New Results from the Multispectral FLIR Camera

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FLIR Observations

- **S-40 Camera**
  - 7.5 – 13 μm
  - 240 x 320 μbolometer array
  - $NE\Delta T_{max}$ = 0.1 (@ 30 °C)
  - T_b images saved to laptop
- **Filters**
  - manual operation initially
  - 10 images per filter
    - "optics = ON and = OFF"
  - T_{air}, RH%, distance, wind speed data, T_s *(radiometer)*

Filter Specifications

- **Fabricated: Andover Corporation, Salem, NH**
  - wavelengths: 8.3, 8.6, 9.0, 9.8, 10.6 & 11.3 μm ±0.15
  - bandwidths: 0.5 μm *(8-9 μm)*, 1.0 μm *(9-12μm)*
  - transmission: 70% (min)
  - blocking: 7.5 - 13.0 micron
  - size: 51.0 ±0.2
  - thickness: 2 - 3 mm
  - substrate: Germanium
  - construction: SWP/LWP, ring mounted
  - polarization: Random
  - cost: *$27,455*

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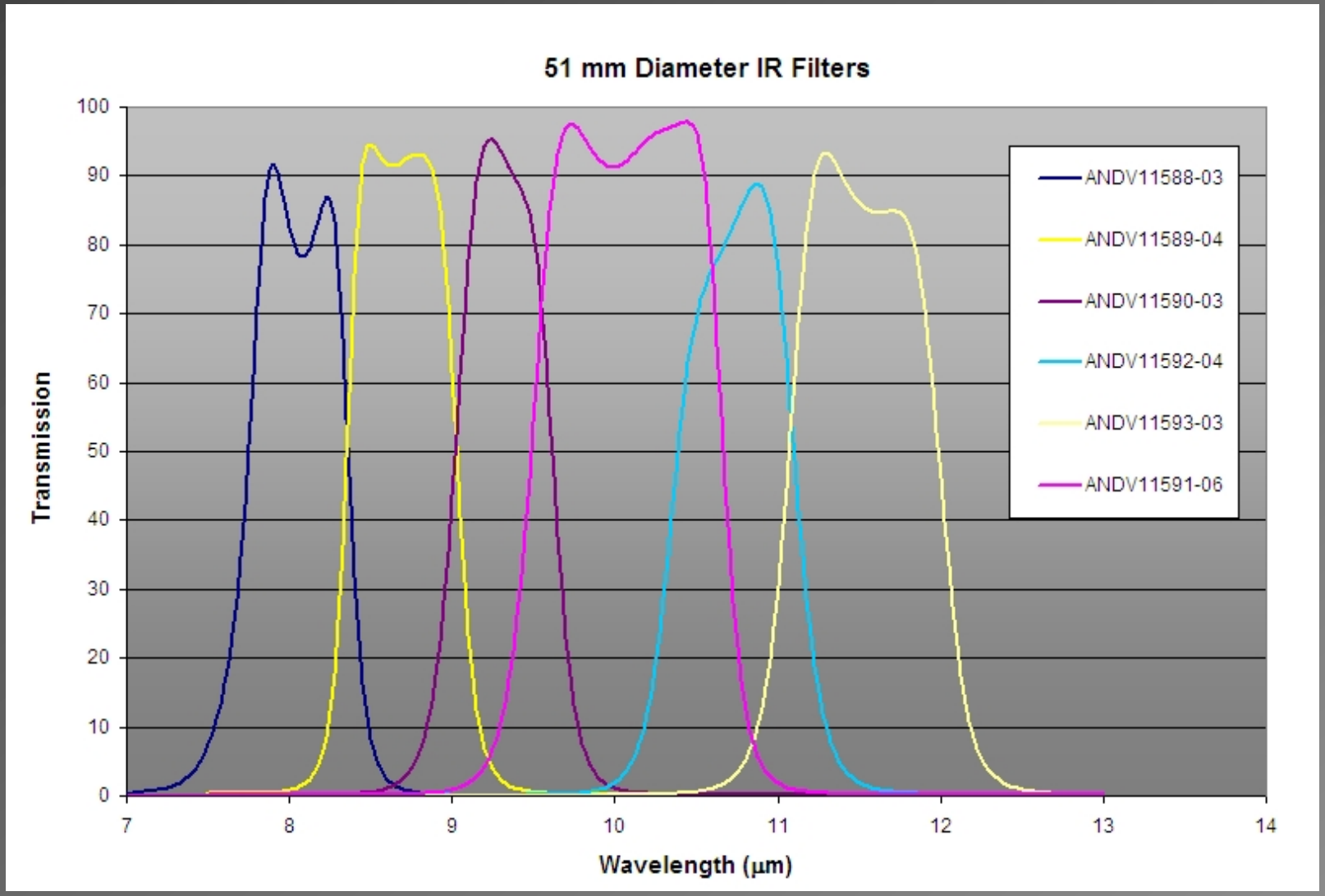
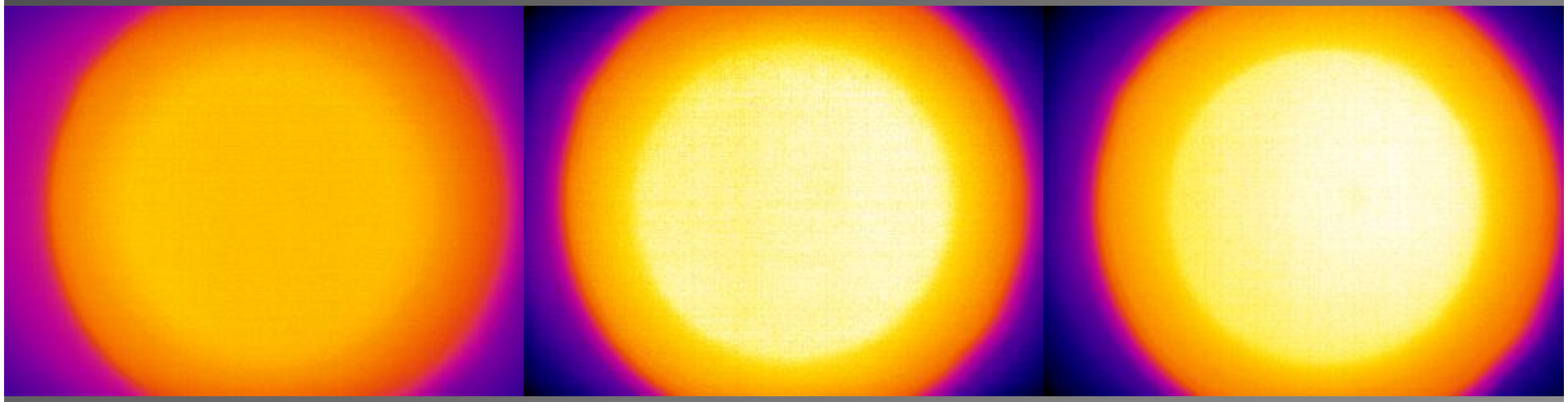
Band Passes


