



Robotic Exploration for Hydrothermal Vents Beneath the Arctic Ice Cap

Press Briefing

June 21, 2007

Dr. Robert Reves-Sohn

Woods Hole Oceanographic Institution

Principal Investigators

Present at briefing:

Chief scientist: Robert Reves-Sohn

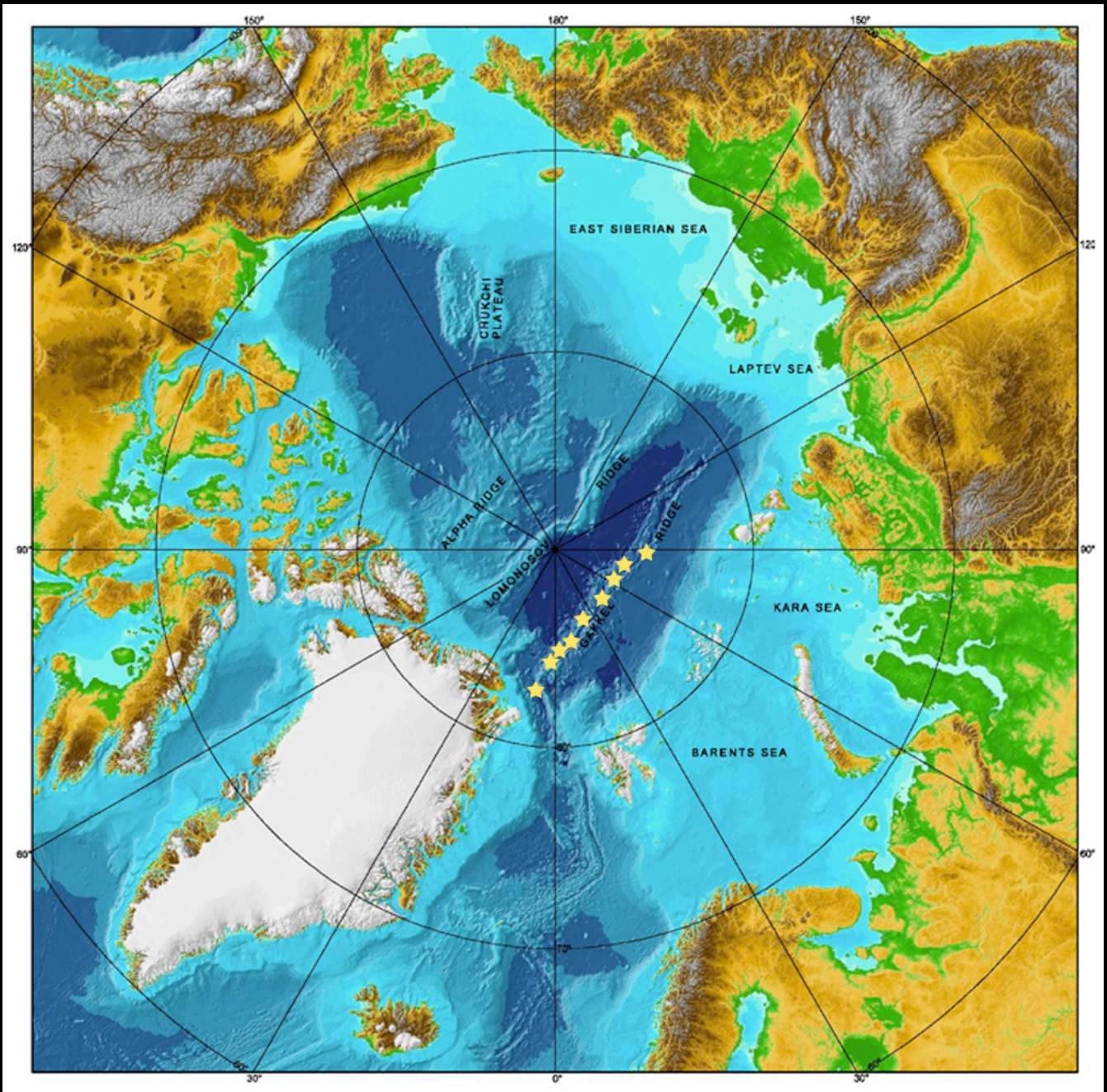
Lead engineer: Hanumant Singh

Lead biologist: Tim Shank

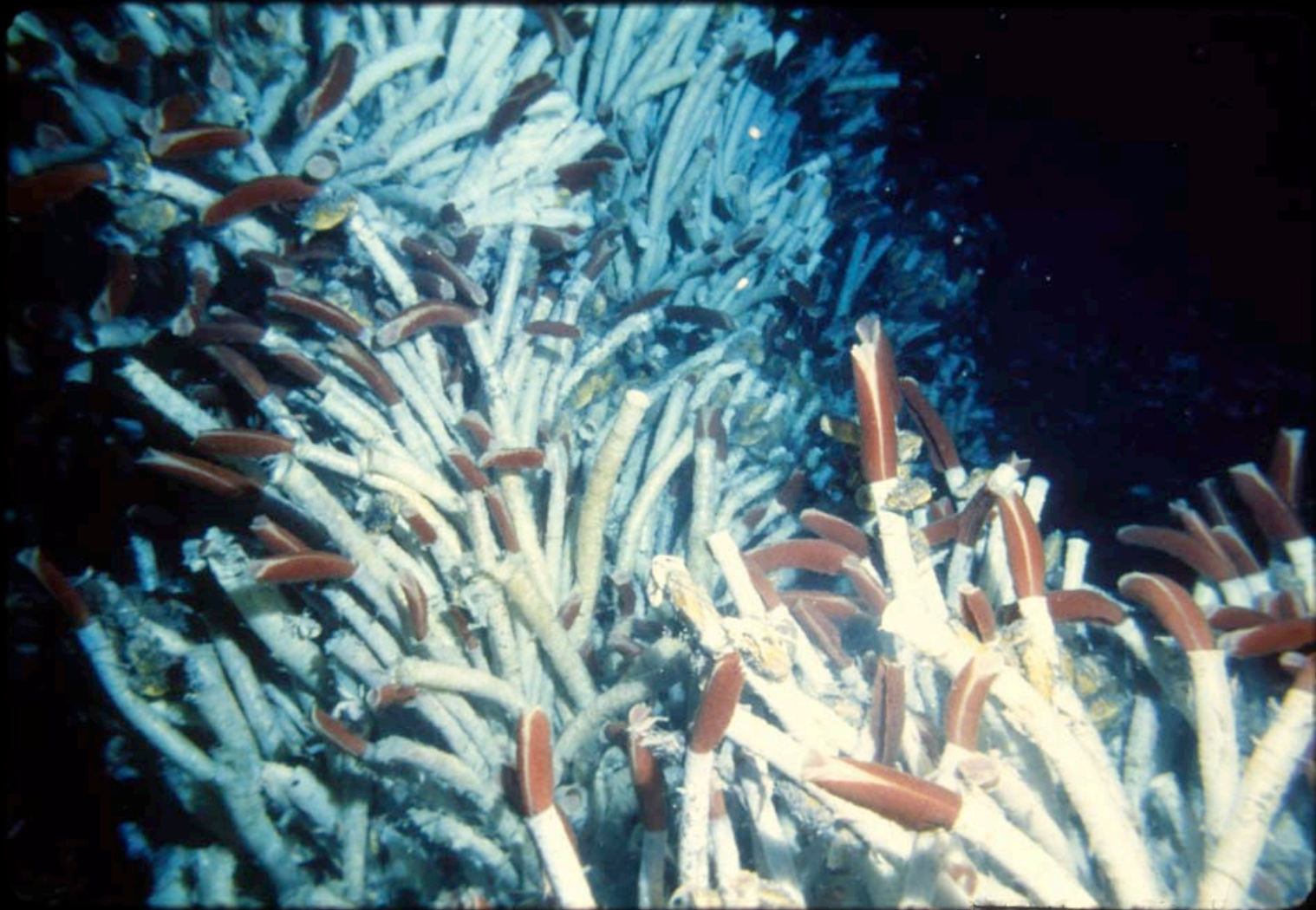
Lead geologist: Susan Humphris

Lead chemist: Hedy Edmonds (U. Texas)

