Isblue Emergence Project TECTOLIFE

A partnership between the **IUEM**, **MATIS in Iceland** and the **University of Bergen**

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K. Alain (BEEP), X (Doctorant, BEEP)

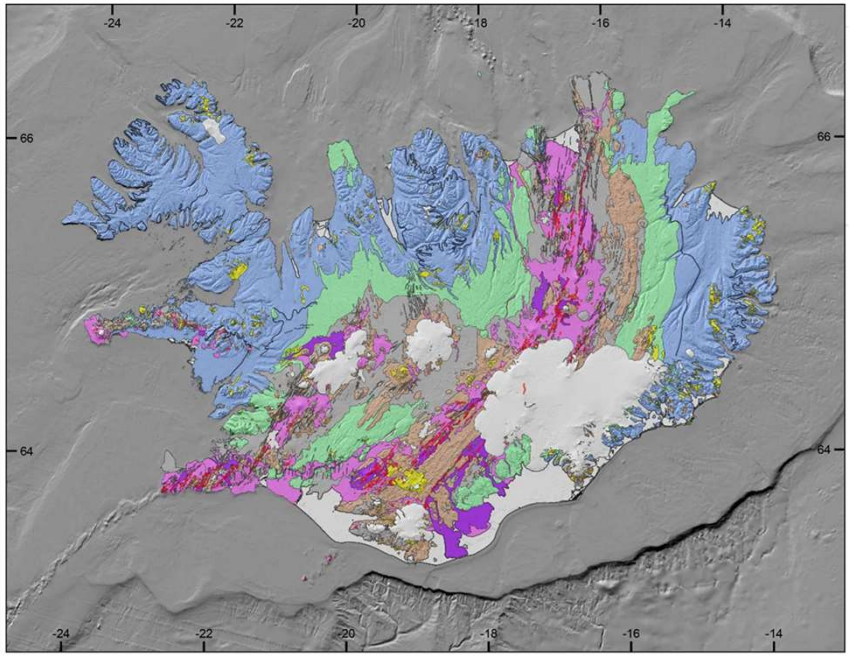
MATIS : P. Vannier, V. Marteinsson

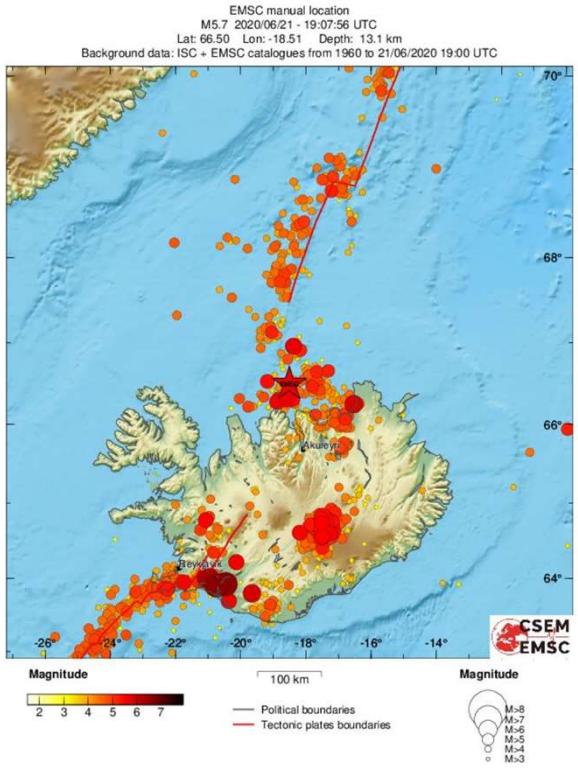
U. Bergen: S. Jørgensen

Iceland is an ideal natural laboratory to:

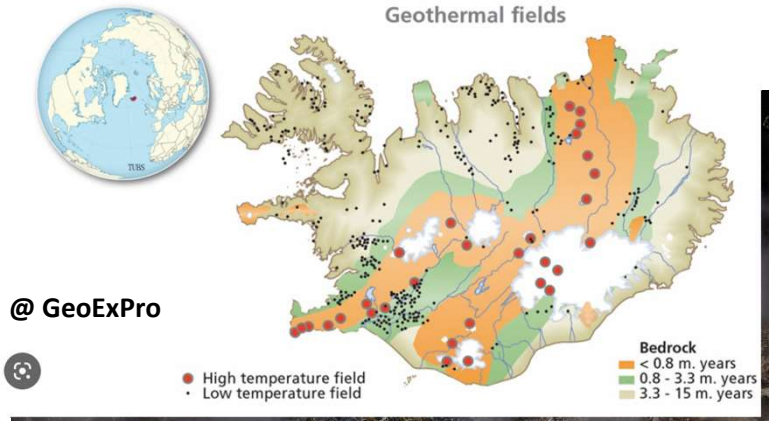
- quantify the energy release at divergent plates boundaries

