

# Proposal for Underwater Surveys at the hydrothermal vents in Eyjafjörður

**Dr. Stefán Áki Ragnarsson**, marine ecologist, Marine Research Institute of Iceland (Hafrannsóknastofnunin), Reykjavík [steara@hafro.is](mailto:steara@hafro.is) and **Haraldur Sigurdsson**, Professor Emeritus, Graduate School of Oceanography, University of Rhode Island, USA, and Eldfjallasafn (Volcano Museum) Stykkishólmur, Iceland [vulkan@simnet.is](mailto:vulkan@simnet.is).

## Abstract

During a visit of the M/Y Octopus to the north coast of Iceland, we propose to view the hydrothermal chimneys located in the region of “Ystuvíkurstrýtur” and “Arnarnesstrýtur” in Eyjafjörður. This is a request for permission to approach the chimneys with a remotely operated vehicle (ROV), and to photograph and video image the structures. No sampling will be conducted, and the structures will not be touched or affected in any way during the viewing. The visit of the M/Y Octopus, equipped with a state-of-the-art ROV with excellent video camera equipment, presents a valuable opportunity to document further the features of the unique submarine hydrothermal chimneys in Eyjafjörður.

## Introduction

In 1997, three geothermal silicate chimney structures rising 25, 33 and 45m above the sea floor were found in Eyjafjörður (65°49.73'N and 18°06.69'W), at 65m depth. These have been termed as the “Ystuvíkurstrýturnar”. The hydrothermal activity is confined to the highest chimney and temperature of fluids emerging is about 72°C. The chimneys increase their size by precipitation of the minerals dissolved in the geothermal water when it mixes with seawater (Marteinsson et al. 2001, Bogason et al. 2004) although the biological activity during precipitation could be of importance (Gerptner et al. 2002).

In 2004, additional geothermal chimney structures (termed as “Arnarnesstrýtur”) were found in Eyjafjörður (centred at 65°52.36'N and 18°13.15'W) during multibeam mapping by the coastguard research vessel Baldur (Fig. 1). These attain up to 10 m height and are located at shallower waters (25 – 45 m). The temperature of the emerging water is 79°C. Observation by divers revealed that the area covered by hydrothermal chimneys was much larger than for the “Ystuvíkurstrýtur”, or about 400x1000 m and the diversity in the size and shape of the cones is much greater (Bogason pers com, <http://staff.unak.is/hreidar/Vistey/Stryturnar.html>).

The “Ystuvíkurstrýtur” and “Arnarnesstrýtur” hydrothermal vents were protected in 2001 and 2007 respectively as a natural monument (Bogason et al. 2004, <http://www.umhverfissraduneyti.is/frettir/nr/1051>). All fishing activities (includes towed gears, long-line and gillnets) and deployment of an anchor are prohibited within the perimeter of the protected area. It is permitted to dive down to the hydrothermal vents to look at the vents as long as these are not disturbed.

The research on the biology of these vents has been confined to study hydrothermal bacteria in “Ystuvíkurstrýturnar” vents only (Marteinsson et al., 2001). Over the past years, the diver Erlendur Bogason has taken a large number of photos of the vents, that can be seen on <http://www.strytan.is/>. The overall impression by Erlendur and other divers is that the invertebrate fauna around the “Arnarnesstrýtur” is more diverse than around the “Ystuvíkurstrýtur”. The fauna there consists of sessile organisms such as sea anemones, bryozoans, sponges and mussels (E. Bogason, pers. comm, <http://staff.unak.is/hreidar/Vistey/Stryturnar.html>).

## Biology

The fauna and habitats of “Arnarnesstrýtur” and “Ystuvíkurstýtur” hydrothermal areas and adjacent areas will be described. Benthic assemblages in the different parts of the geothermal chimneys and inside and outside the hydrothermal vent areas will be compared. Association between geothermal and fish will be assessed.

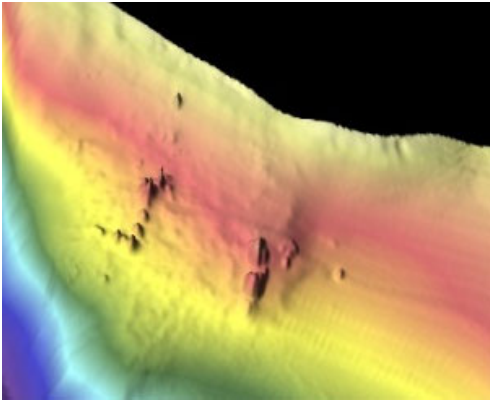


Fig. 1. Multibeam image, showing the “Arnarnesstrýtur” hydrothermal vents in Eyjafjörður.

## Geology

The chimneys can grow through inorganic precipitation of minerals, by biological activity related to sessile organisms, or by accumulation of particulate matter transported upward and to the surface by the hydrothermal fluids. We will make visual observations on the hydrothermal fluids emerging from the chimneys, in order to evaluate the potential role of these processes.

## ROV and Research plan

We will use a remotely operated underwater vehicle (ROV) for this research, to be deployed from the vessel M/V Octopus. This is the Octo ROV unmanned vehicle, with a depth rating of 3 km, equipped with a 1080 HD video camera, with direct live video feed to the surface vessel. It is further equipped with two manipulator arms and a sampling tube, CTD sensor and depth sensor, as well as hydrophone and compass and multiple lights. The visit to the hydrothermal chimneys in Eyjafjörður will be coordinated by Erlendur Bogason, who will be on board Octopus during the surveying of the hydrothermal chimneys and will participate in planning the ROV dives. He is the person most familiar with the area. During surveying, the video footage and underwater photographs that will be obtained will be analyzed by the staff at the Marine Research Institute of Iceland with respect to the biological data under supervision of Stefán Áki Ragnarsson and by Haraldur Sigurðsson at Eldfjallasafn, the Volcano Museum, with respect to the geological data. No samples will be collected and we will not use the 10-person manned submersible Pagoo as due to its large size, there is a risk of imposing damage to these sensitive habitats. Dives will be made to video the structures from the bottom to the top and similarly in surrounding areas for comparison. Copies of all data, images and video material collected during the dives will be made available to the Icelandic authorities at the Icelandic Institute of Natural History and the Marine Research Institute, to facilitate further research by other Icelandic scientists on this material.

### References

- Marteinsson, Jakob K. Kristjánsson, Hrefna Kristmannsdóttir, M. Dahlkvist, Kristján Sæmundsson, M. Hannington,, Sólveig K. Pétursdóttir, A. Geptner og P. Stoffers, P. 2001 Discovery and description of giant submarine smectite cones on the seafloor in Eyjafjörður, northern Iceland, and a novel thermal microbial habitat. *Applied and Environmental Microbiology* 67: 827-833.
- Bogason E, Viggósson G, Sverrisdóttir G, Haraldsson H, Valtýsson H (2004) Strýturnar í Eyjafirði, Verndaráætlun 2004. UST-2004: 17
- Geptner, A., Hrefna Kristmannsdóttir, Jakob Kristjánsson and V. Marteinson 2002. Biogenic Saponite from an Active Submarine Hot Spring, Iceland. *Clay and clay minerals* 50 (2): 174-185

<http://www.strytan.is>

<http://www.umhverfisraduneyti.is/frettir/nr/1051>

<http://staff.unak.is/hreidar/Vistey/Stryturnar.html>