Lead oceanographer: Peter Winsor



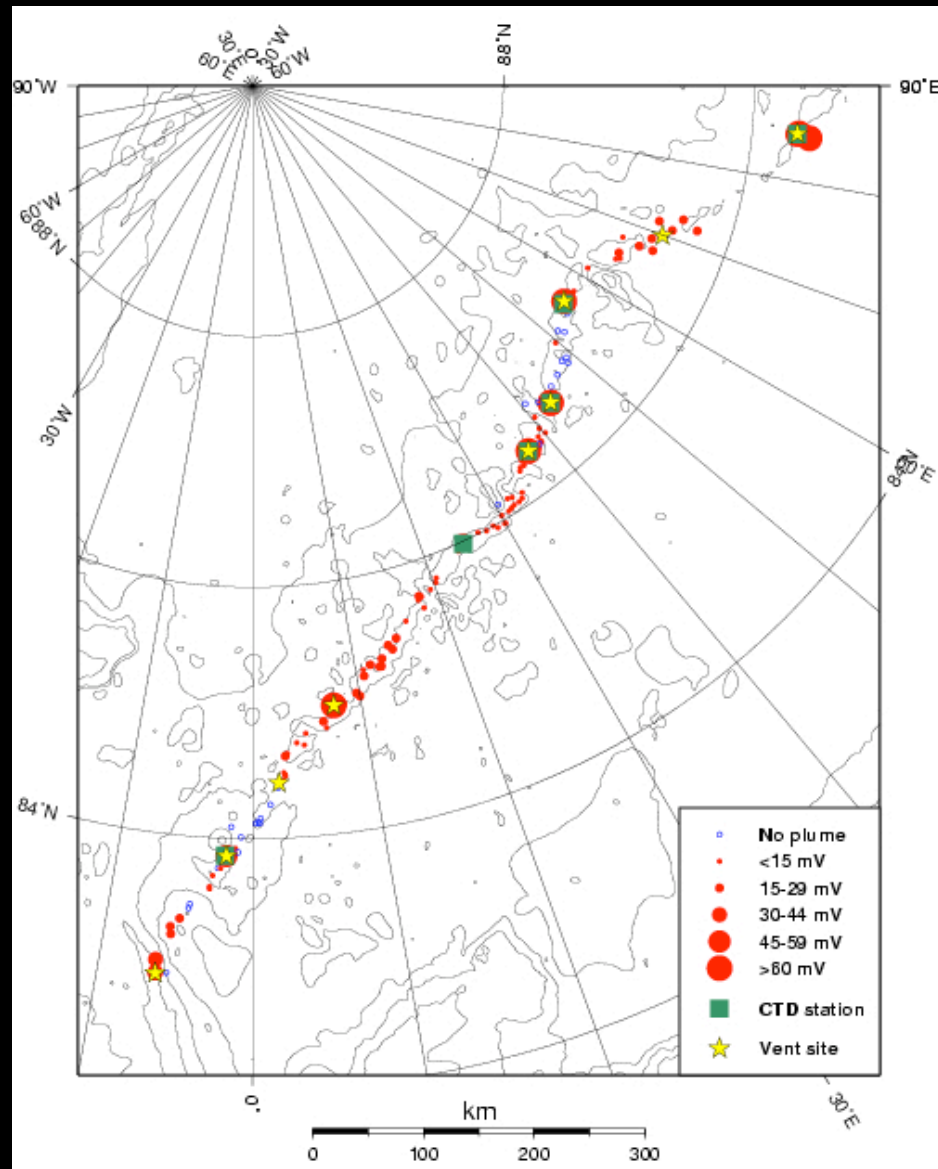




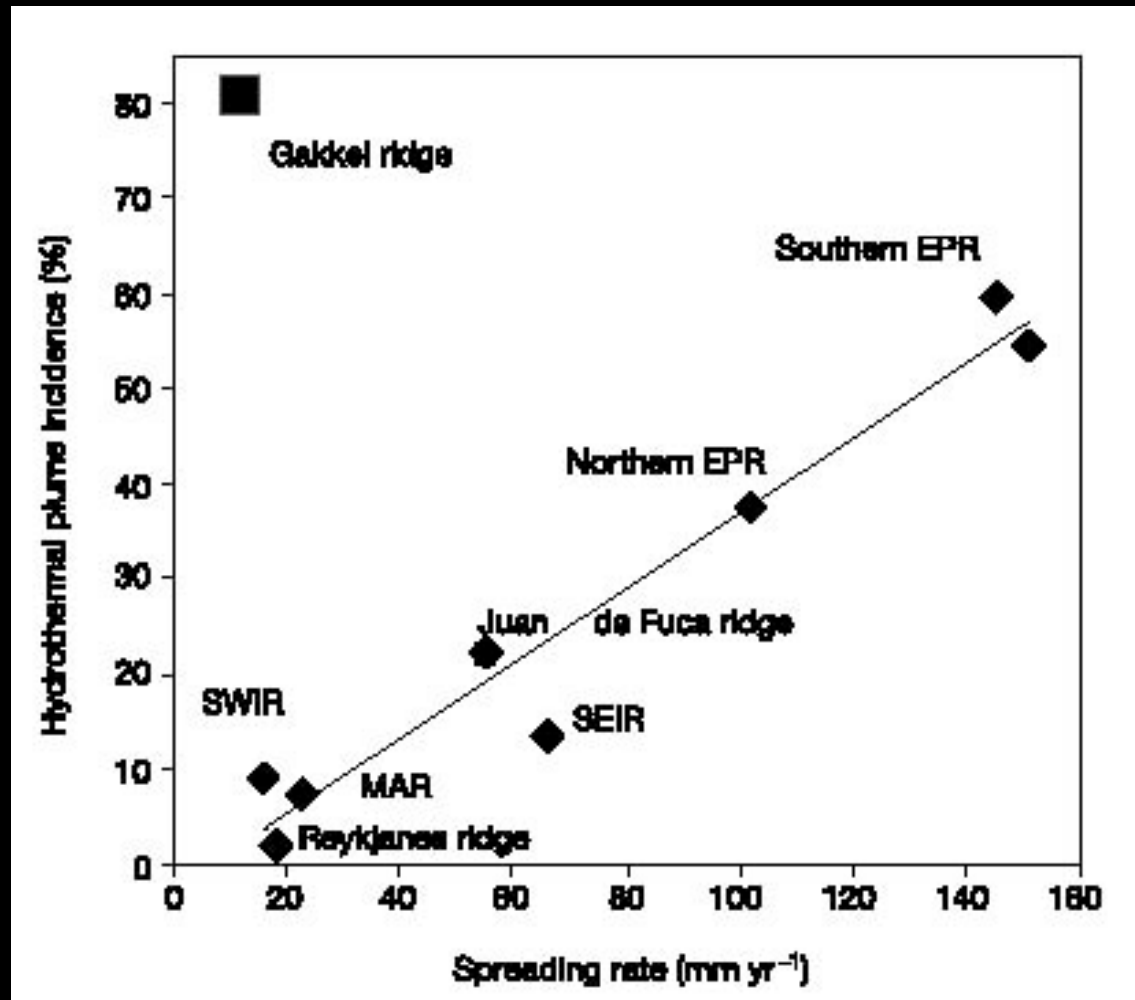
The Arctic Venting Anomaly

- 145 water column profiles made during AMORE in 2001
 - 118 (82%) with light scattering anomalies indicating hydrothermal venting
- Nine vent sites located to within ~2-5 km (yellow stars)
- Order of magnitude anomaly for global system
- Or just smog?

(from Edmonds et al., Nature, 2003)