- *study speciation processes during early life evolution (Isblue Tectolife)*

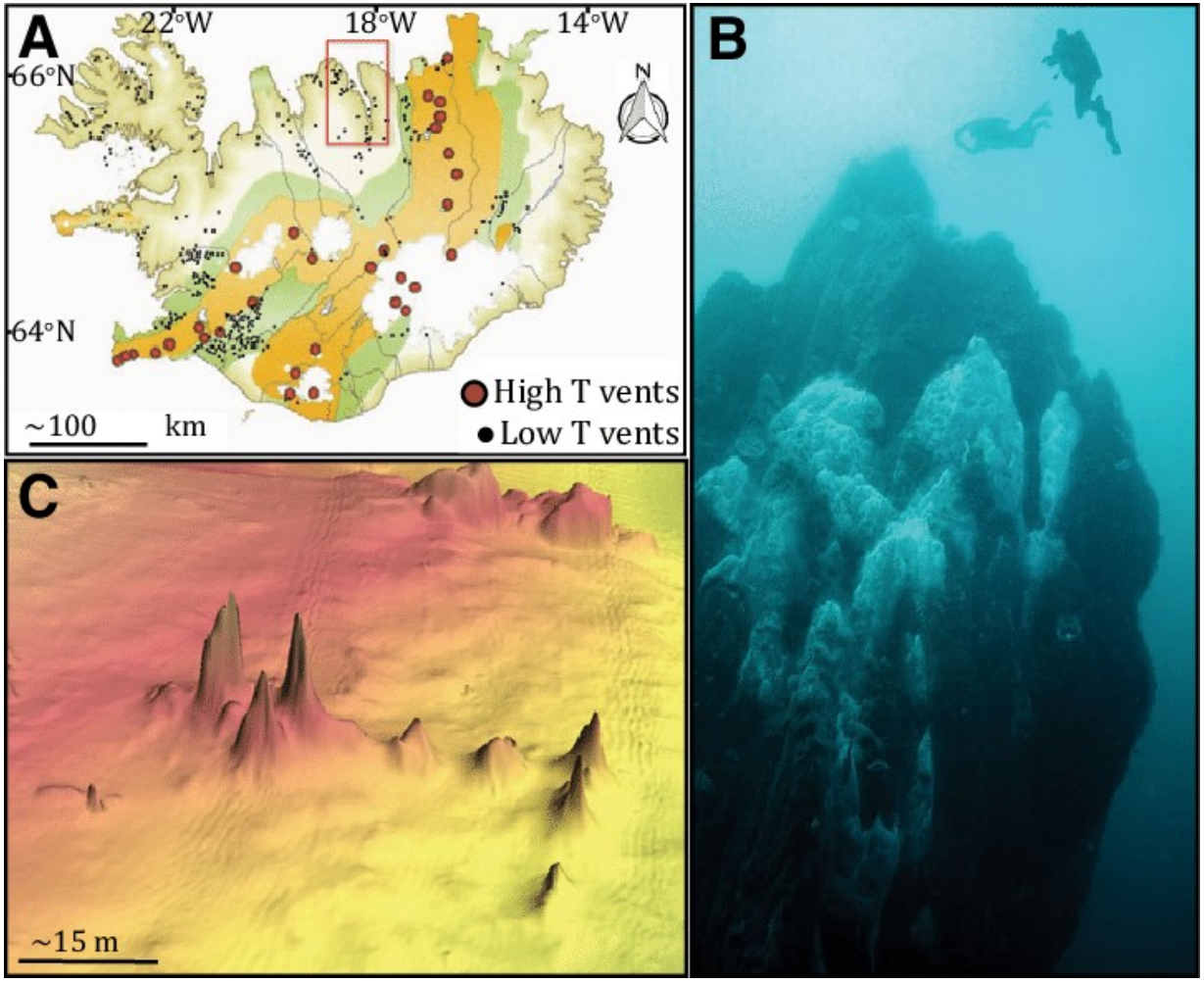




High-T hydrothermal system, Iceland



@ GeoExPro

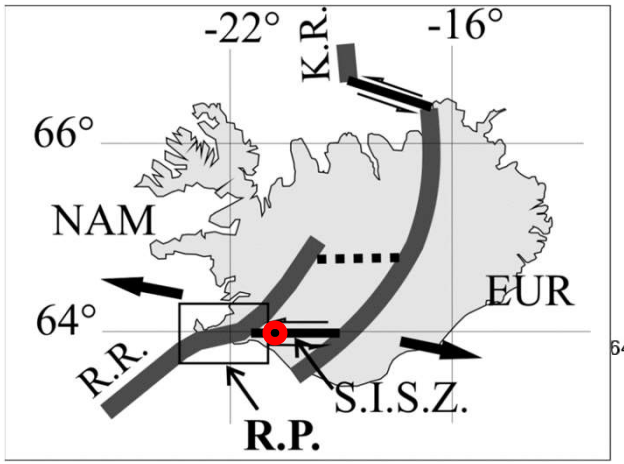


