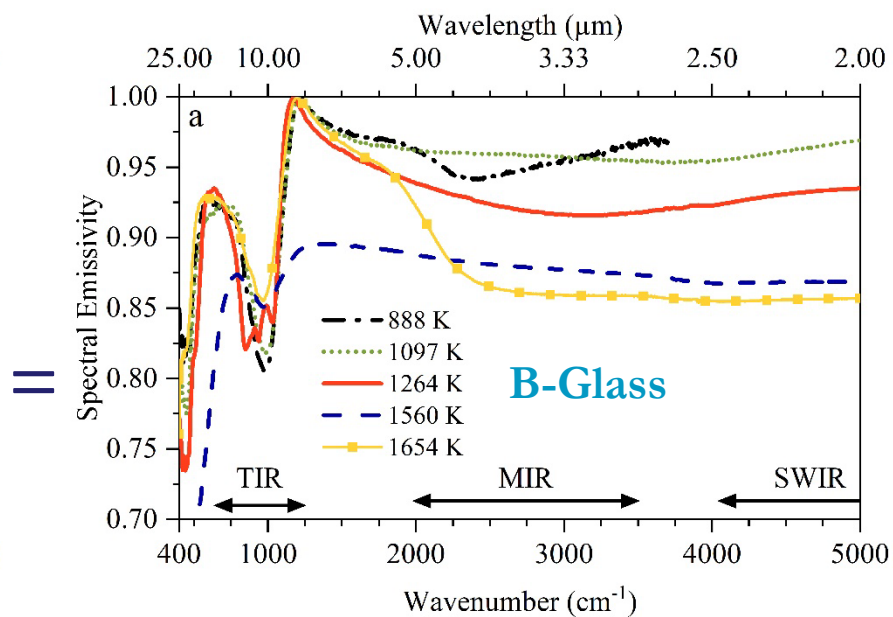
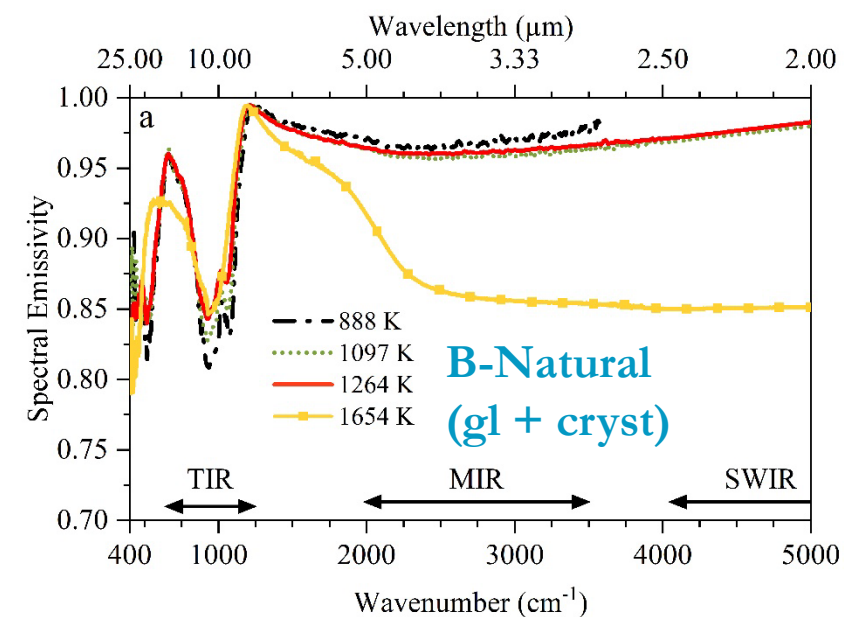
$$\epsilon_{\lambda}(\sigma, T, \theta) = \frac{L_{\lambda}(\sigma, T, \theta)}{L_{\lambda}^0(\sigma, T, \theta)} = \frac{\text{Sample}}{\text{BB}}$$