51 mm Diameter IR Filters
Transmission
100
90
80
70
60
50
40
30
20
10
0
7
8
9
10
11
12
13
14
Wavelength (μm)
ANDV11588-03
ANDV11589-04
ANDV11590-03
ANDV11592-04
ANDV11593-03
ANDV11591-06

Testing/Calibration

- **Laboratory Testing**
  - using the IVIS calibrated blackbody
  - preliminary FLIR filter mount system created
  - applied in the field two weeks later!

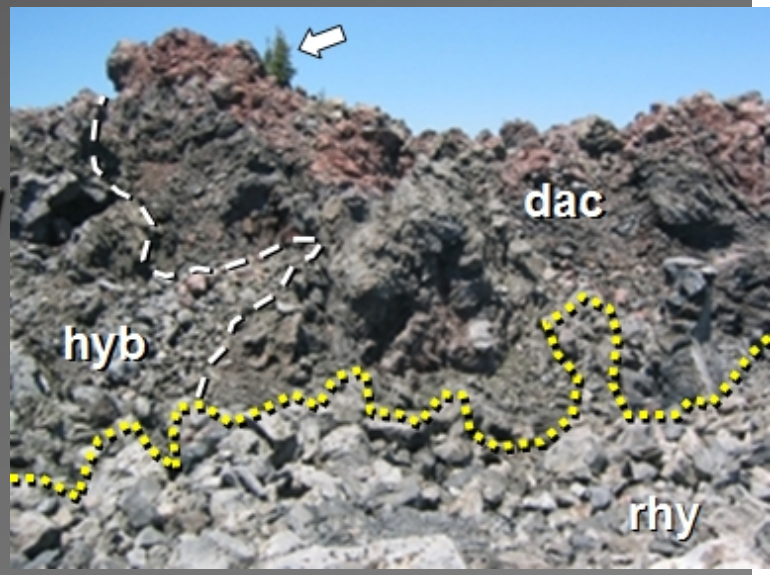