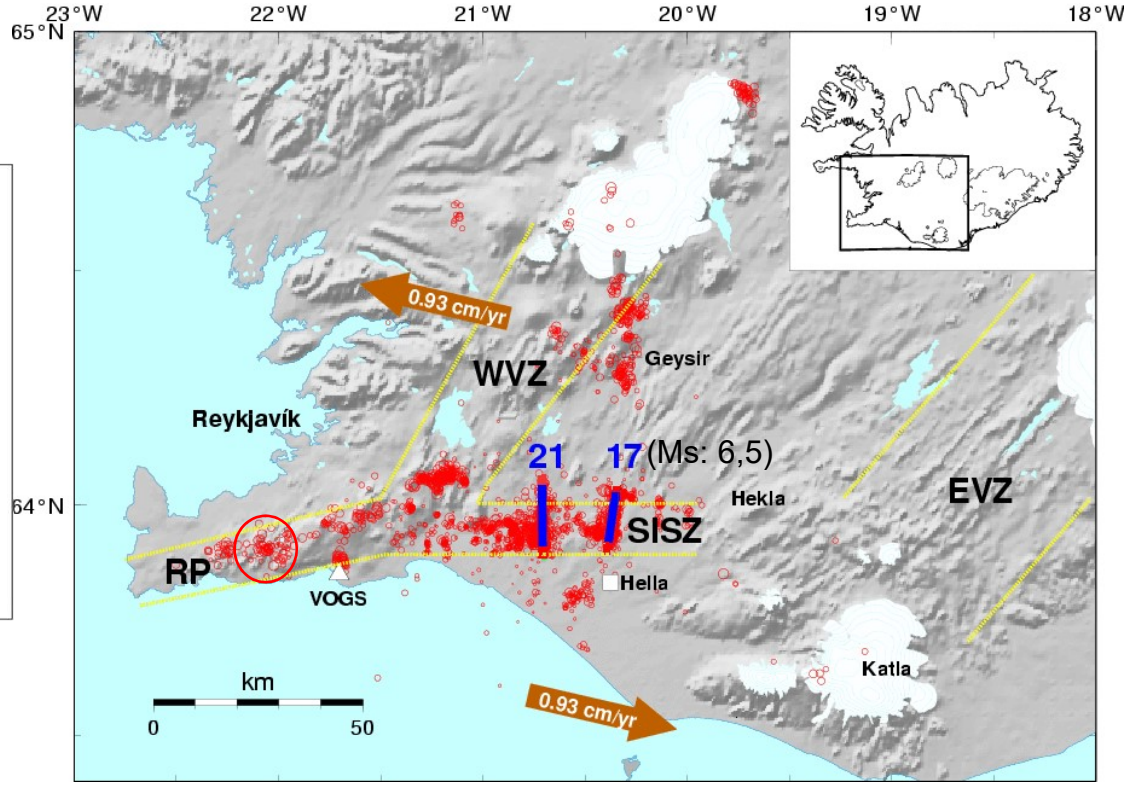
Price et al. 2017

Low-T hydrothermal system, Iceland (shallow seawater)

M 6.5 - 25 km E of Selfoss, Iceland

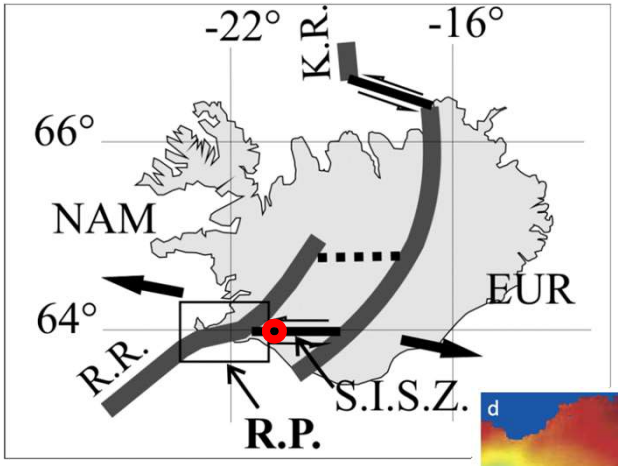
2000-06-17 15:40:41 (UTC) | 63.966°N 20.487°W | 10.0 km depth

