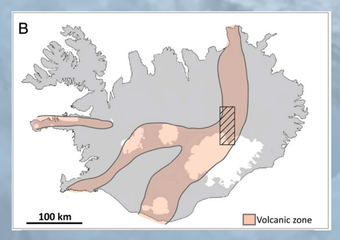
GIFT Iceland Expedition 2018: Europa Analog Field Research Team

Conor Nixon[1], Dina Bower[2], Claire Cousins[3], Jennifer Eigenbrode[1], Tilak Hewagama[2], Aaron Regberg[4], Jennifer Stern[1], Molly Wasser[5]
[1] NASA GSFC, [2] University of Maryland, [3] St Andrews University, UK, [4] NASA JSC, [5] AdNet Systems Inc.

Objectives

- To investigate the Kverkfjöll glaciovolcanic area of Iceland as a site for Europa analog research.
- To make field measurements of volcanically-altered ice with multiple instruments.
- To return samples for laboratory analysis and future instrument development efforts.

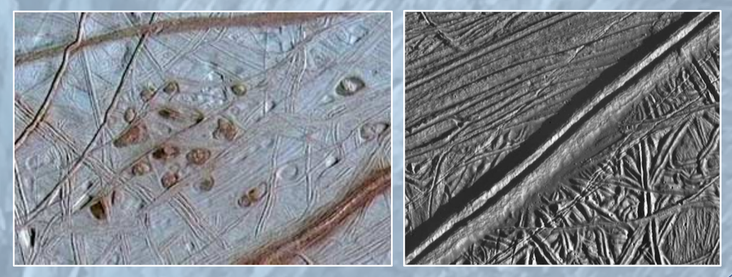


Iceland

- The Kverkfjöll glaciovolancic area is characterized by a mixture of active hydro-thermal springs, meltwater pools and larger lakes, surrounded by icy terrain.
- Sulfur deposits are found near active springs.

Europa

- Europa's surface is characterized by stress fractures, double ridges, lenticular features, and re-arranged ice blocks (chaos terrain).
- Dark, reddish coloration is thought to indicate hydrated salts such as magnesium sulfate.



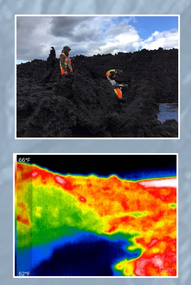
Instruments and Measurements

Measurement Type	Instrument	Science Return
Raman 768 nm	Delta-Nu Rockhound	Characterization of inorganic minerals and organic molecules.
Portable DNA sequencer	Oxford Nanopore MinION	Identification of chromosomal DNA; microbial identification.
UV-Vis reflectance spectrometry	StellarNet Stellar Rad	Characterization of ambient light; mineral and organic composition.
Water metering	Hanna HI98191	Water pH, temperature and conductivity.
Thermal imaging	FLIR e8 camera	Environment temperature; active hot regions; anomalies.
Field microscopy	Dino-Lite Edge Series	Mineral composition, biology and alteration of rocks and samples.

Iceland Field Work Locations

#1: Holohruan outflow

- Holohruan is a large recent lava flow (85 km²) in 2014.
- Characterized by jagged basalt lava desposits (A'a).
- Cut through by glacial run-off streams and pools.

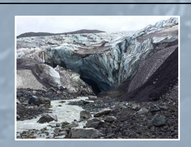


#2: Kverkjökull Glacier

- We ascended the glacier and sampled pristine ice, moraine and sediment.
- Many of the pools contained high purity water; but minerals and biological material were also found.

#3: Kverkjökull Ice Cave

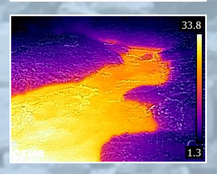
- At the base of the glacier Kverkjökull a cold outflow stream emerges.
- The ice cave has collapsed in previous years.
- River rocks in this area were sampled and studied.



#4: Hveragil Gorge

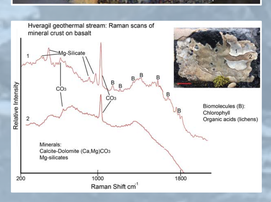
- Hveragil is a unique environment: a hydrothermal river.
- The water temperature varies and can reach 62°C: we measured 34°C .
- Substantial calcium carbonate deposits can be seen.

Results and Conclusions



Results so far and anticipated from NASA Iceland 2018 include:

- Physical and chemical environmental measurements.
- Characterization of anaerobic bacterial mats found at Hveragil.
- Mineralogy and composition of rock and sediment samples, alteration history.
- Identification of extremophile life through DNA sequencing.



Team Ice

Goddard Space Flight Center — **Conor Nixon, Jen Eigenbrode, Jen Stern**

University of Maryland — **Tilak Hewagama, Dina Bower**

University of St Andrews — **Claire Cousins**

JSC — **Aaron Regberg**

ADNET Systems, Inc. — **Molly Wasser**

And thanks to…

NASA GIFT Team:
- **Jacob Bleacher** (GSFC), **Nicole Whelley** (UMD)

Team Fire:
- **Patrick Whelley, Jacob Richardson** (UMD), **Sarah Sutton** (UofA)

Team UAV:
- **Christopher Hamilton, Steven Scheidt, Joanna Voigt** (UofA)

Team X-Ray
- **Kelsey Young, Amy McAdam** (GSFC), **Cherie Achilles, Christine Knutson** (UMD)