Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03176, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03176
EGU General Assembly 2008

Sounds of a deep submarine explosive eruption at the ultraslow-spreading Gakkel ridge, Arctic Ocean

V. Schlindwein (1), C. Riedel (1) and R. Sohn (2) for the AGAVE team

(1) Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany, (2) Woods Hole Oceanographic Institution, Massachusetts, USA (Vera.Schlindwein@awi.de)

The Gakkel ridge is the slowest spreading end-member of the global system of mid-ocean ridges (6-14 mm/y full spreading rate). Heat loss by conductive cooling is thought to drastically decrease the production of magma at spreading rates below 20 mm/y giving rise to a distinctly different mode of crustal accretion at ultraslow spreading rates with magmatism focussed in widely spaced volcanic complexes. The 85°E volcanic complex is the site of a recent spectacular eruption cycle which started in 1999 with the largest ever recorded mid-ocean ridge earthquake swarm lasting for 8 months.

In 2001, during a deployment of a seismic array on an ice floe about 30 km north of the rift valley, we recorded a swarm of 200 seismoacoustic explosive signals originating at the seafloor in the rift valley at the 85°E volcanic site. We interpreted the signals as the sounds of an ongoing eruption. The discovery of extensive deposits of pyroclastic material including bubble wall fragments (limu o' Pele) during the Arctic Gakkel Vents Expedition (AGAVE) in 2007 now provides compelling evidence for deep submarine explosive activity. A newly detected series of small craters seems to be the source site of explosive eruptions which might cause the observed sound signals.

We reinvestigated the sound signals which are to date the only in-situ sound records of a deep (˜4000 m) submarine explosive eruption and therefore provide important insights into the eruption style and dynamics. The main eruptive phase lasted for about a day with similar sized explosions occurring on average every 4 minutes followed by a phase of alternating vigorous and small explosions at intervals of about 6 minutes.

The signals consist of a short (<1 s, 15-35 Hz signal frequency) waveform with compressive onset and its multiply reflected echoes. As the seismic array drifts with the sea ice towards the east, the waveforms of the sound signals change showing a lack of the direct phase as a result of interfering seafloor topography. Assuming the craters as potential source sites we use waveform modelling to match the observed waveform changes and thereby try to identify the active eruption site.