9.317 μm



T_{bb} = 40 °C T_{bb} = 60 °C T_{bb} = 80 °C

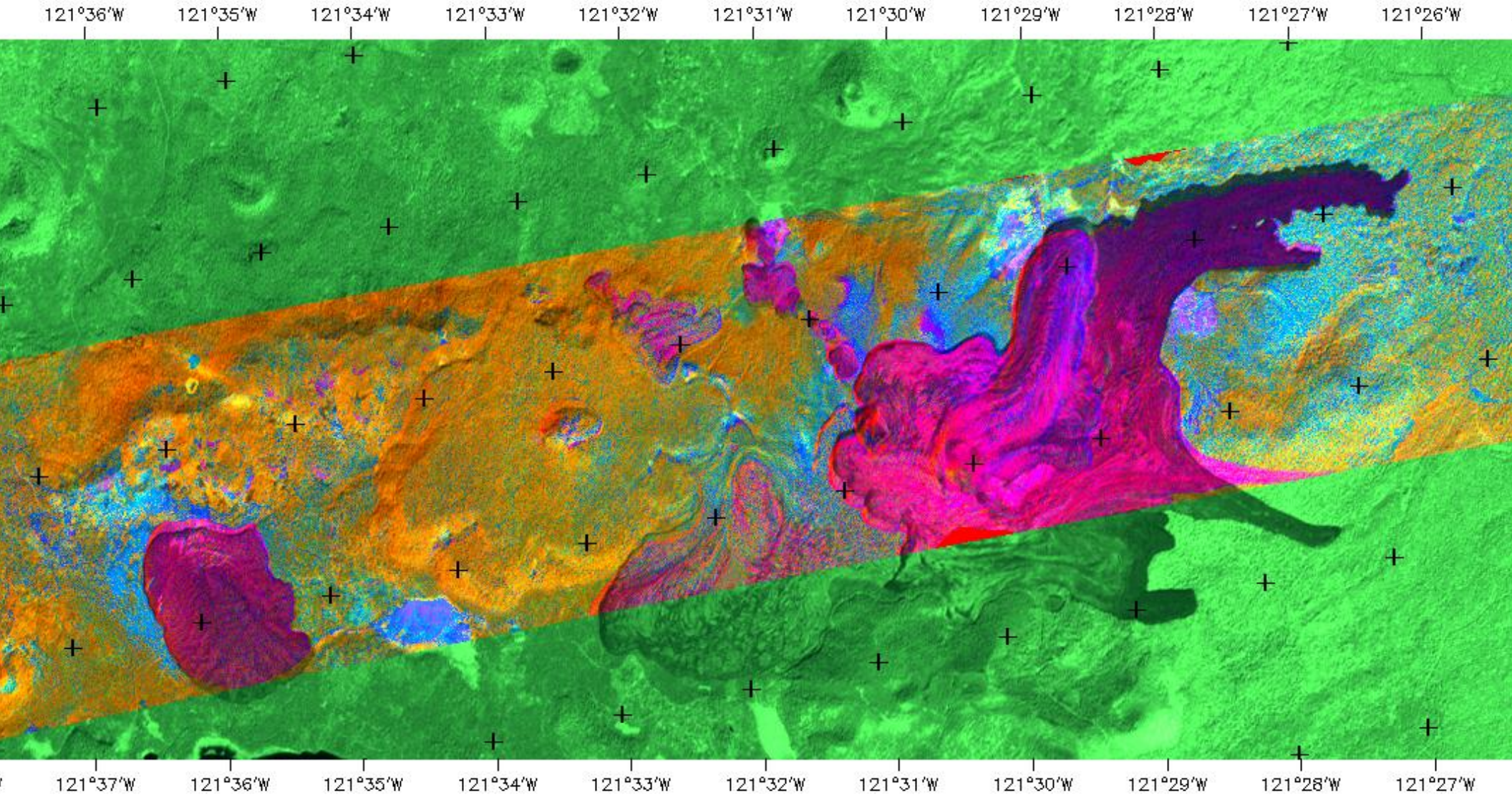
Field Location

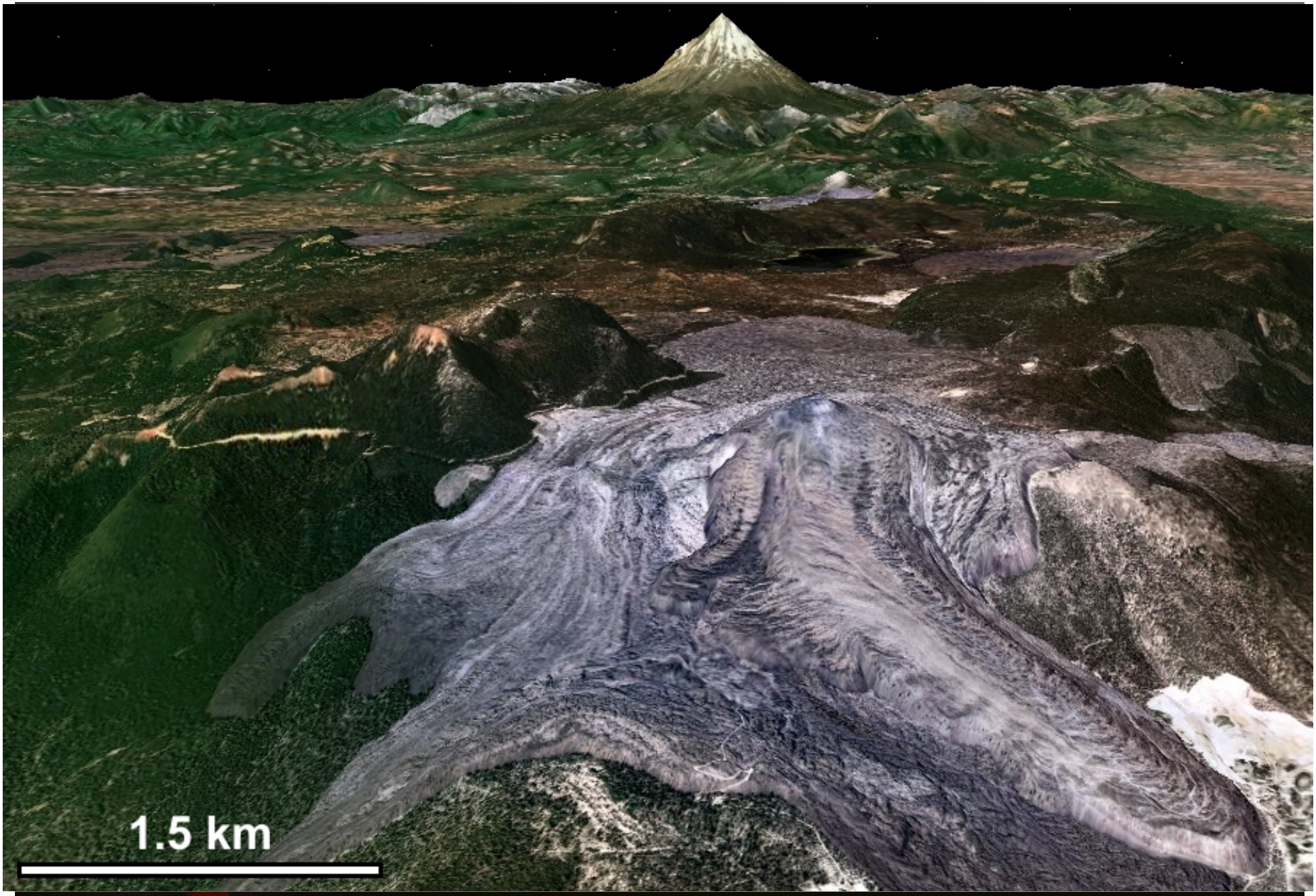
- **Medicine Lake Volcano, CA**
  - located 50 km N-NE of Mt. Shasta Volcano, USA
  - bimodal volcanism *(extensional regime)*
    - older, peripheral calc-alkalic basalt flows
    - younger, summit rhyolite / dacite domes