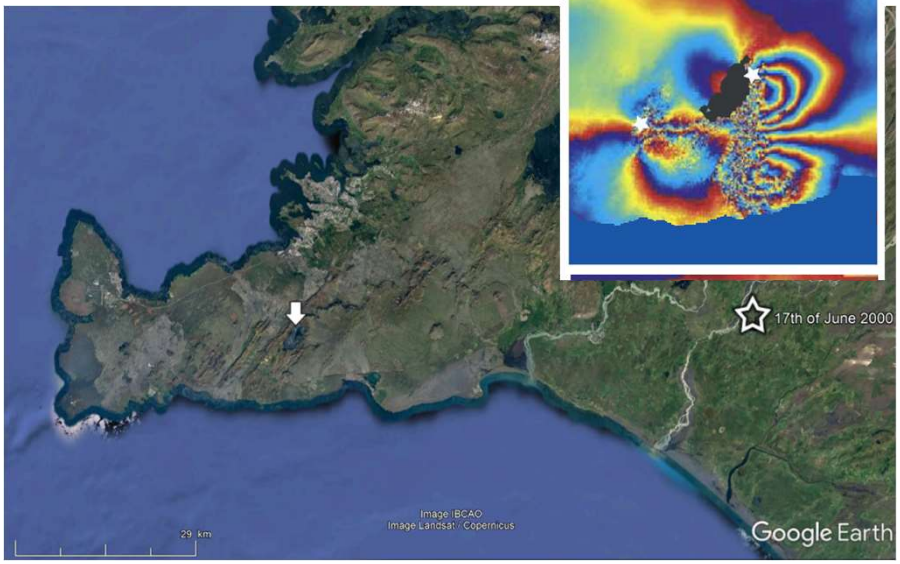


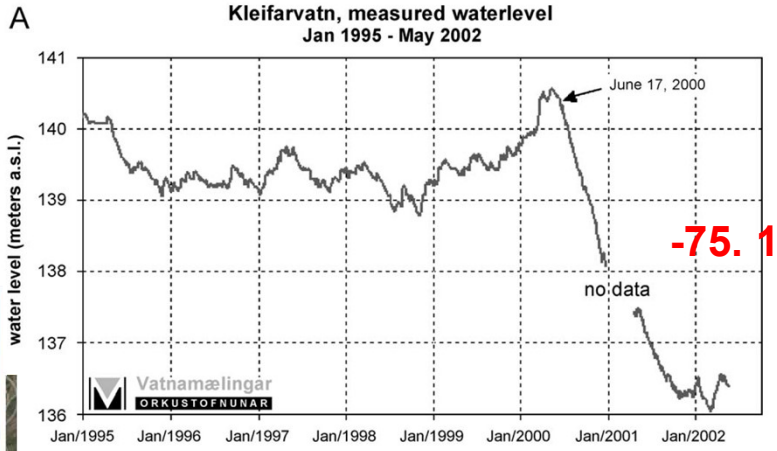


Steffanson et al., 2003

KLEIFARVATN : a key for life evolution?