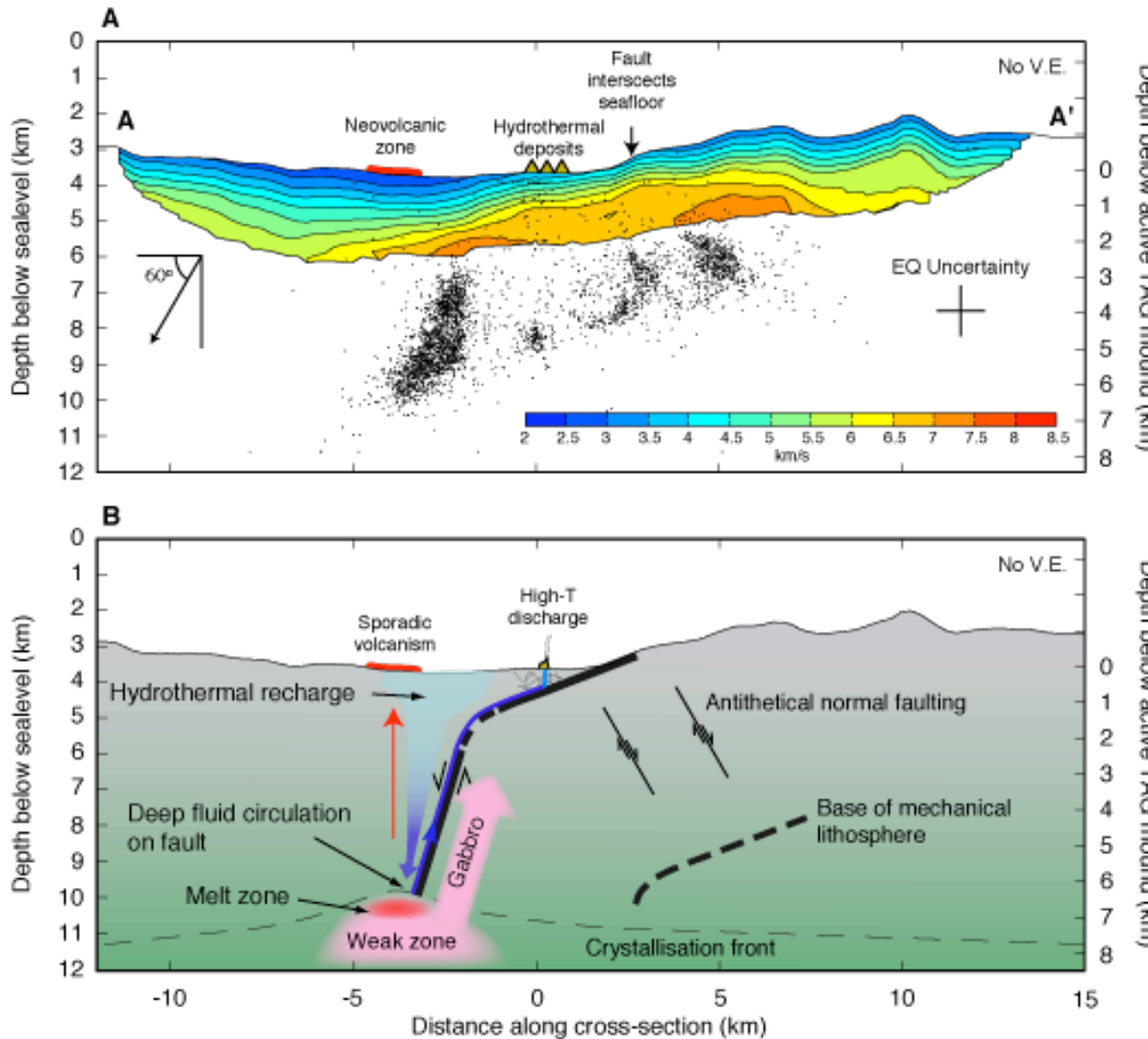


Gakkel Venting Anomaly



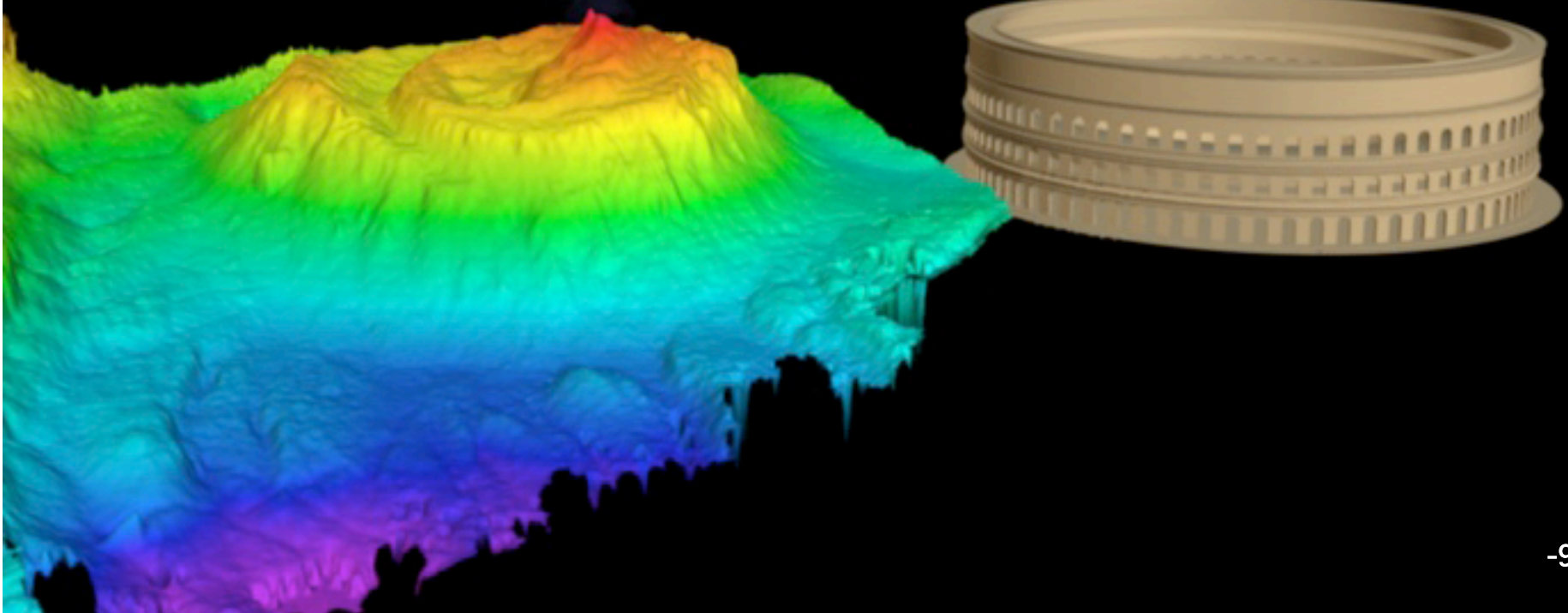
(Michael et al., *Nature*, 2003)

Deeply penetrating faults provide hydrothermal “super-highways” into the Earth’s mantle



- Slow spreading leads to a cold lithosphere and large, long-lived faults