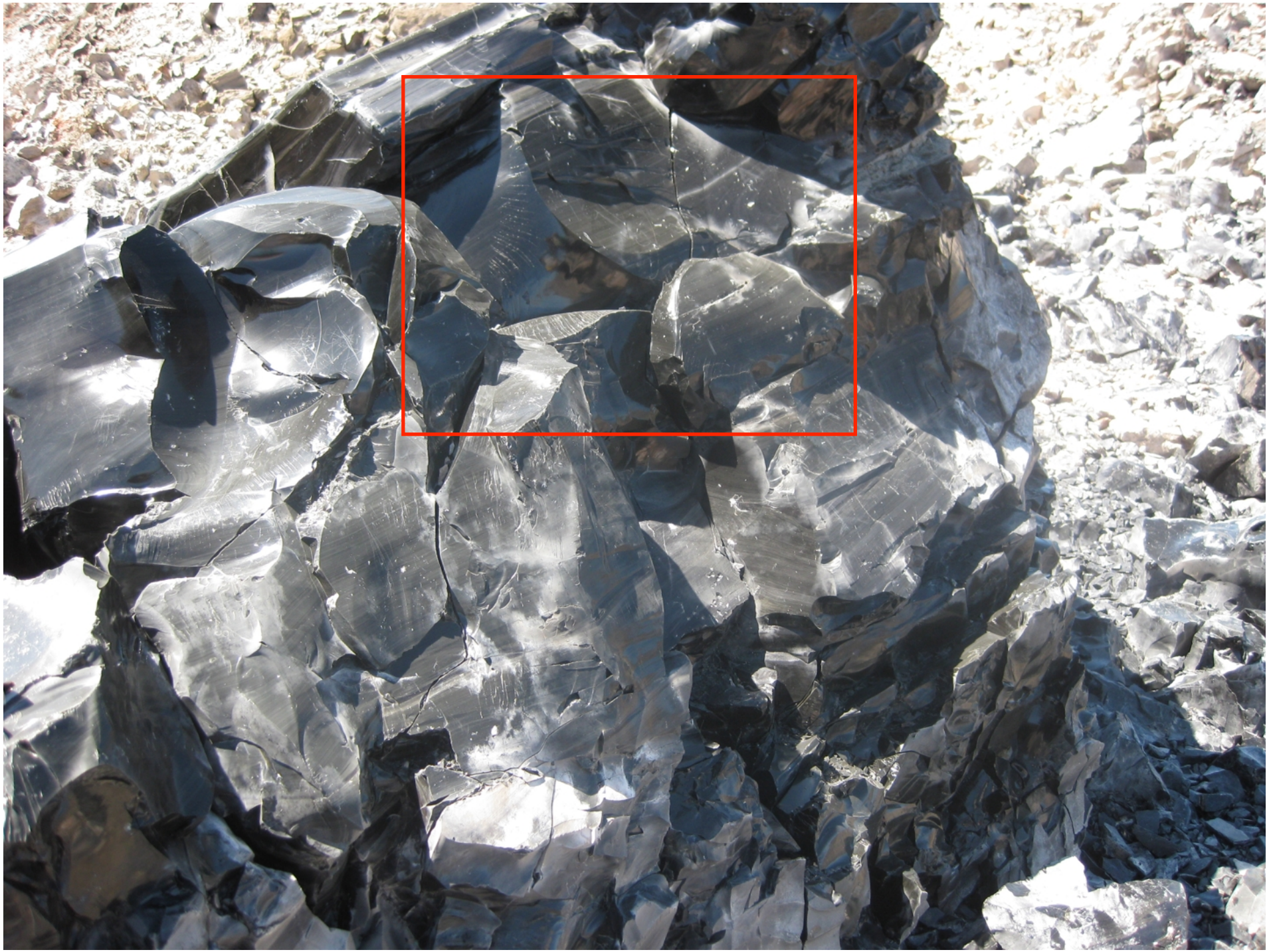


  - Big Glass Mountain (BGM)
    - variable composition (63 - 74 wt. % SiO_2) *[Donnelly-Nolan, 1990]*
    - complex mixing / emplacement dynamics *[Eisinger et al., 2000]*
    - overprinting of composition and texture causes complications in the TIR emissivity data

