



HAL
open science

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

Jonas Biren, Lionel Cosson, Leire del Campo, Cécile Genevois, Emmanuel Veron, Sandra Ory, Hao Li, Joan Andújar, Aneta Slodczyk

► **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-03559137>

Submitted on 6 Feb 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

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



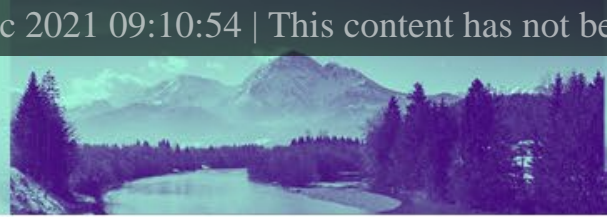
Jonas Biren^{1*}, Aneta Slodczyk^{1,2}, Lionel Cosson², Leire del Campo²,
Cécile Genevois², Emmanuel Veron², Sandra Ory², Hao Li¹, Joan Andújar¹

¹CNRS-Université d'Orléans, ISTO, BRGM, UMR 7327, F-45071, Orléans, France.

²CNRS-Université d'Orléans, CEMHTI, UPR 3079, F-45071, Orléans, France.

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

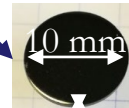
Lava flow T retrieved by remote sensing (RS) depends on **spectral emissivity (ϵ)**.

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

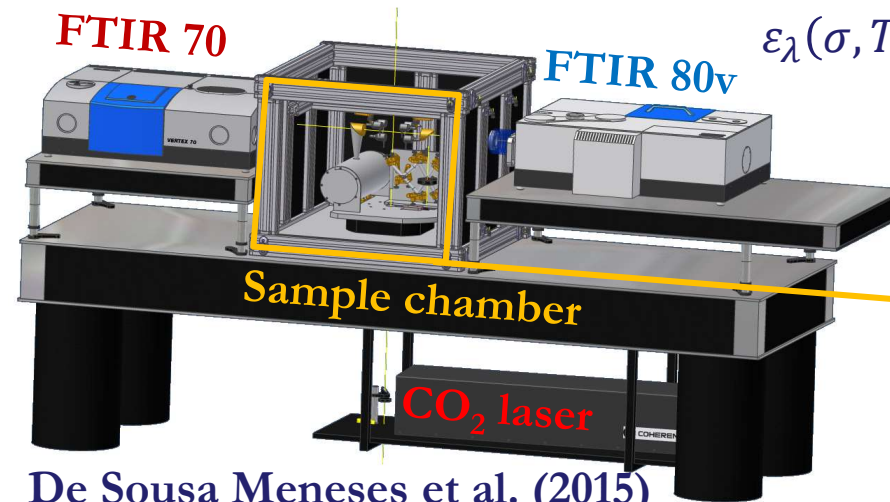
Only few studies of ϵ at relevant magmatic conditions:

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

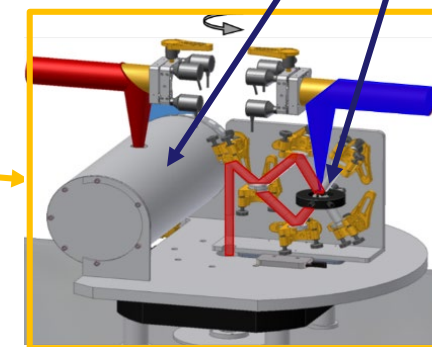
High Temperature and broad spectral range ϵ data are necessary!