- Fluids can exploit these faults to extract heat directly from the Earth’s mantle
- One consequence: **LARGE Deposits**
- For example, the TAG field on the Mid-Atlantic Ridge

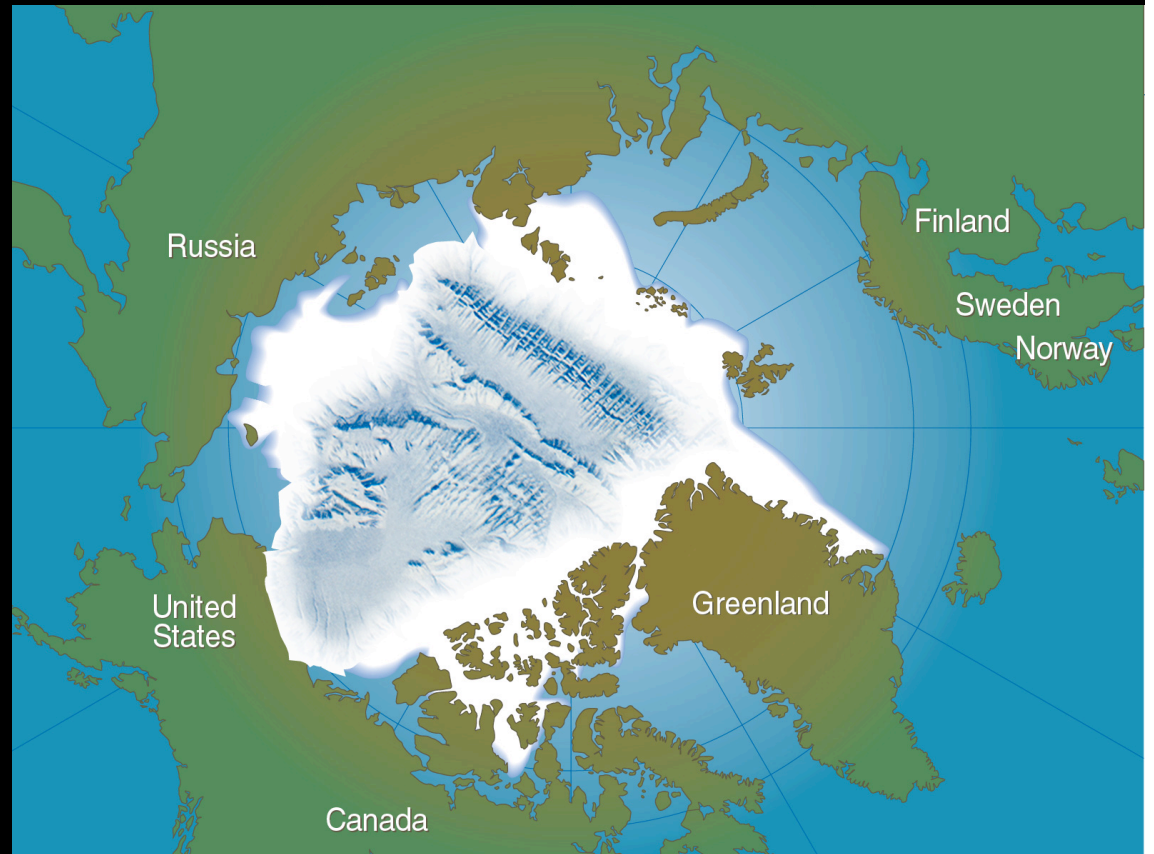
Slow spreading generates BIG mineral deposits, and apparently lots of them, why?