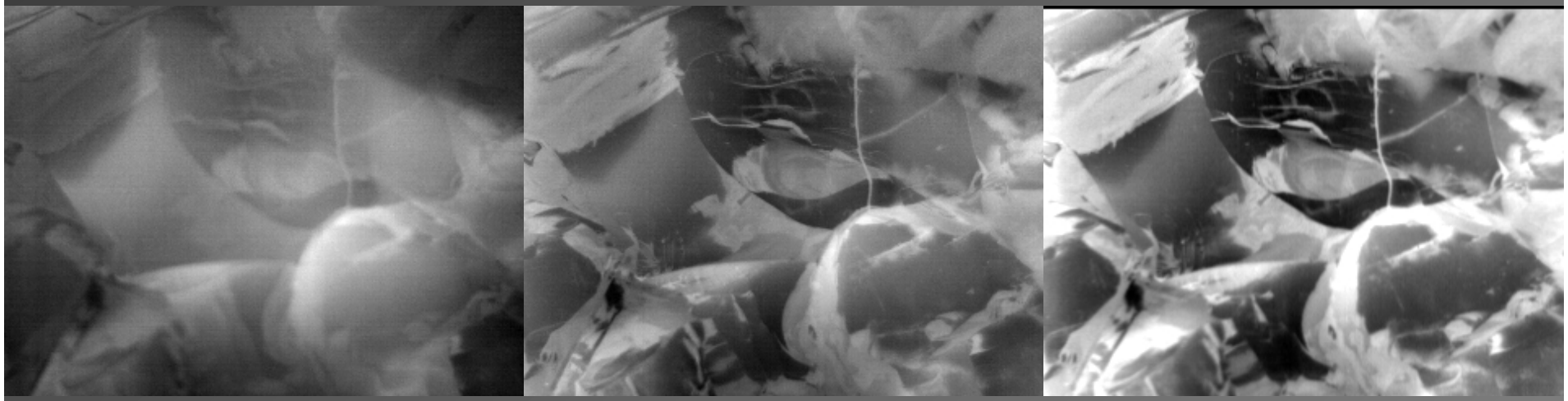
MASTER Data


121°36'W
121°35'W
121°34'W
121°33'W
121°32'W
121°31'W
121°30'W
121°29'W
121°28'W
121°27'W
121°26'W
121°37'W
121°36'W
121°35'W
121°34'W
121°33'W
121°32'W
121°31'W
121°30'W
121°29'W
121°28'W
121°27'W


