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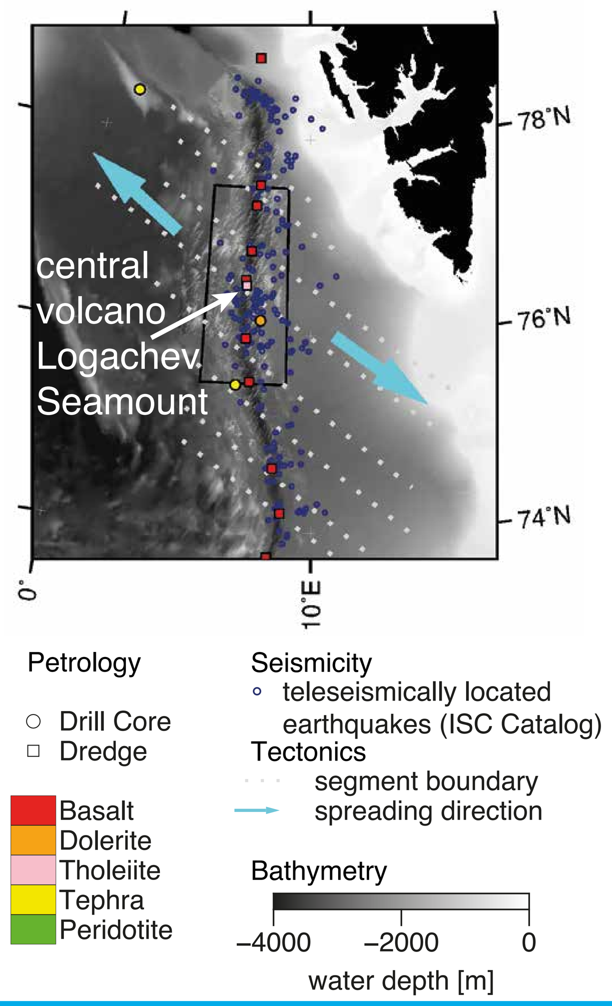
Earthquake Distribution Along an Entire Ridge Segment of the Ultraslow Spreading Knipovich Ridge

1. Background

The ultraslow spreading Knipovich Ridge is part of the Arctic Ridge System. With a full spreading velocity of 14-17 mm/yr it represents **one of the slowest and most obliquely spreading ridges**. The ridge is also highly sedimented and teleseismic activity is distributed asymmetrically. **Magmatic centres**, mostly represented by prominent **seamounts** (e.g. the Logachev Seamount) are **connected by deep basins**. Since transform faults are absent, those **amagmatic segments act as transfer regions**, where tectonism dominates the spreading.

scientific questions:
- How do the **transfer regions** between segments work?
- Where is the **spreading axis** located exactly?
- How does a **central volcano** function?

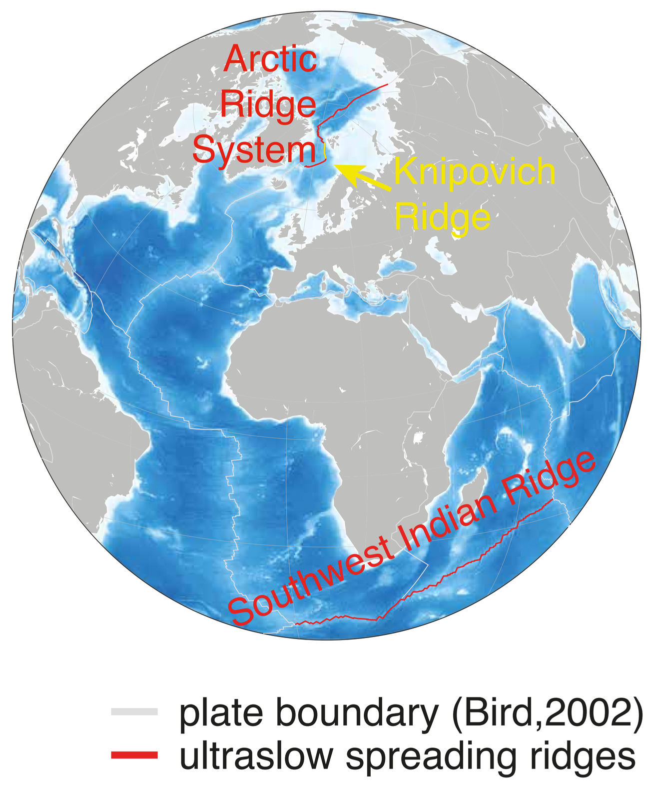


2. Methods

30 ocean bottom seismometers continuously recorded seismicity along 160 km of the Knipovich Ridge for on average 11.5 months during the years 2016-2017.

The study area covers several non-transform discontinuities and a very prominent central volcano, the Logachev Seamount (Vogt et al., 1998).

We used the detection algorithm Lassie[a] and pick refining algorithm PSPicker[b] followed by review of an analyst. The velocity model was defined with PyVelest[c] using around 1000 well defined events. The events are then located with Hyposat[d]. Here, we present the first results of this project.