Just one problem.... ICE

The Gakkel Ridge lies under the permanent ice cap (minimum summer ice cover shown here)

In the open ocean we use manned submersibles and remotely-operated vehicles to search for vent fields, but these are too dangerous to use in the permanent ice pack

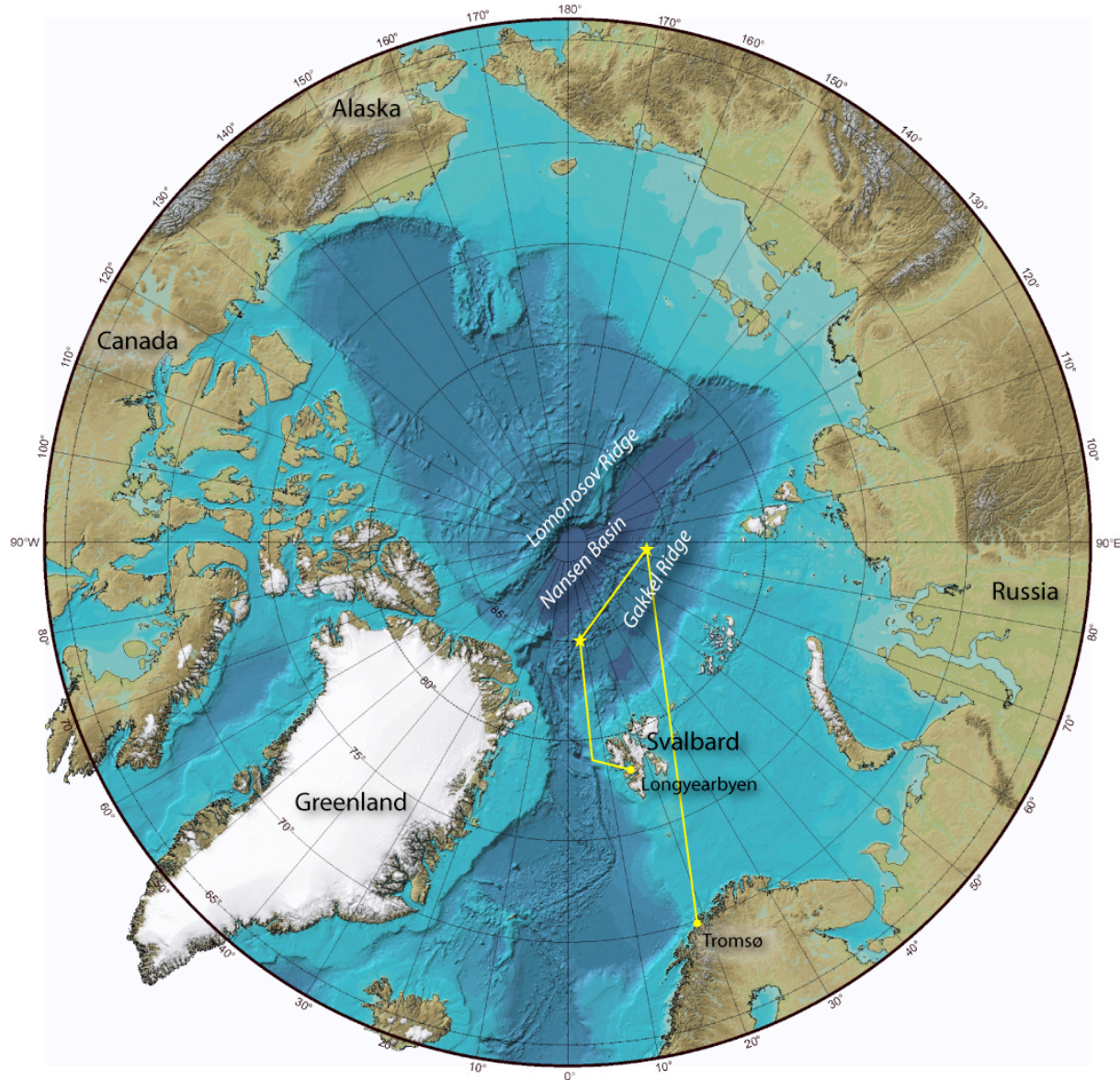


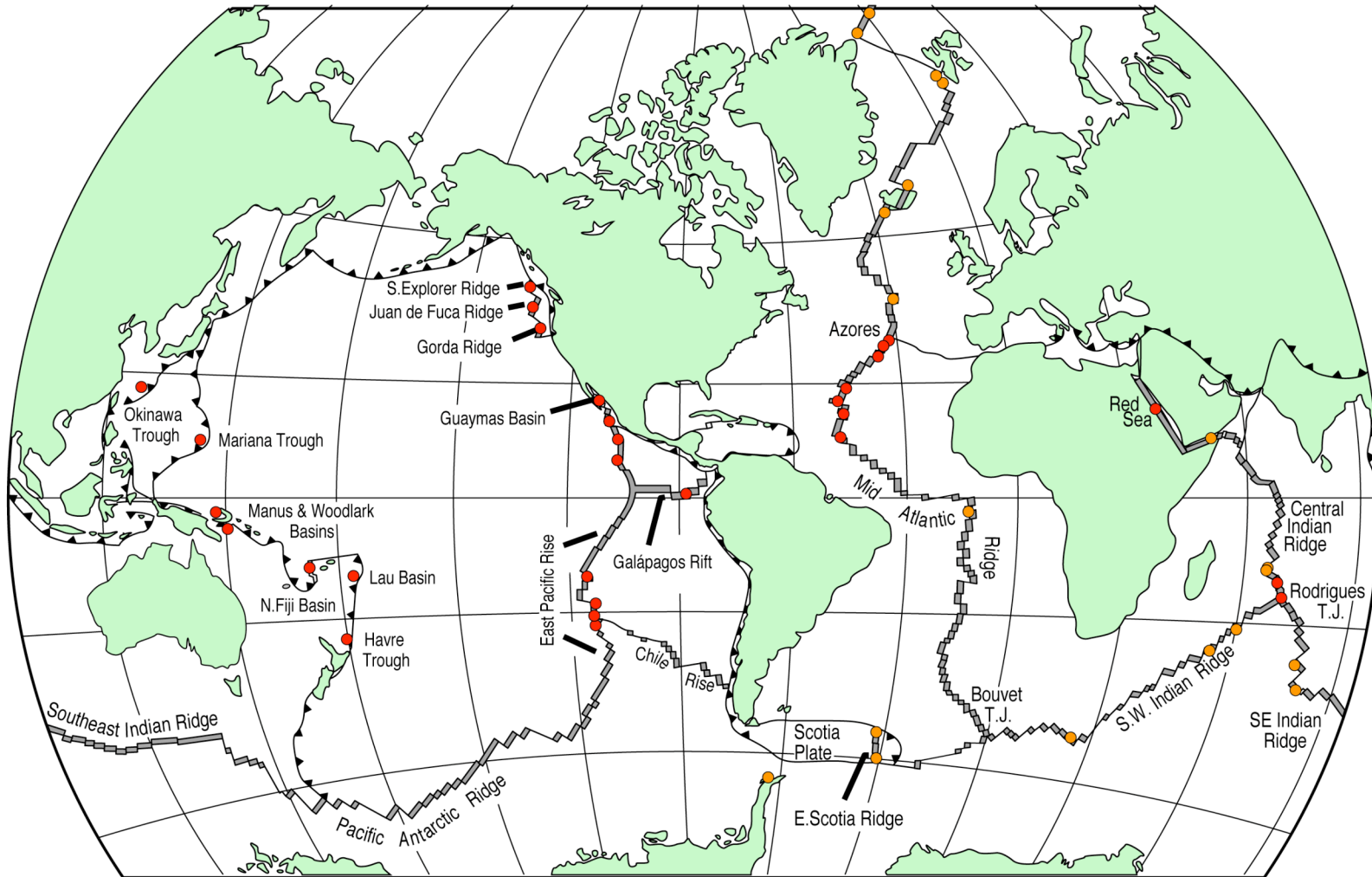
Swedish icebreaker
Oden





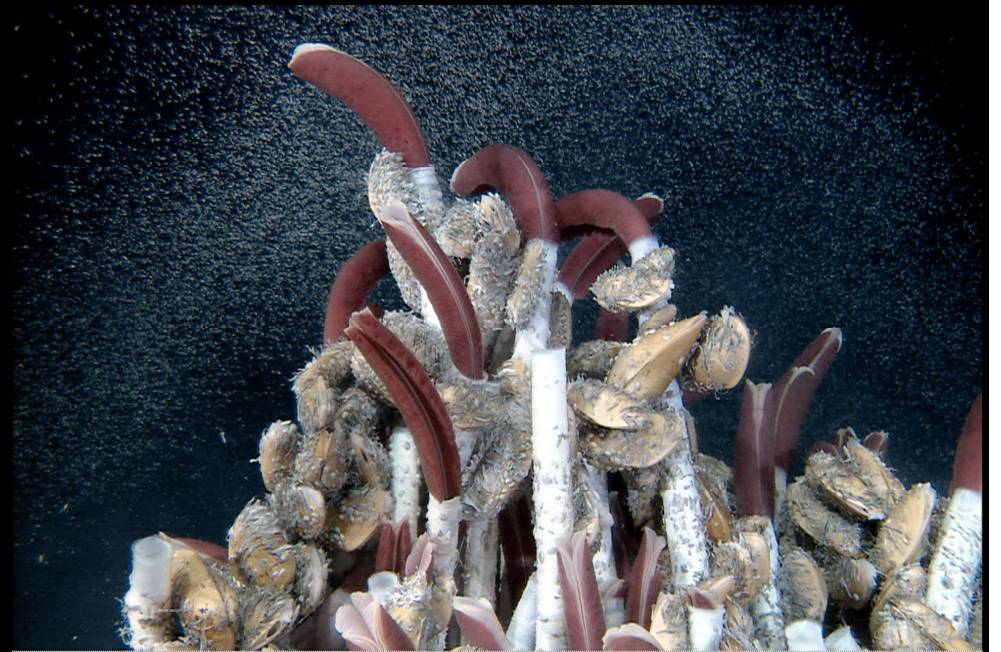
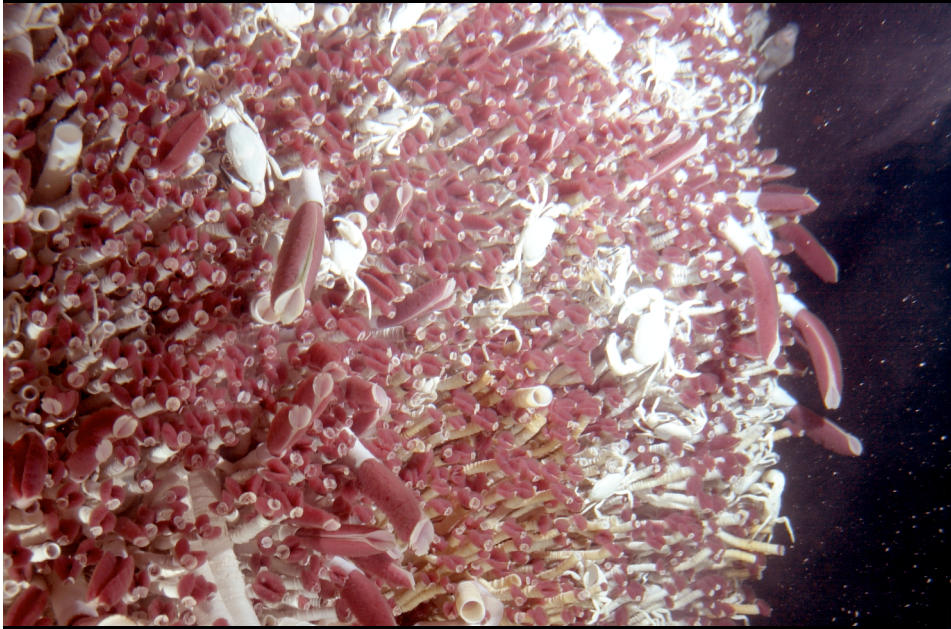
Gakkel expedition, July 1 - August 10



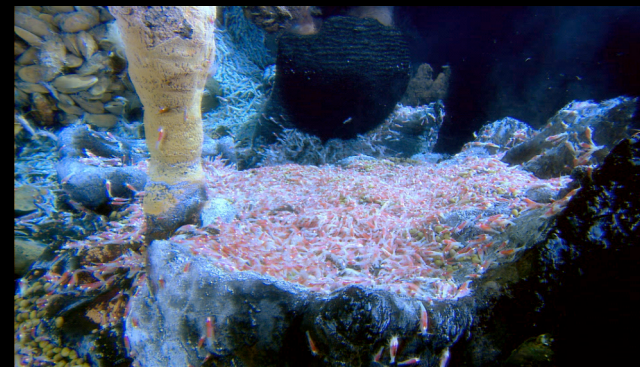
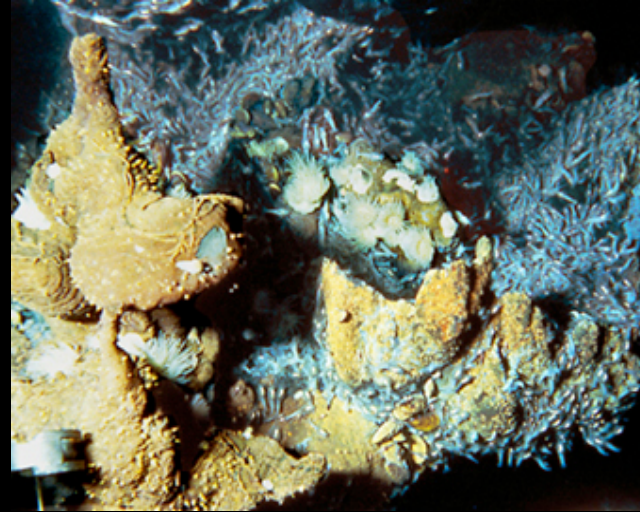