1.5 km

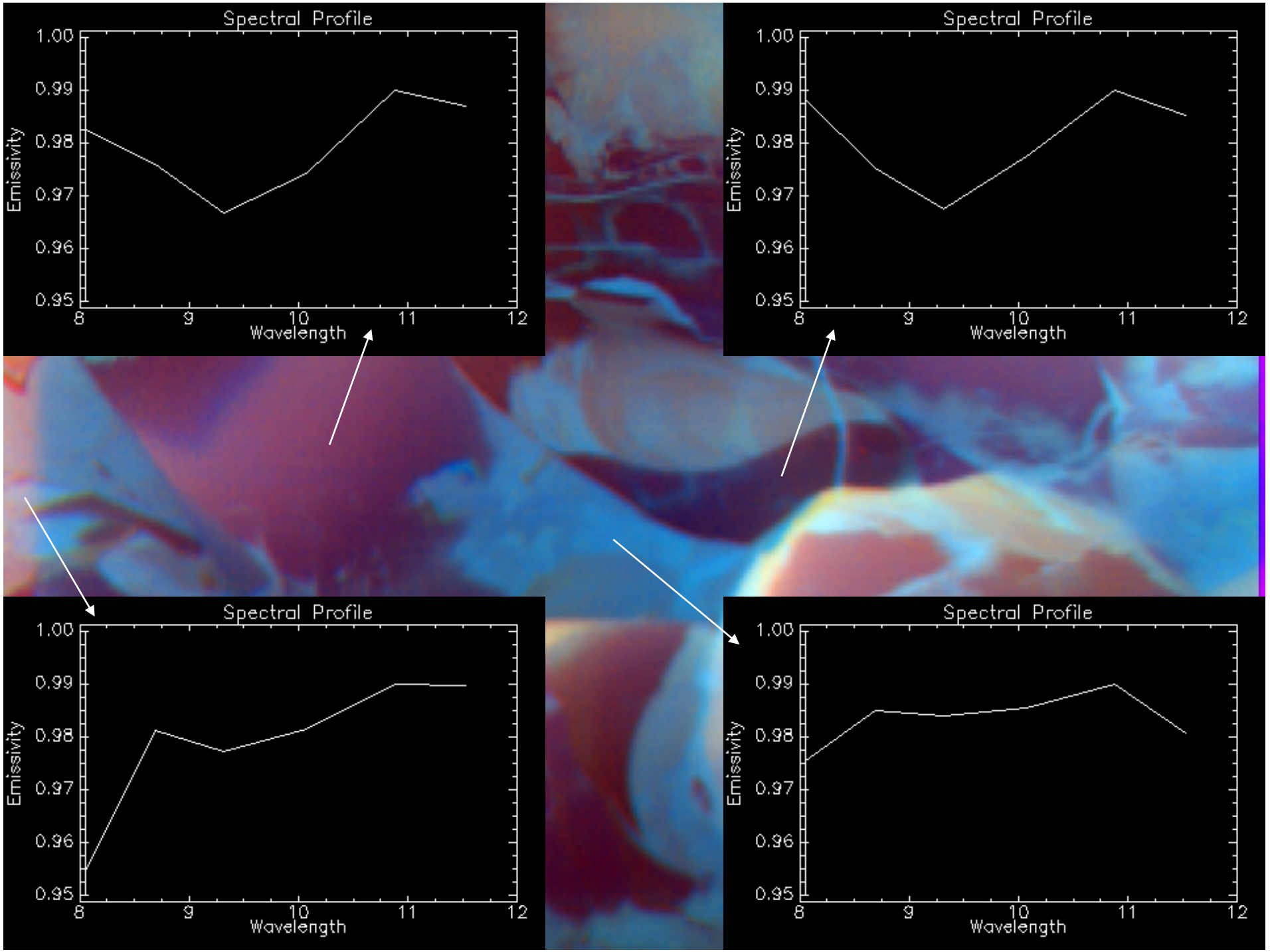


Obsidian Outcrop

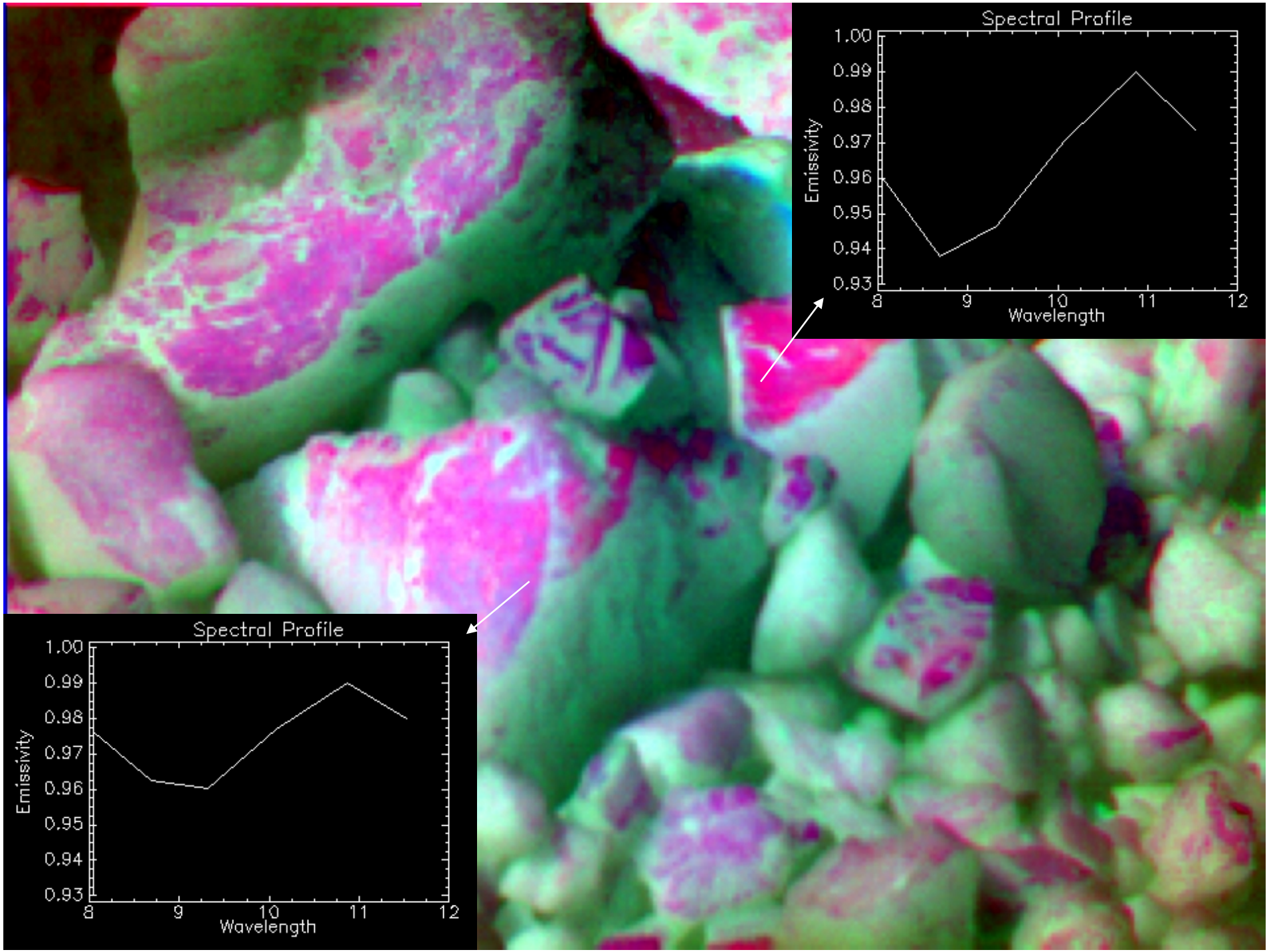


8.052 μm | 8.690 μm | 9.317 μm

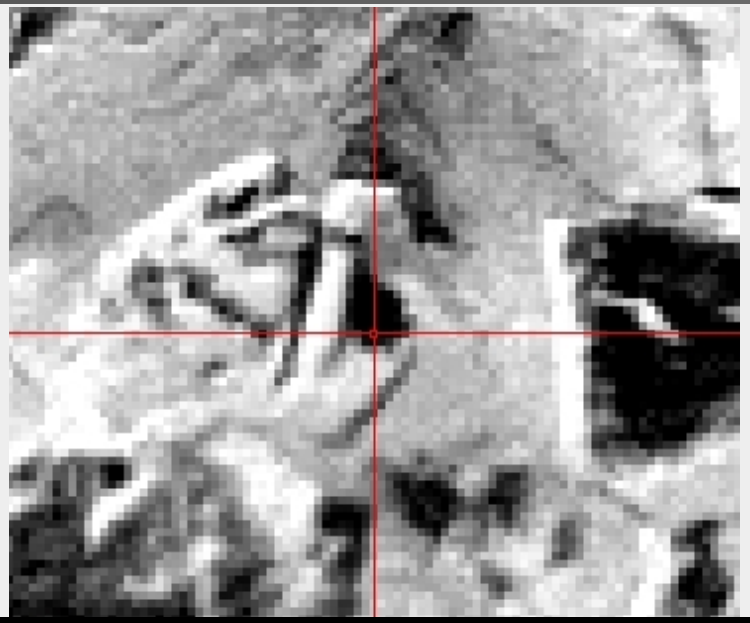
10.075 μm | 10.874 μm | 11.527 μm

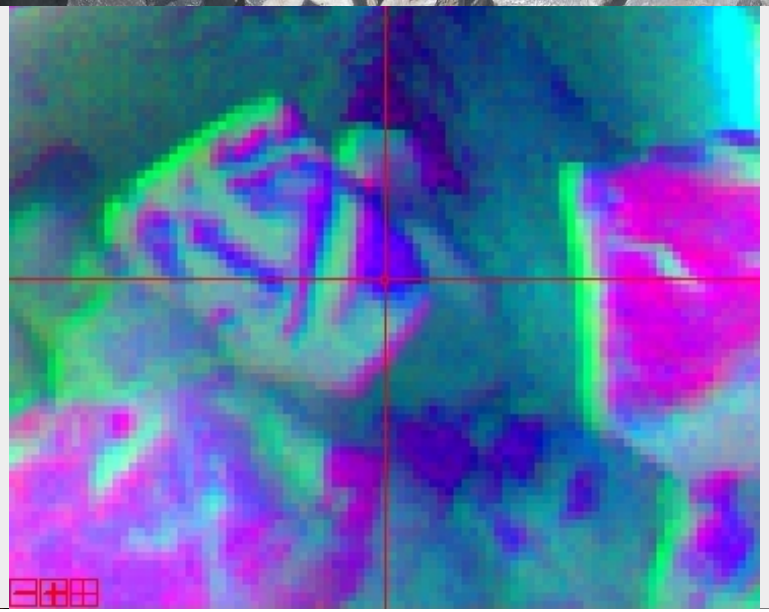

Spectral Profile
Emissivity
1.00
0.99
0.98
0.97
0.96
0.95
8
9
10
11
12
Wavelength
Spectral Profile
Emissivity
1.00
0.99
0.98
0.97
0.96
0.95
8
9
10
11
12