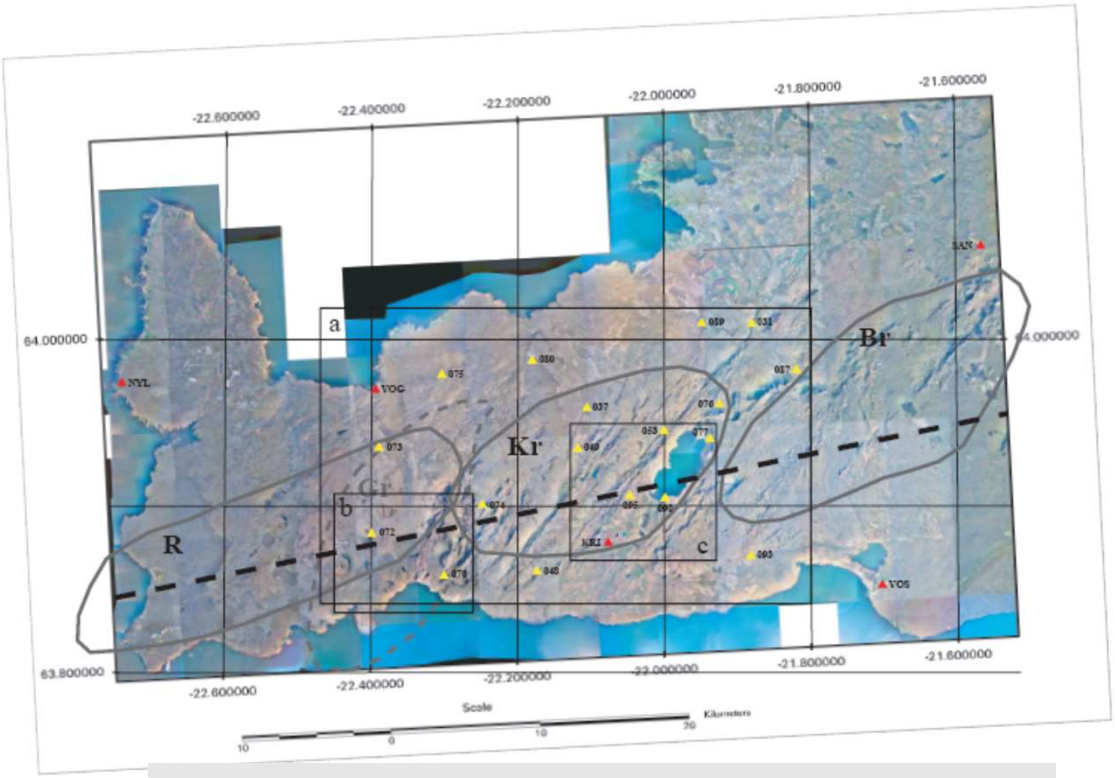




-75. 10^6 m^3

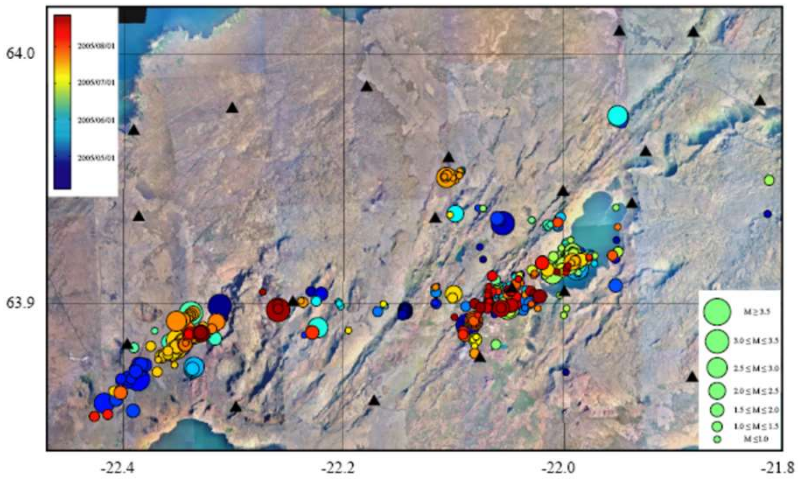
Clifton et al., 2003

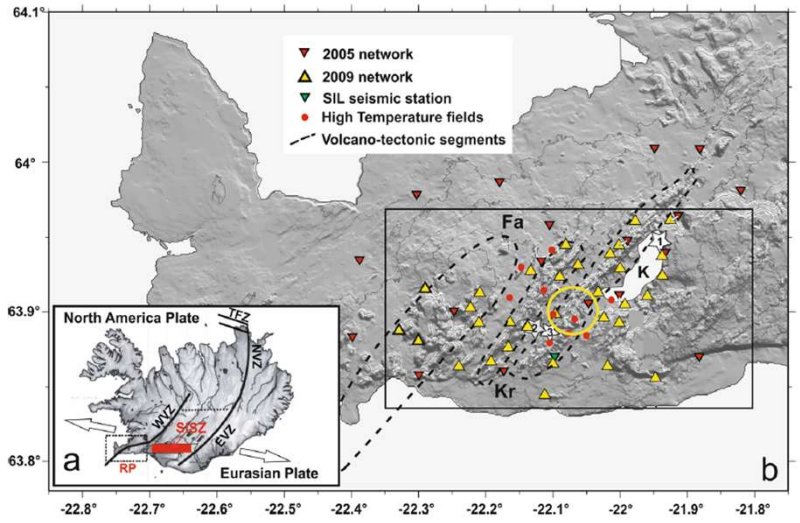
Looking for Kleifarvatn 'lost water': the HYDRORIFT 1 experiment



Date: 04/2005 to 08/2005
Number of stations (3C, 1-2Hz): 18 + 5 SIL
Number of recorded events:900
Magnitude range:0 to 3.7
Precision (after relocation) z:~200m, H~100m

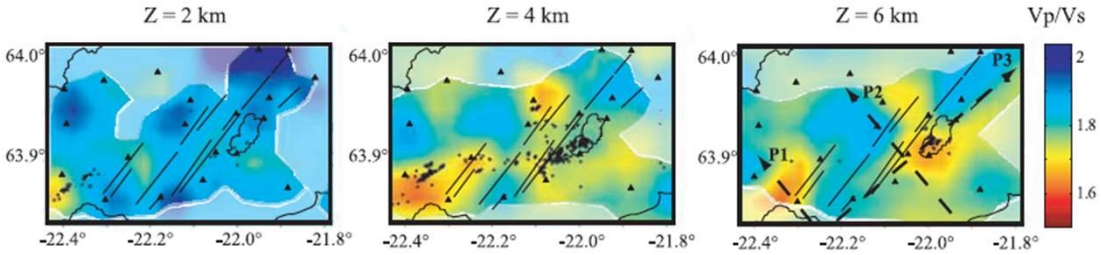
Hydrorift 1 (2005)