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



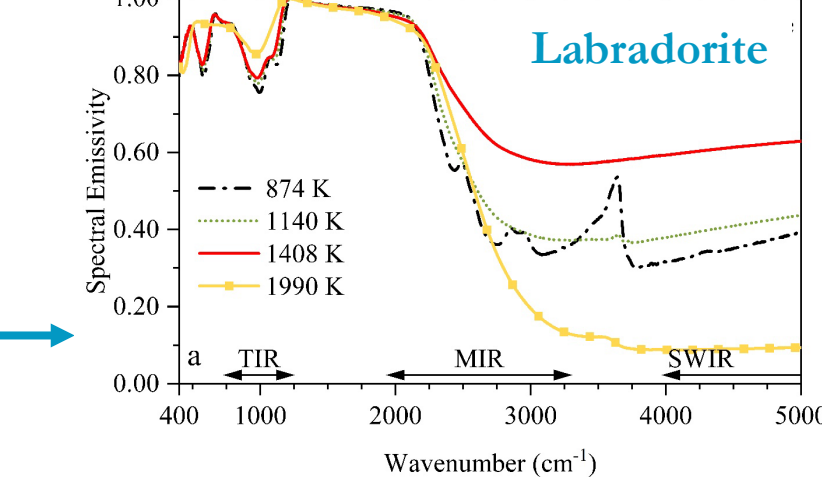
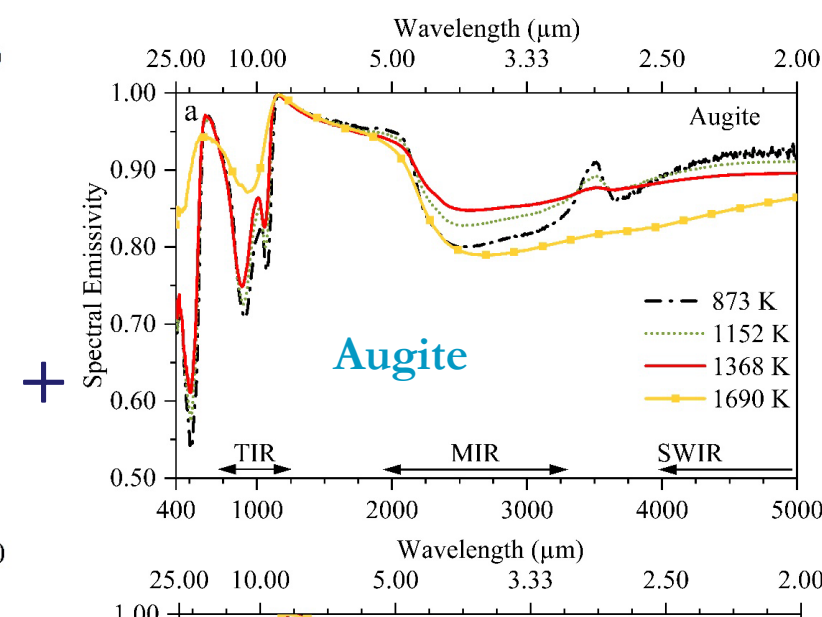
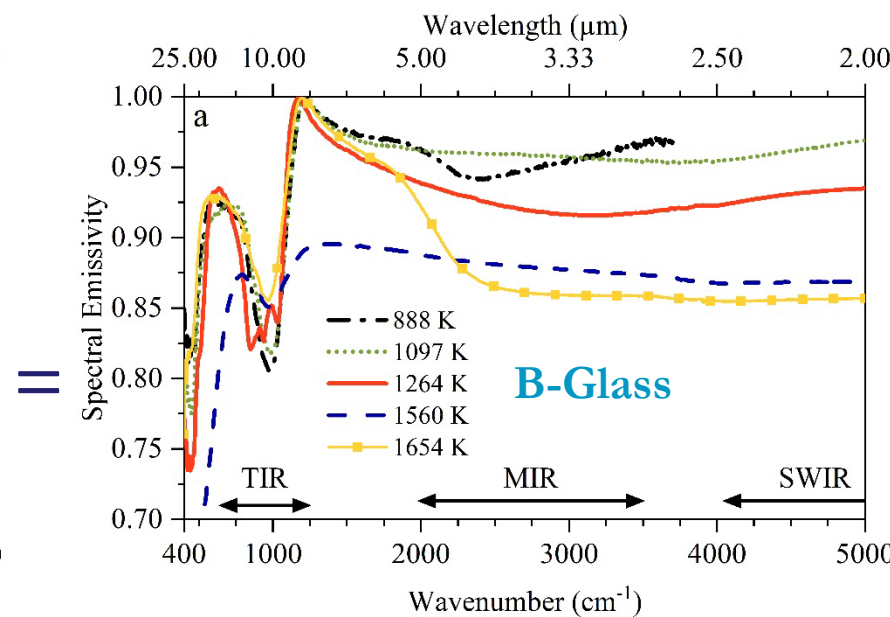
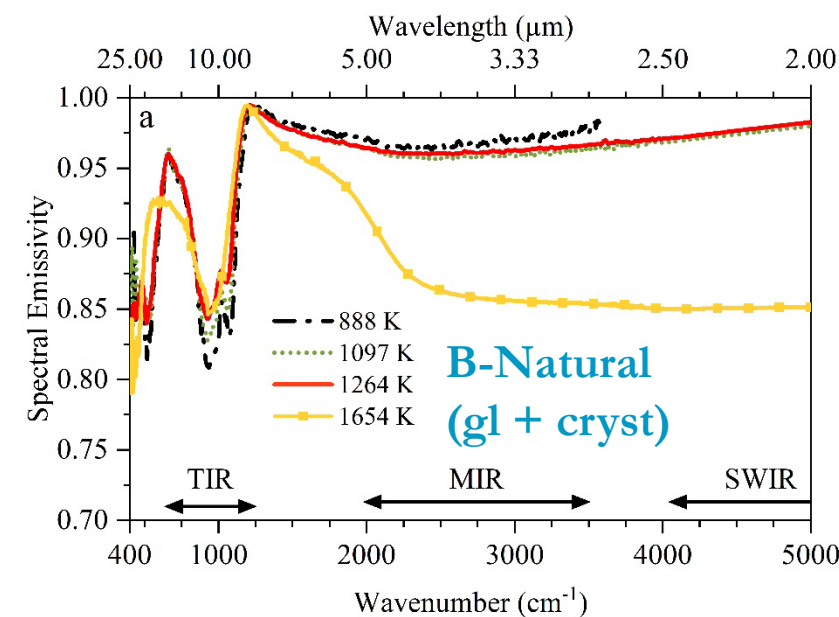
$$\epsilon_{\lambda}(\sigma, T, \theta) = \frac{L_{\lambda}(\sigma, T, \theta)}{L_{\lambda}^0(\sigma, T, \theta)} = \frac{\text{Sample}}{\text{BB}}$$