Wavelength
Spectral Profile
Emissivity
1.00
0.99
0.98
0.97
0.96
0.95
8
9
10
11
12
Wavelength
Spectral Profile
Emissivity
1.00
0.99
0.98
0.97
0.96
0.95
8
9
10
11
12
Wavelength

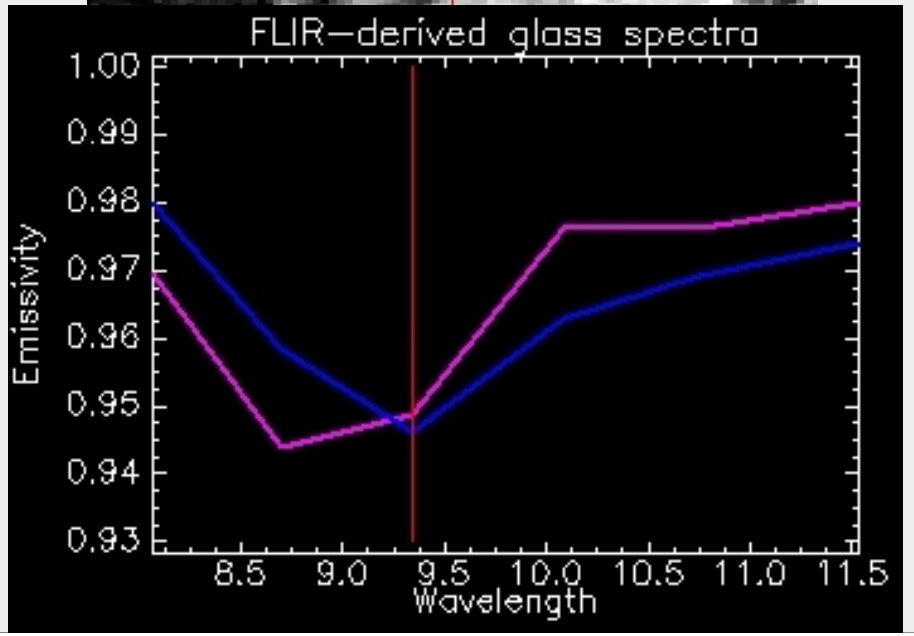
Mixed Outcrop


Spectral Profile
Emissivity
1.00
0.99
0.98
0.97
0.96
0.95
0.94
0.93
8
9
10
11
12
Wavelength
Spectral Profile
Emissivity
1.00
0.99
0.98
0.97
0.96
0.95
0.94
0.93
8
9
10
11
12
Wavelength