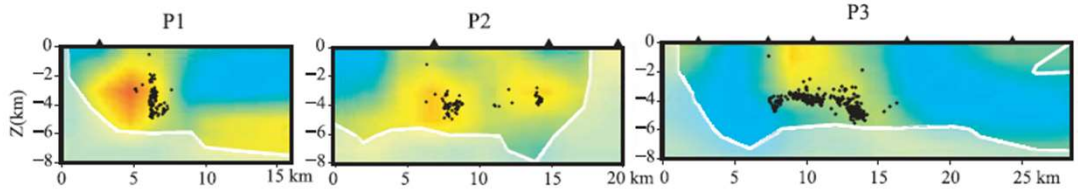




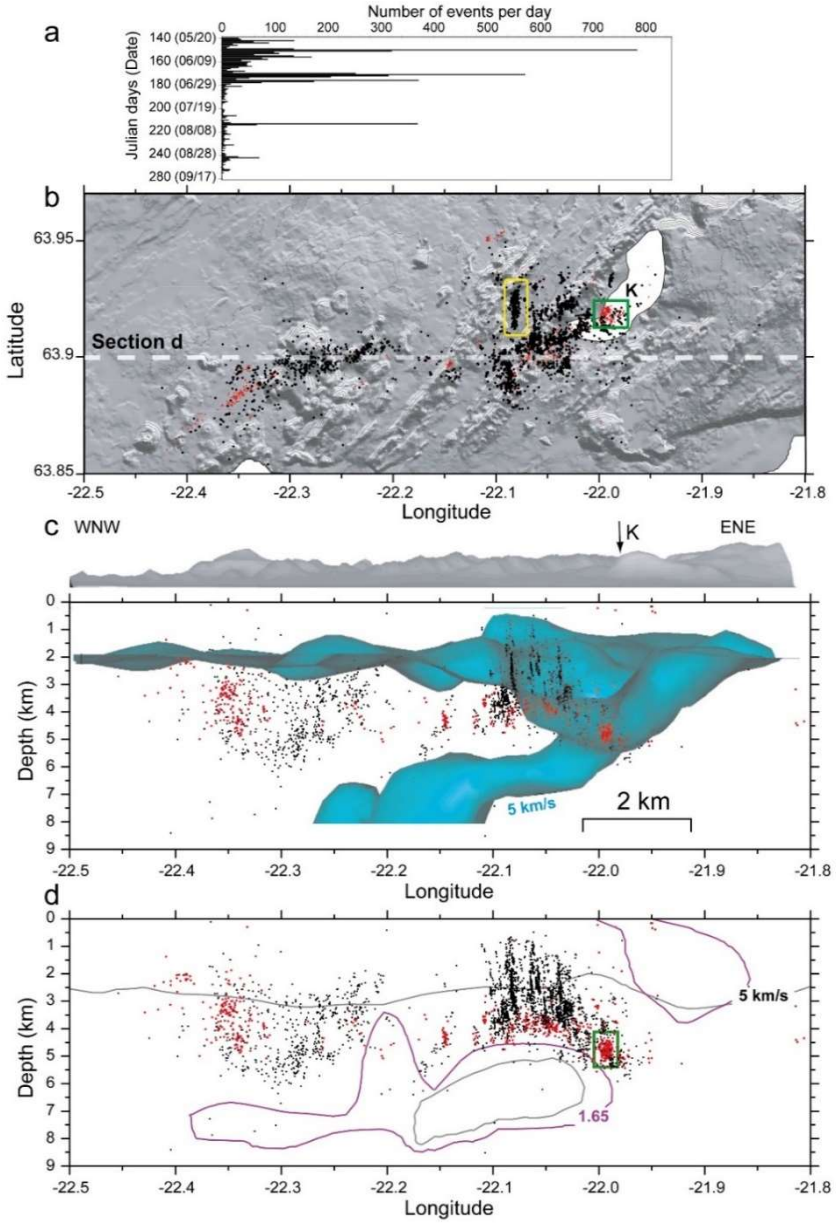
Hydrorift 2 (2009)

GEOFFROY AND DORBATH: FLUIDS AND SEISMICITY IN ICELAND





GRL, 2008



Kleifarvatn shallowest hot springs

@ Dive.is

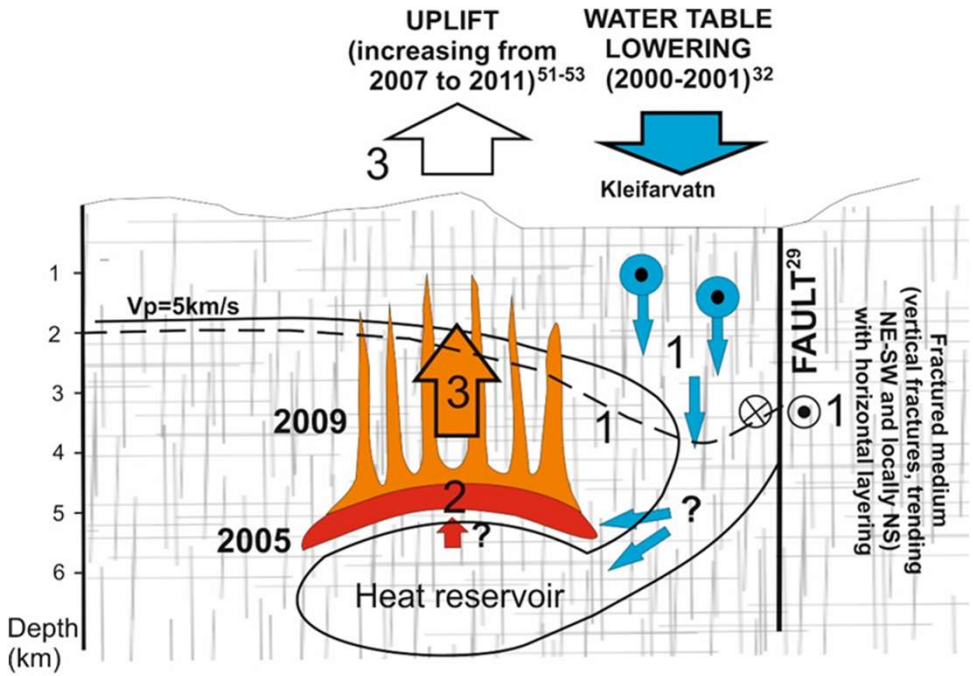
COMMUNICATIONS EARTH & ENVIRONMENT | (2022)3:54 | https://doi.org/10.1038/s43247-022-00382-0 | www.nature.com/commsenv

Seismic faulting => fluid recharge in the crust => onset of convection cells => ↗ hydrothermal activity

Cyclic (~50-200y)

Cyclic

Temperature
Chemistry
Eh, Ph
Flux



1: June 2000 earthquake: lateral/downward fluid penetration along, mostly, NE-SW trending fractures
2: fluid heating top of the heat reservoir (2000-2007?)
3: strong convection (2007-Present?)