3. Results

4. Interpretation

earthquake cluster close to volcanic features occuring in September and October 2016

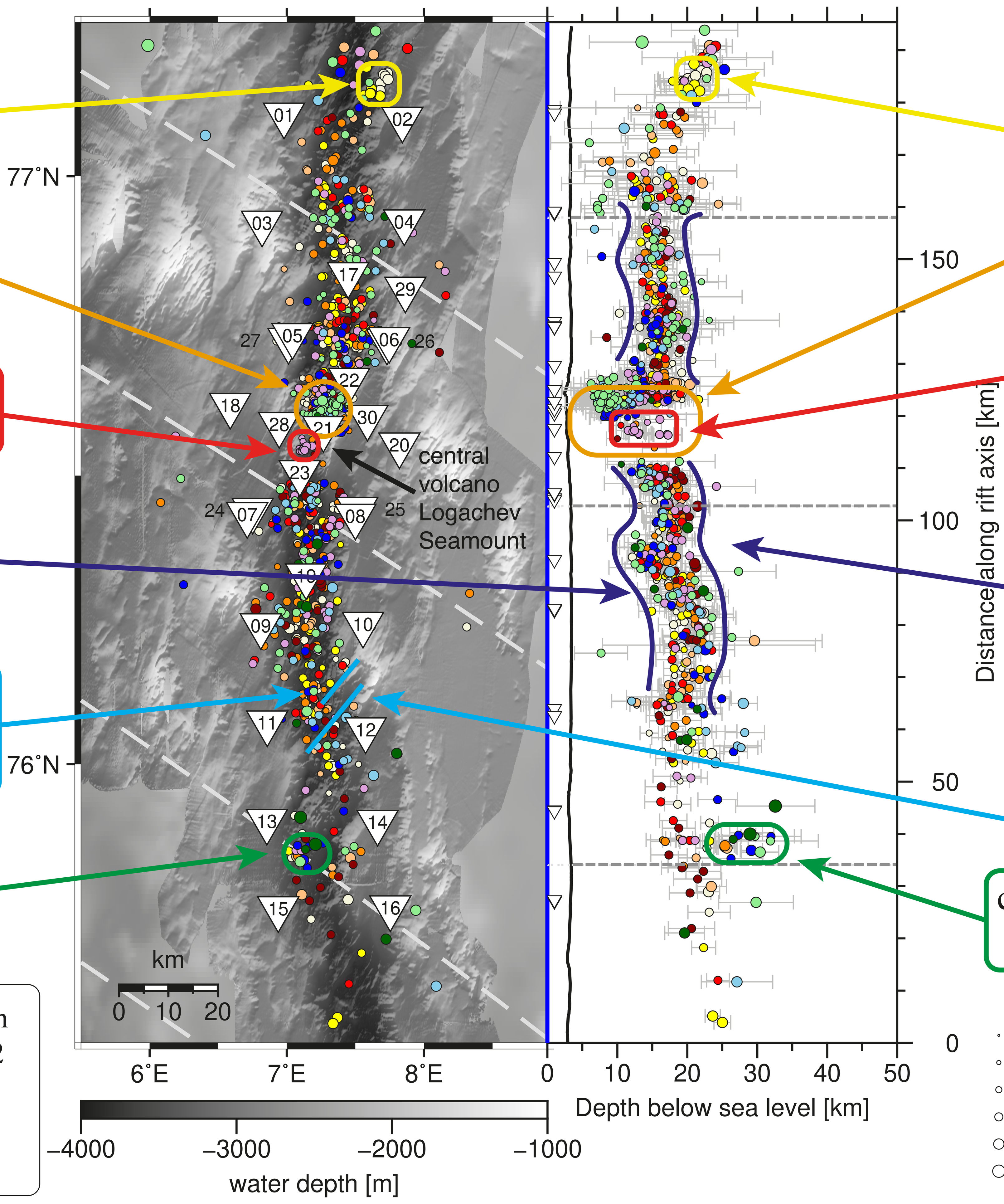
shallow depths of earthquakes and prominent gap in seismicity

cluster of earthquakes in seismically quiet area occuring in March

undulating focal depths along the ridge axis down to depths of 15-25 km below the seafloor

earthquakes follow bathymetric features that strike nearly perpendicular to the spreading direction

higher depths down to 30 km bsf, higher magnitudes of deeper events



event cluster close by volcanic edifice, possibly represents magmatic activity

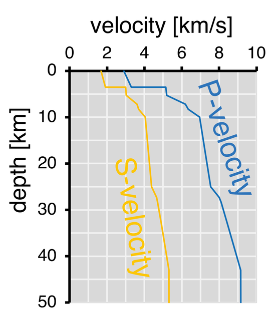
higher thermal gradient, where melt is focussed to and can ascend

event cluster (swarm?) could represent a dyke intrusion

undulating seismicity band due to changing characterisitcs of the ridge:
upper boundary: transformation from possibly serpentinised peridotite to brittle deforming rocks
lower boundary: follows an isotherm, warmer material reacts ductile

areas with higher stresses and faults

coinciding with segment boundary, activity could represent detachment fault



1D-velocity model for location
- P- to S- velocity ratio of 1.72
- Moho depth at 3.5 km
- in agreement with velocities from Jokat et al. (2012)

5. Conclusion and Outlook

The varied distribution of seismicity along the studied section of the Knipovich Ridge is the result of changing characteristics along the ridge axis.

Further plans to analyse seismicity and study spreading processes:
- fault plane solutions to analyse the stress field
- analysing clusters to identify swarm activity as magmatic or tectonic
- other location algorithms to test robustness of the solutions

- The transfer regions at segment boundaries show very different seismic activity and might have very different characteristics. One boundary is possibly represented by a detachment fault, others show varying levels of activity and stresses.

- The exact location of the spreading axis seems to follow the rift valley, but spreading stresses are also hosted by faults perpendicular to the spreading direction.

- The central volcano is fed with hot material by melt focussing along the ridge axis. The magma is also able to ascent to the surface via intrusions.

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