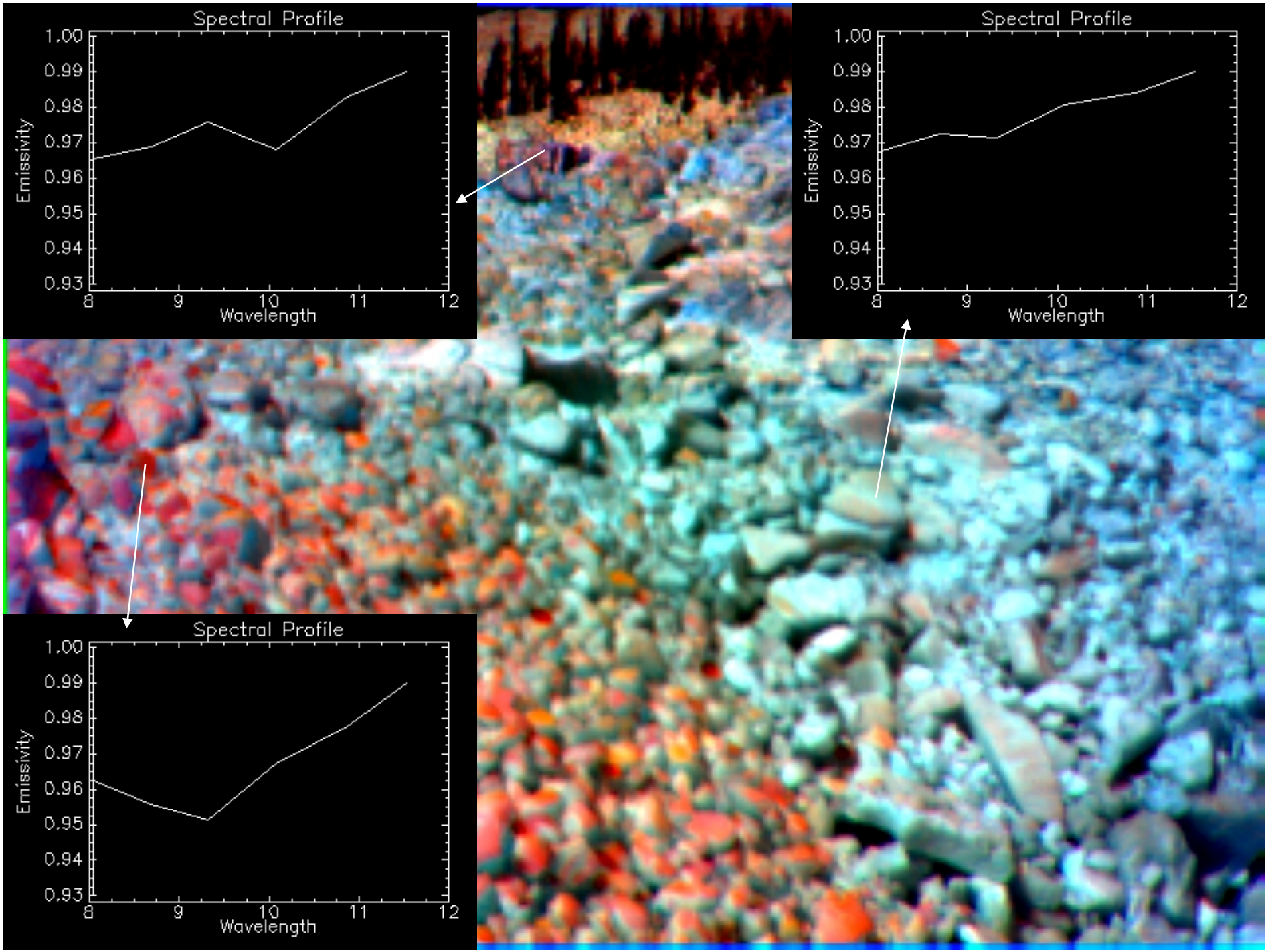
Compositional Mapping







Textural Mapping


Spectral Profile
Emissivity
1.00
0.99
0.98
0.97
0.96
0.95
0.94
0.93
8
9
10
11
12
Wavelength
Spectral Profile
Emissivity
1.00
0.99
0.98
0.97
0.96
0.95
0.94
0.93
8
9
10
11
12
Wavelength
Spectral Profile
Emissivity
1.00
0.99
0.98
0.97
0.96
0.95
0.94
0.93
8
9
10
11
12
Wavelength

Conclusions

- **Multispectral Filters**
  - preliminary results appear promising
  - tested for SO_2 absorption at Poas Volcano

- **Future Work**
  - analysis of filter anomalies
  - scripting for faster post-processing
  - continued mapping of silicic domes and flows
  - filter automation & new mounting hardware
    - application to more dynamic processes