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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 Cosson[2], Leire del Campo[2], Cécile Genevois[2], Emmanuel Veron[2], Sandra Ory[2], Hao Li[1], Joan Andújar[1]

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V23A-04 - Properties of magmas- 14 December 2021

AGU FALL MEETING

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AGU FALL MEETING

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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:

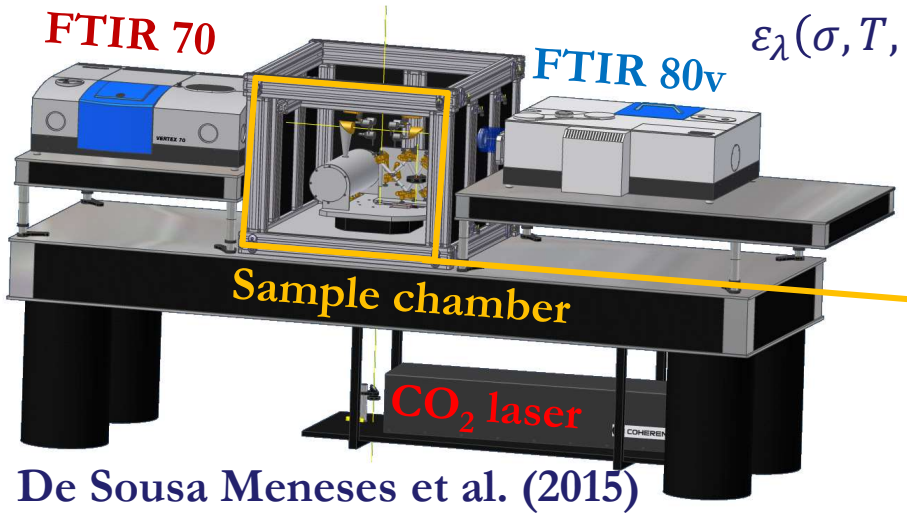
- Limited T range (<T_g) / spectral range (TIR)/ composition (synthetic)

High Temperature and broad spectral range ε data are necessary!

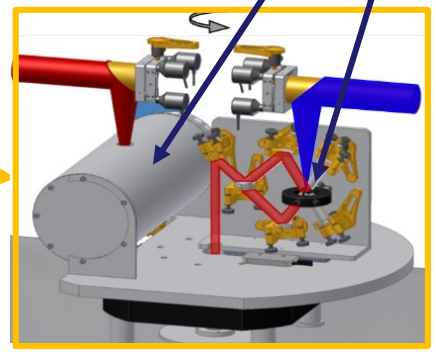
1.5 mm

$$\varepsilon_\lambda(\sigma,T,\theta) = \frac{L_\lambda(\sigma,T,\theta)}{L^0_\lambda(\sigma,T,\theta)} = \frac{Sample}{BB}$$

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



De Sousa Meneses et al. (2015)



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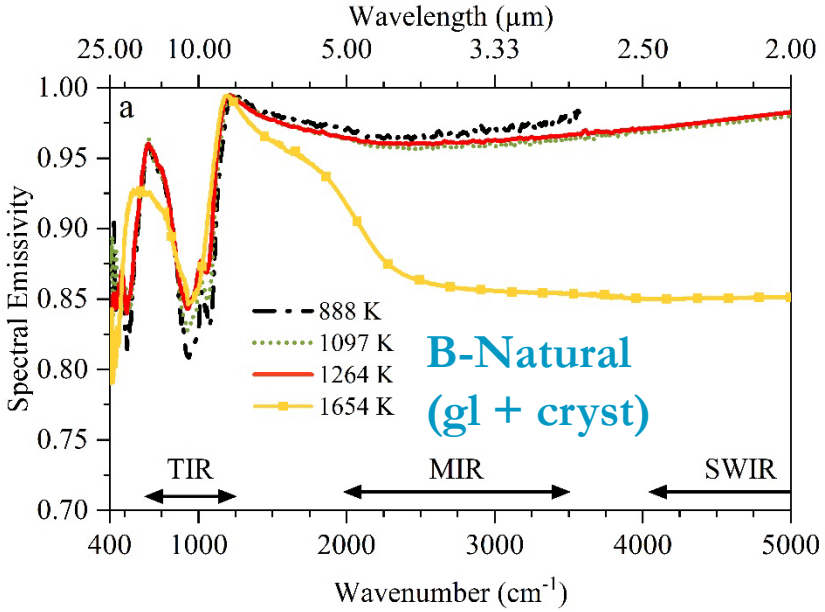
SPECTRAL EMISSIVITY BEHAVIOR OF BASALT WITH CRYSTALS