Locations of known hydrothermal activity along the global mid-ocean ridge system

● = Known active sites ● = Active sites indicated by midwater chemical anomalies



Eastern Pacific



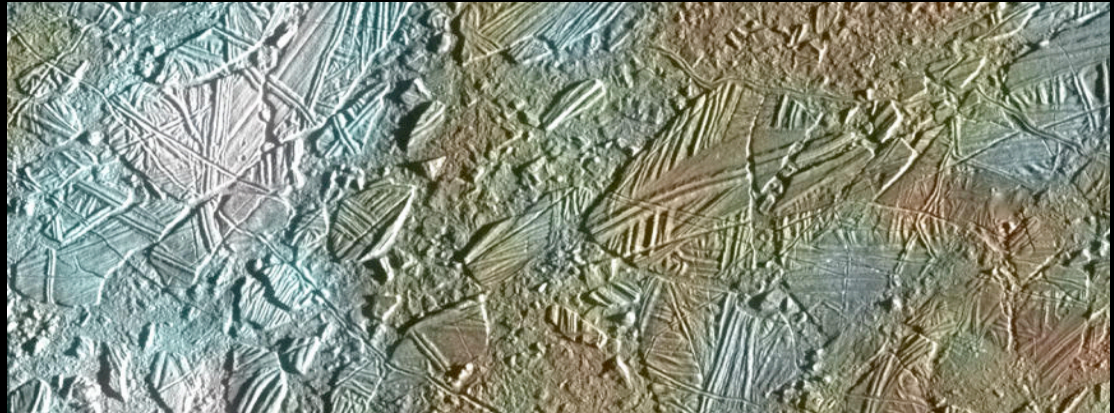
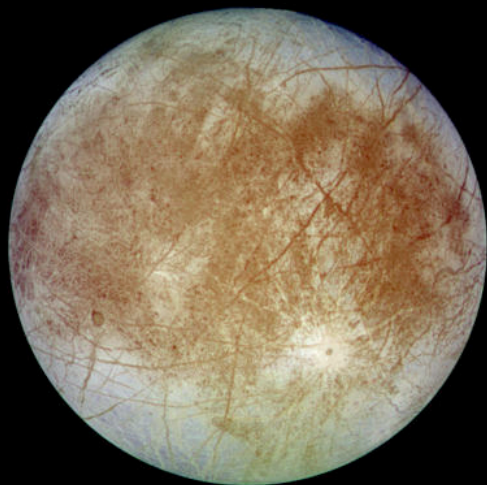
Rimicaris exoculata
Mid-Atlantic Ridge

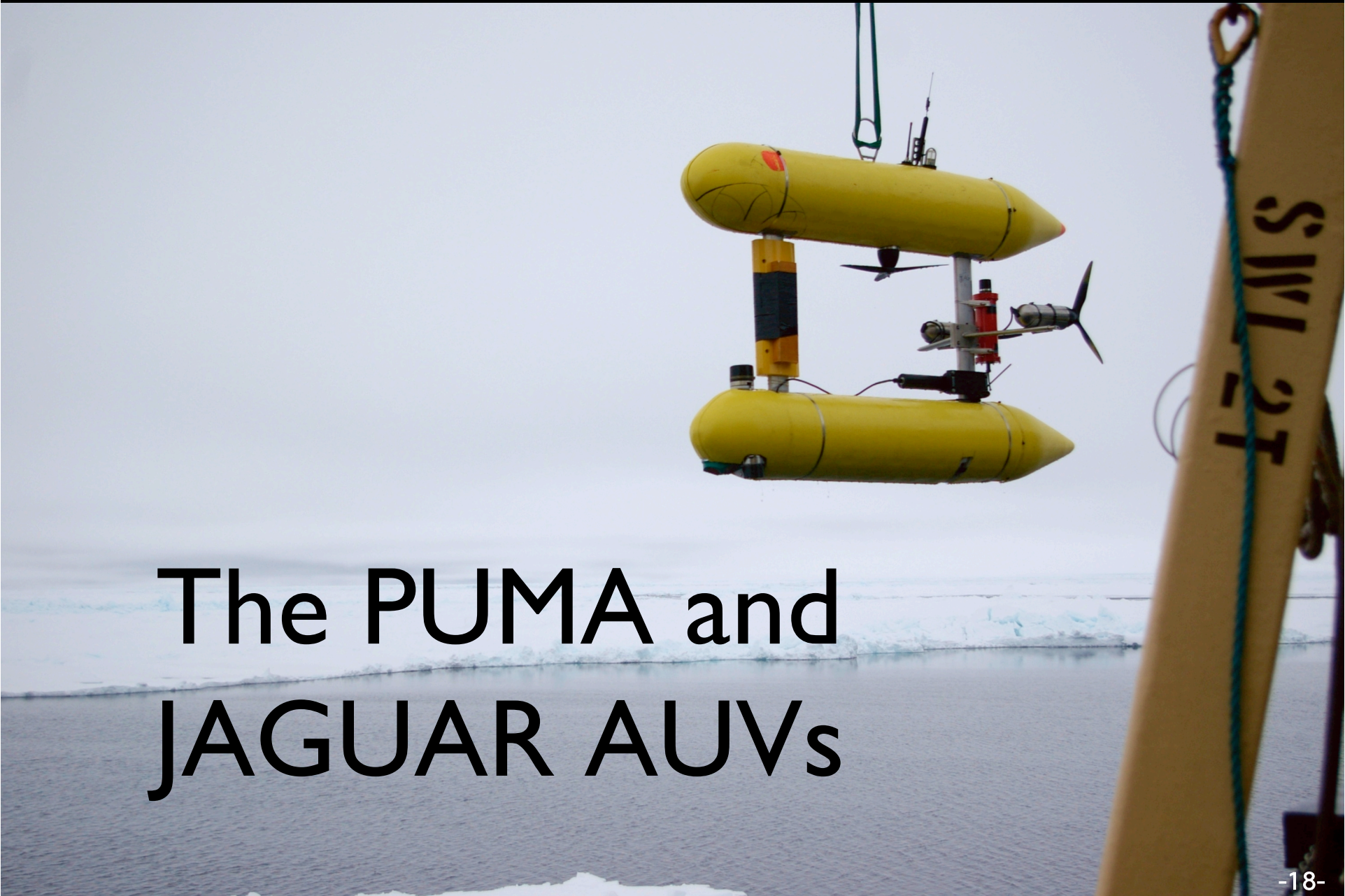
Science

First biological and geological characterization of hydrothermal processes on the ultra-slow spreading Gakkel Ridge in the hydrographically isolated Arctic Basin