Hypocenters 2005[23] 2009[this study]

LG et al., 2022

TECTOLIFE AIMS

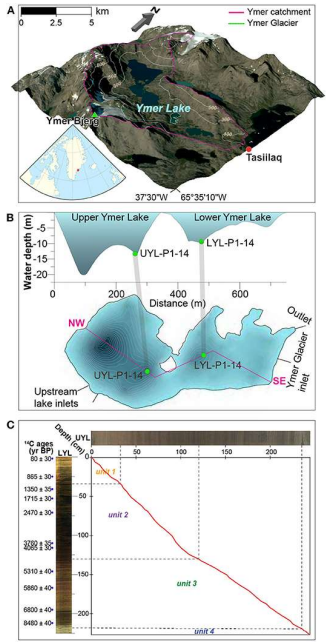
What is the influence of fault-controlled T/chemical cyclic variations on the biocenose?

Could such cyclic environmental stresses exert a pressure on species evolution*?

Could Icelandic lakes be a proxy of early life conditions and evolution?

* > Periodically stressful conditions may influence evolutionary rates by generating and maintaining variability and by overcoming adaptation limits caused by gene flow, helping to explain diversification patterns in the fossil record **Hoffmann & Hercus, 2000**

It is technically possible to calibrate the variations of (replicated) DNA sequences of living or past bacteria and/or archaea in cores



ORIGINAL RESEARCH article

Front. Microbiol., 24 July 2020 | https://doi.org/10.3389/fmicb.2020.01520

Microbial Community Structure in Arctic Lake Sediments Reflect Variations in Holocene Climate Conditions

Tor Einar Møller[1,2*], Willem G.M. van der Bilt[1,3], Desiree L. Roerdink[1,2] and Steffen L. Jørgensen[1,2*]

Quaternary Science Reviews 181 (2018) 19–29

Contents lists available at ScienceDirect

Quaternary Science Reviews

journal homepage: www.elsevier.com/locate/quascirev

Archaeal community changes in Lateglacial lake sediments: Evidence from ancient DNA

Engy Ahmed [a, b, c, 1], Laura Parducci [d, 1], Per Unneberg [e], Rasmus Ågren [f], Frederik Schenk [a], Jayne E. Rattray [a, g], Lu Han [d, h], Francesco Muschitiello [a, i], Mikkel W. Pedersen [j], Rienk H. Smittenberg [a], Kweku Afrifa Yamoah [a], Tanja Slotte [b, c], Barbara Wohlfarth [a, *]

Biogeosciences, 9, 3491–3512, 2012
www.biogeosciences.net/9/3491/2012/
doi:10.5194/bg-9-3491-2012

Biogeosciences

Sedimentological imprint on subseafloor microbial communities in Western Mediterranean Sea Quaternary sediments

M.-C. Ciobanu[1,2,3,4], M. Rabineau[4], L. Droz[4], S. Révillon[4], J.-F. Ghiglione[5], B. Dennielou[6], S.-J. Jorry[6], J. Kallmeyer[7], J. Etoubleau[6], P. Pignet[3,1,2], P. Crassous[8], O. Vandenabeele-Trambouze[2,1,3], J. Laugier[1], M. Guégan[1], A. Godfroy[3,1,2], and K. Alain[2,1,3]