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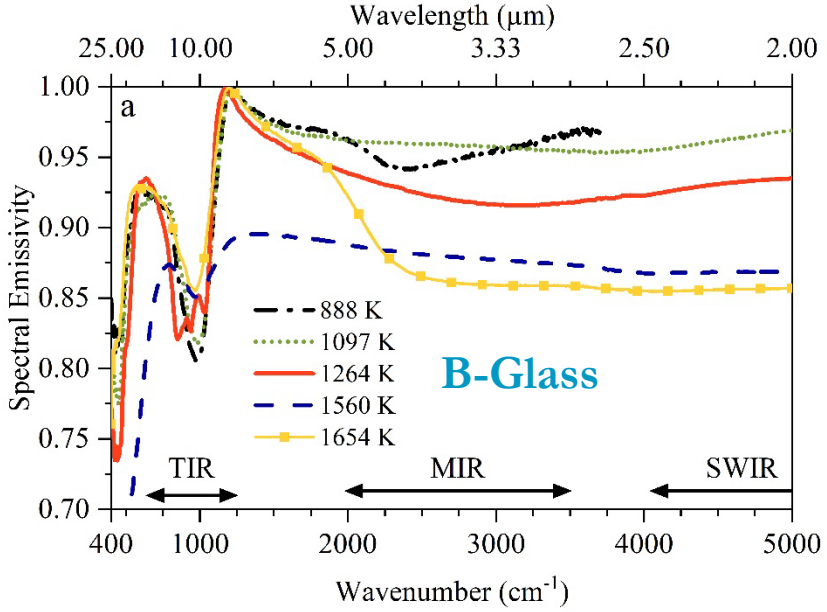

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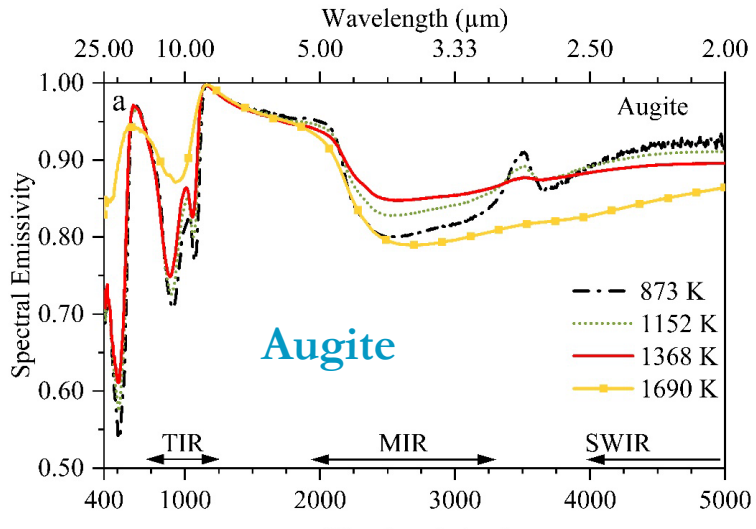