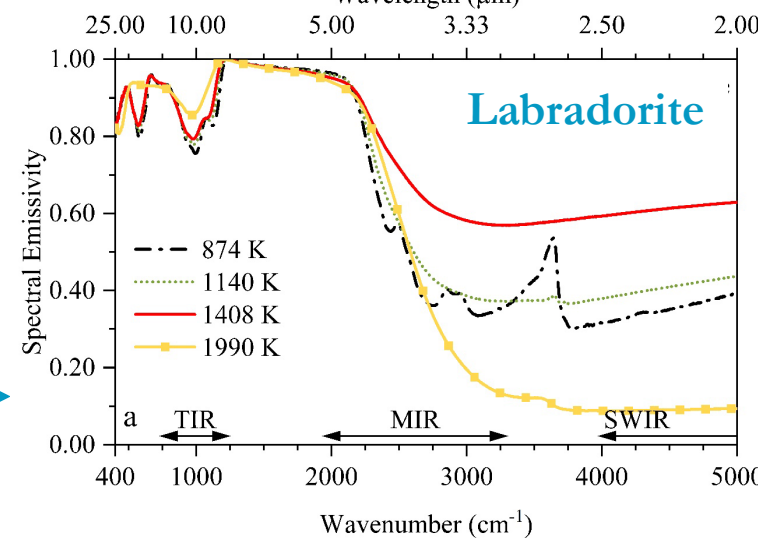
De Sousa Meneses et al. (2015)



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 →





IMPLICATION

Andújar and Scaillet (2012)

ϵ behavior is highly complex

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

Better constrain on surface radiance

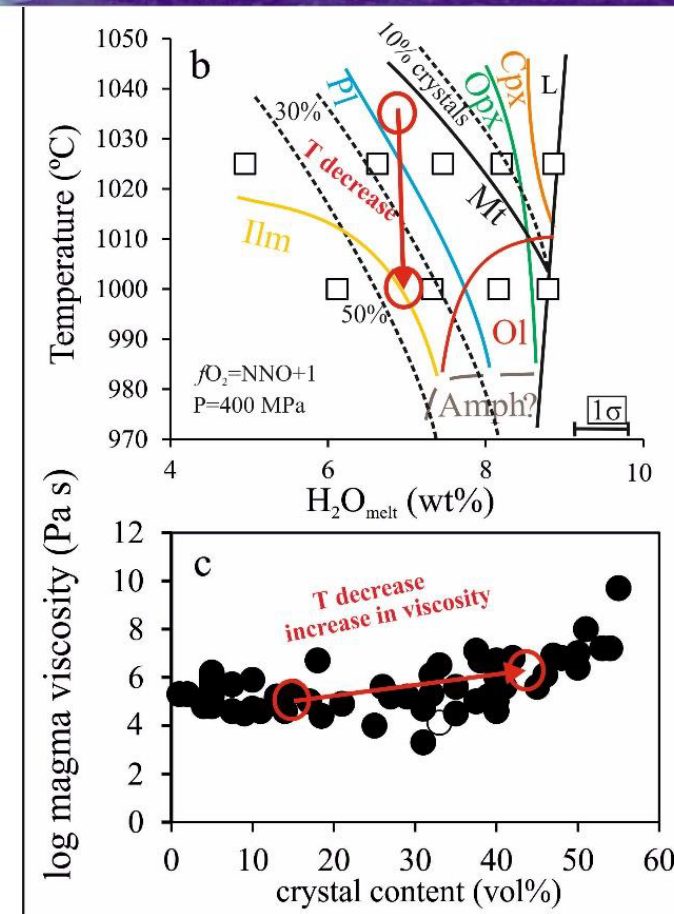
- Refine T by ~ 50 degrees with RS

More appropriate rheological evolution

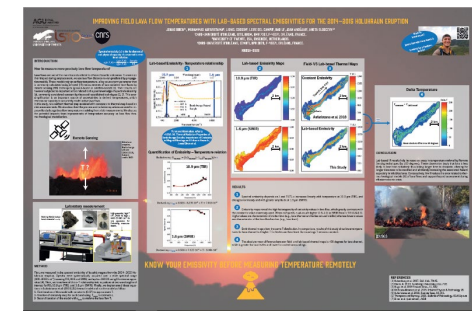
- lava flow behavior: from liquidus to subsolidus

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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https://www.researchgate.net/profile/Jonas_Biren



La Palma eruption (2021), credit: IGME

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