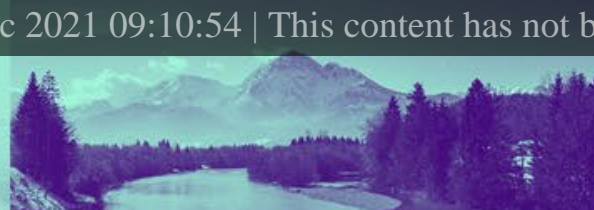
De Sousa Meneses et al. (2015)



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 Scalliet (2012)

ϵ behavior is highly complex

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

Better constrain on surface radiance

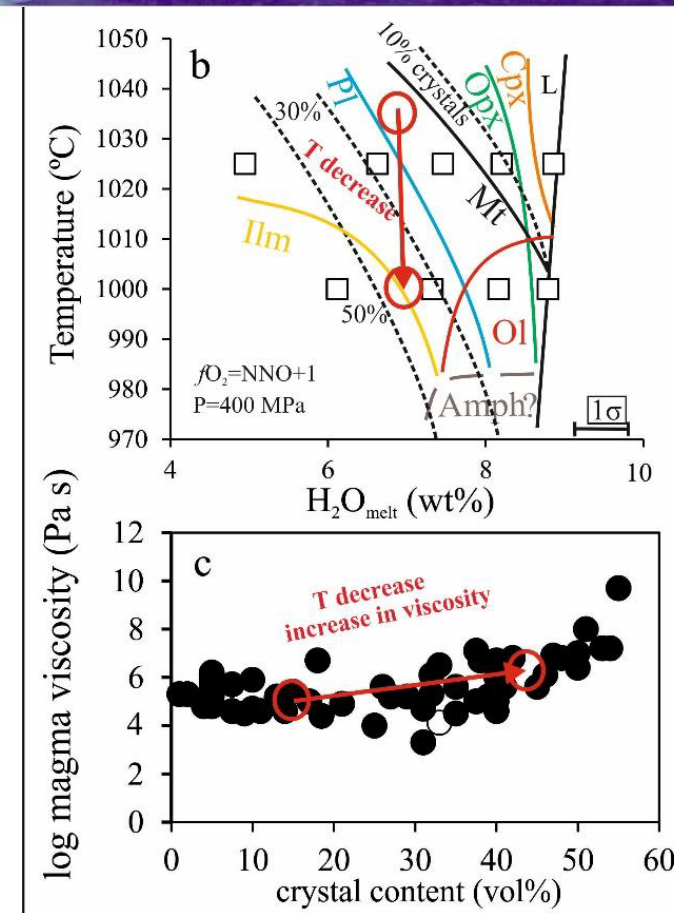
- Refine T by ~50 degrees with RS

More appropriate rheological evolution

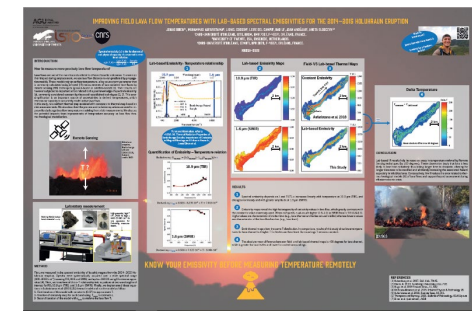
- lava flow behavior: from liquidus to subsolidus

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?

jonas.biren@cnsr-orleans.fr

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



La Palma eruption (2021), credit: IGME

AGU FALL
MEETING



SCIENCE
is SOCIETY