Thick sediment sections are known from nearby lakes of similar dimension

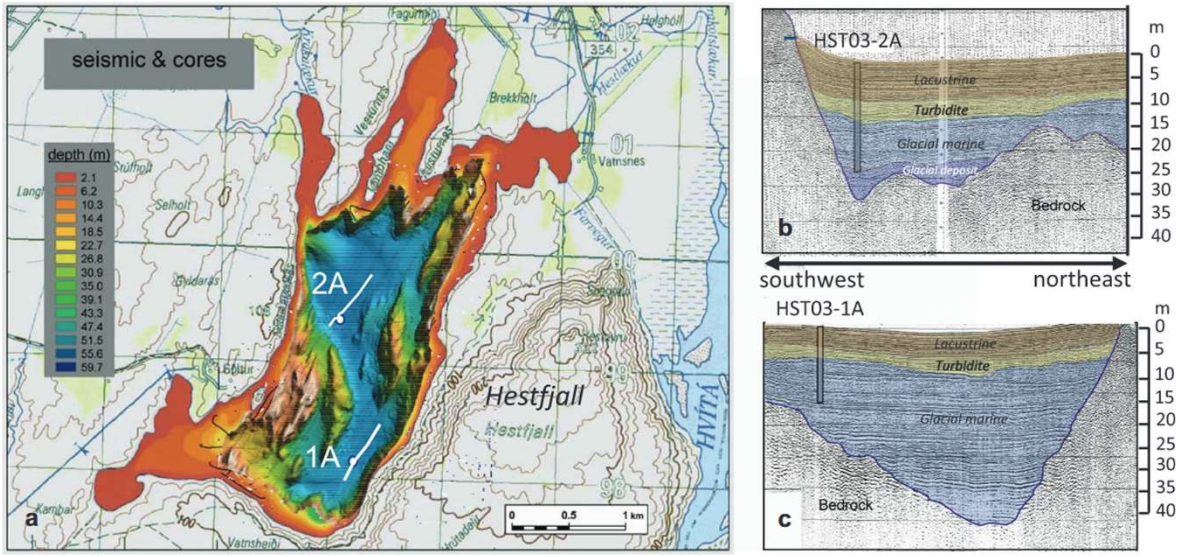


Figure 3. (a) Multibeam bathymetric map of the lake floor of Hestvatn with seismic profiles (white lines) and core locations for 1A and 2A (white dots); (b) seismic profile across 2A core site in the north basin showing the four units of glacial deposit, glacial marine sediment, turbidites and lacustrine sediments; and (c) seismic profile across 1A core site in the south basin with glacial marine sediments at the bottom, turbidites in the middle and lacustrine sediments on top. More detailed information on the seismic units is given in Hannesdóttir *et al.* (2009).

JQS Journal of Quaternary Science QRA

Recurrent outburst floods and explosive volcanism during the Younger Dryas–Early Holocene deglaciation in south Iceland: evidence from a lacustrine record

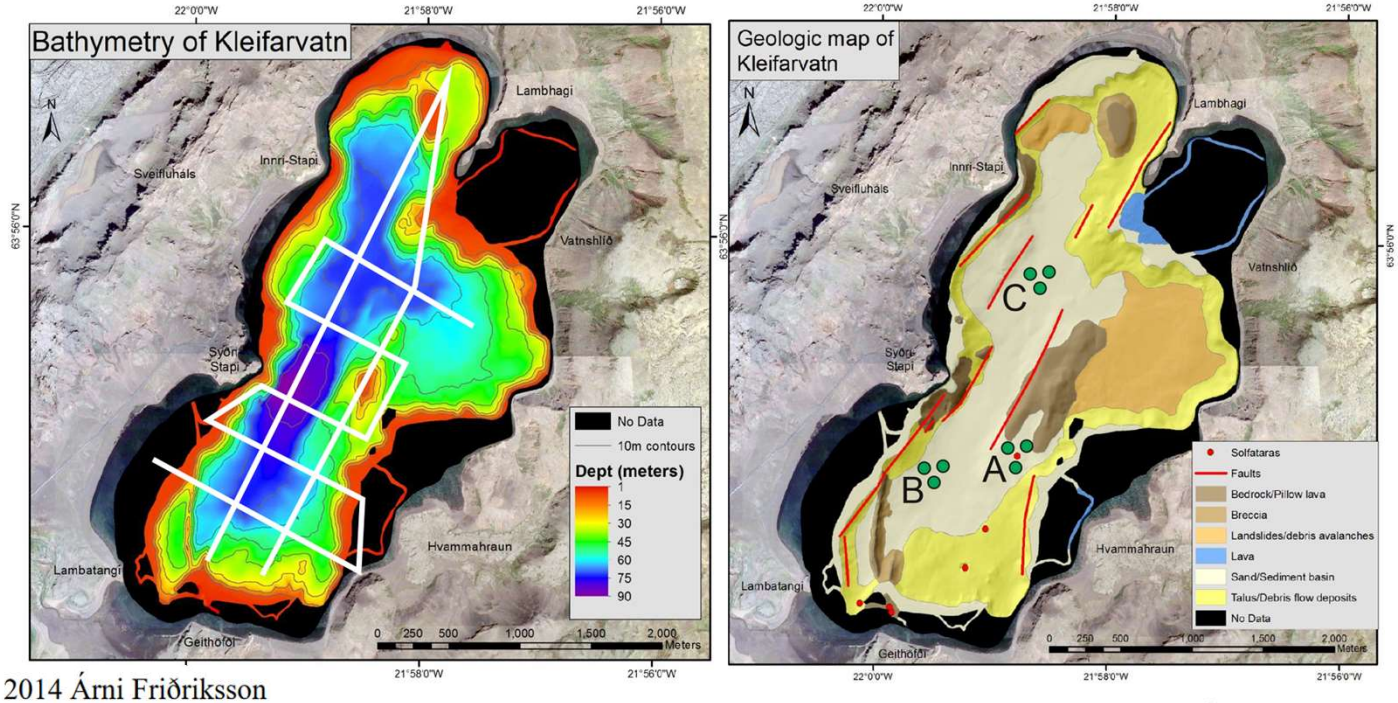
ÁSLAUG GEIRSDÓTTIR,[1]* GIFFORD H. MILLER,[2,3] DAVID J. HARNING,[2] HRAFNHILDUR HANNESDÓTTIR,[4] THOR THORDARSON[1] and INGIBJÖRG JÓNSDÓTTIR[1]

The TECTOLIFE IsBlue project in 2023

<u>Coring</u> Kleifarvatn to study :

- Microbiote with time (assemblages + DNA) at 3 locations
- Correlation with chemistry
- Correlation with seismic cycle

June : seismic survey (HF Boomer) **September** : coring survey



Approximate location of sampling sites A (~40m, at vent), B (~55m) and C (~75m) (note that red dots correspond to known hydrothermal vents). 3x3 drills are scheduled.