Technology

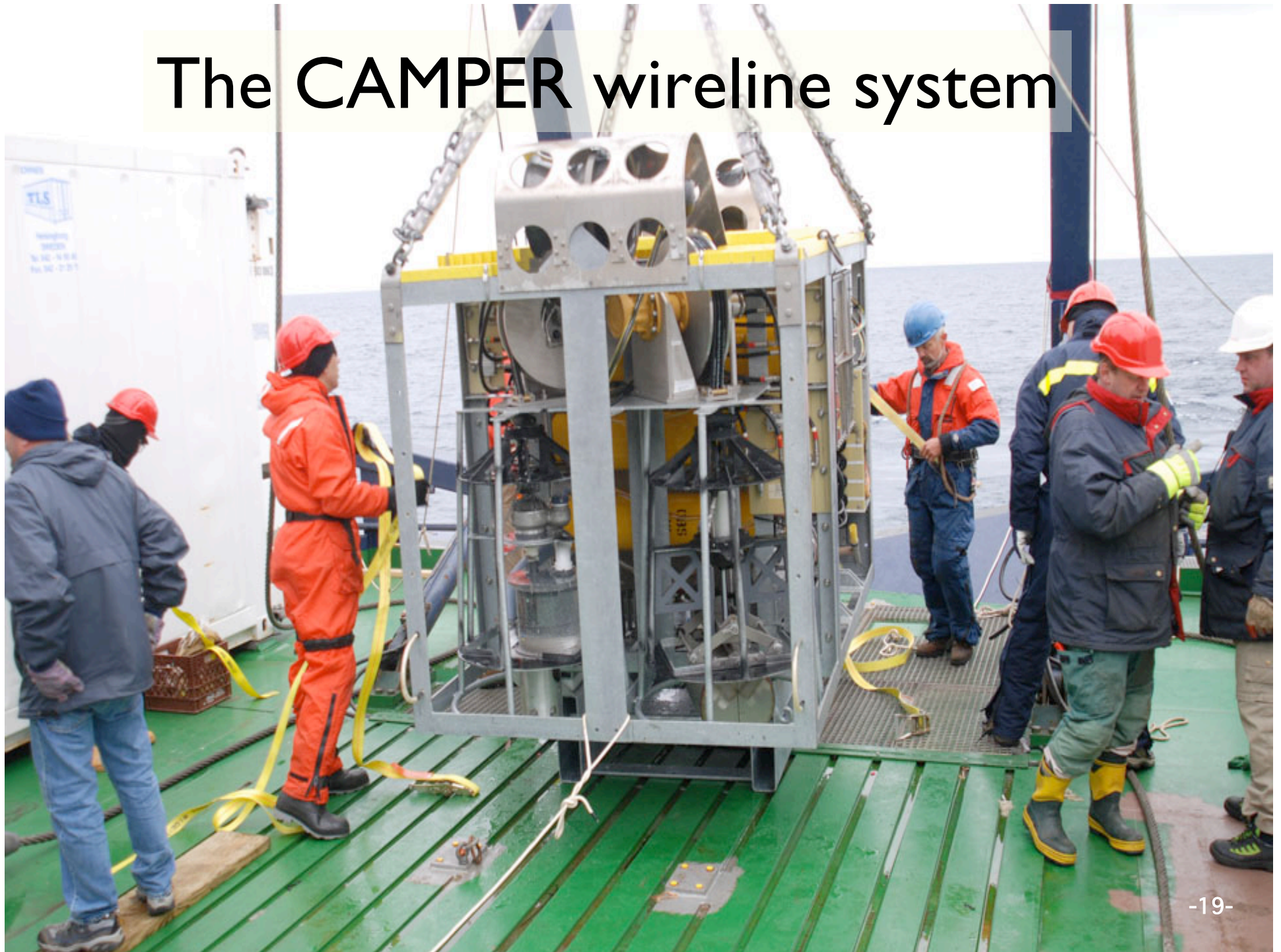
Technology development for polar oceanography and future astrobiology missions to Europa



A yellow autonomous underwater vehicle (AUV) is being hoisted by a crane. The AUV consists of two yellow cylindrical floats connected by a central vertical structure. The top float has a red stripe and a small antenna. The central structure includes a propeller and various sensors. The AUV is suspended by a green strap. In the background, there is a body of water with a line of ice. On the right side, a yellow crane arm is visible with the text 'SW 27' written on it.

The PUMA and JAGUAR AUVs

The CAMPER wireline system



Drop Camera System
12 species recovered-
from grab and slurp sampler
1500m muddy bottom

Stalkless
Crinoid

Ophiuroid
(Brittle Star)

Arctic Gakkel Vents Expedition and the International Polar Year

- International collaborators in Germany, Sweden, Japan, and Norway
- Major themes of scientific exploration and technology development
- Comprehensive media program, incl. museums, internet, and print media (2 journalists, 1 photog, 1 videographer onboard)



Polar Discovery brings you the stories of science on ice.

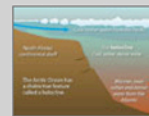
The polar regions are experiencing unprecedented environmental changes that are having significant impacts on global climate, ecosystems, and society. Using the latest engineering advancements, scientists are studying the changing climate at the heart of the icy Arctic Ocean, melting glaciers of Greenland, and the creatures of Antarctica's Southern Ocean.

Learn about the day to day challenges of studying the world's coldest places through [daily dispatches](#). Read more about [our first expedition mission](#) or [explore](#) the poles on your own.

Watch for details about our next expedition in July!



Daily photojournals: In April 2007, our team headed to the North Pole to deploy instruments for research. [Read about our adventures](#) »



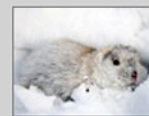
View an animation: Learn about the "halocline," a cold, salty layer that separates surface waters from the deep waters of the Arctic. [Animation](#)



See an interview: Dr. Mary-Louise Timmermans discusses Arctic climate research and modelling and what it means for climate change. [Video](#)



Explore the past: Explore the long history of exploration of the Arctic – from ancient Greece in 330 BC to the present. [Start the Journey through time](#) »



Polar fun: Listen to Arctic sounds, play jigsaw puzzles, view picture-perfect postcards from the Arctic, and guess what some photos are. [Start now!](#) »



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Expedition 11: Gakkel Ridge

July 1 - Aug. 10, 2007

Mission

Check back after July 1 for daily updates, photos, interviews, puzzles, hot topics, and more!

Our Mission: July 1 - August 10, 2007

For the first time in the history of humankind, a scientific team—using unique underwater and under-ice vehicles—will attempt to reach the bottom of the Arctic Ocean to find seafloor hydrothermal vents. Join Expedition 11 this summer on a potentially historic and groundbreaking (and certainly icebreaking) research cruise aboard the Swedish icebreaking ship *Oden*.

We know so little about the Arctic Ocean seafloor, because exploration of the Arctic is so difficult. At the top of the world, the Arctic Ocean is cold, remote, and covered in darkness for half the year. It's hard enough to get onto the ice-covered ocean. It's even harder to get under it and down to its seafloor.

For this 40-day cruise to the Gakkel Ridge in the eastern Arctic Ocean, engineers have built two new robotic underwater vehicles called PUMA and JAGUAR. They are autonomous, which means they have no pilot and can swim on their own. PUMA and JAGUAR are designed to be put into holes in the sea ice (that's the relatively easy part) and to explore the deep reaches of the Arctic Ocean. Many hours later, they will have to find their way back to another hole in the ice and be recovered by the *Oden*.

AUVs (short for Autonomous Underwater Vehicles) have been deployed in open ocean waters off Antarctica, sent under the ice, and recovered in open waters. That is risky enough: Quite

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Ecological and evolutionary comparisons across biogeographic provinces