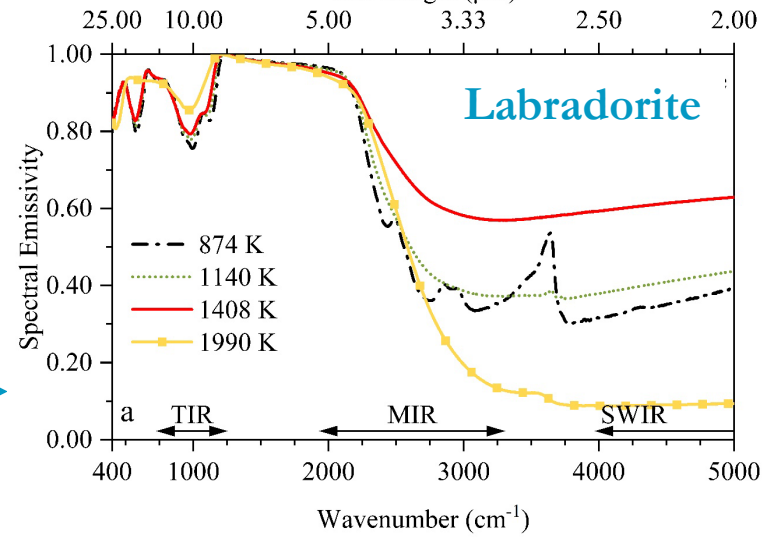

- ε increases linearly with T in TIR
- ε changes non-linearly with T in SWIR, MIR
- ε highly impacted by crystals content, composition

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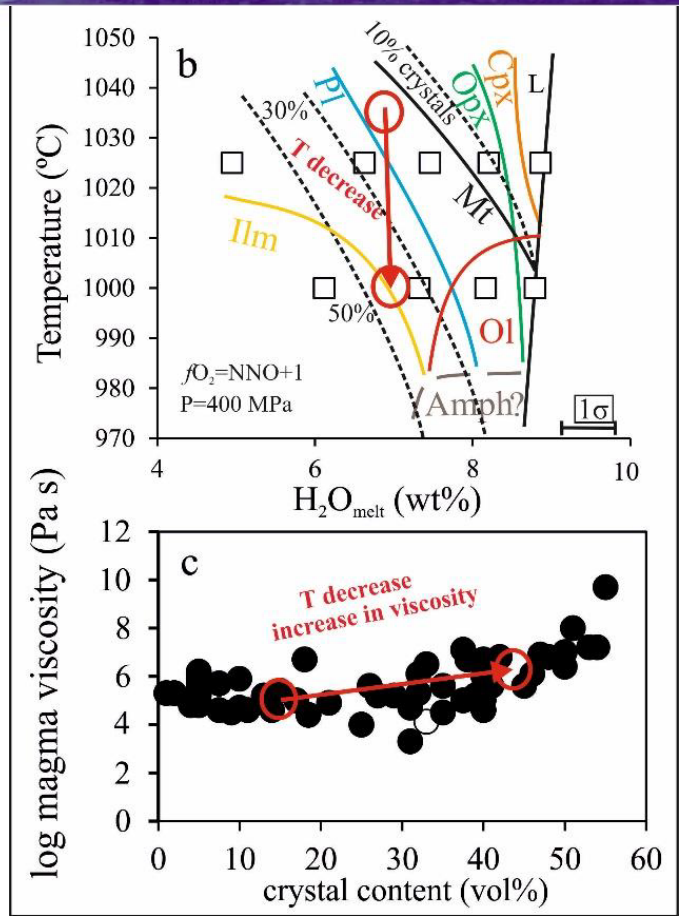
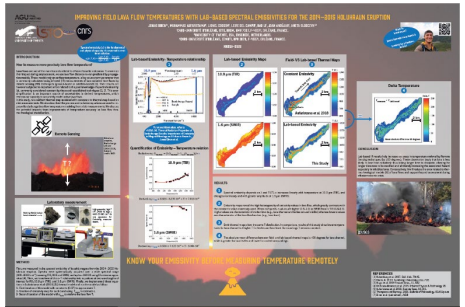
IMPLICATION

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



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THANK YOU

La Palma eruption (2021), credit: IGME

Looking for a postdoc fellow?

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