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Sediment features at the grounding zone and beneath Ekström Ice Shelf, East Antarctica, imaged using on-ice vibroseis

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1. Introduction

An extensive grid of seismic reflection data collected on Ekström Ice Shelf (***Fig. 1***), East Antarctica, shows glacial flow and retreat features, which can be used to constrain palaeo-ice flow in the region.

It is common to map geomorphological sediment features in front of ice shelves and beneath modern-day ice streams using geophysical methods, but there is much less data documenting landforms beneath ice shelves. The data presented here were collected as part of a pre-site survey for envisaged sub-ice shelf geological drilling campaign (*see poster by G. Kuhn*). A wide variety of geomorphological features are clearly imaged, which has allowed us to map sub-ice shelf bathymetry. Furthurmore, these features can help us determine paleo-ice extent, flow and retreat. Eventually this data will feed in to models used to reconstruct past ice flow.

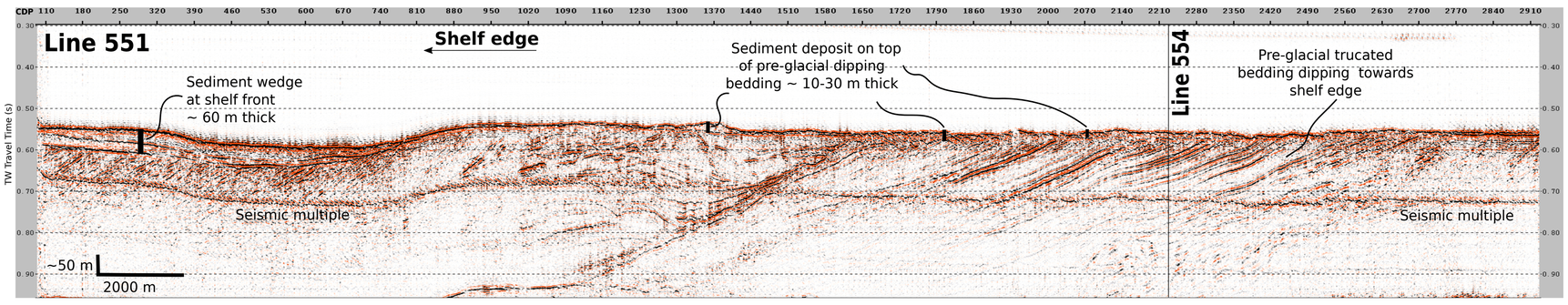
All data shown here is unmigrated stacked data

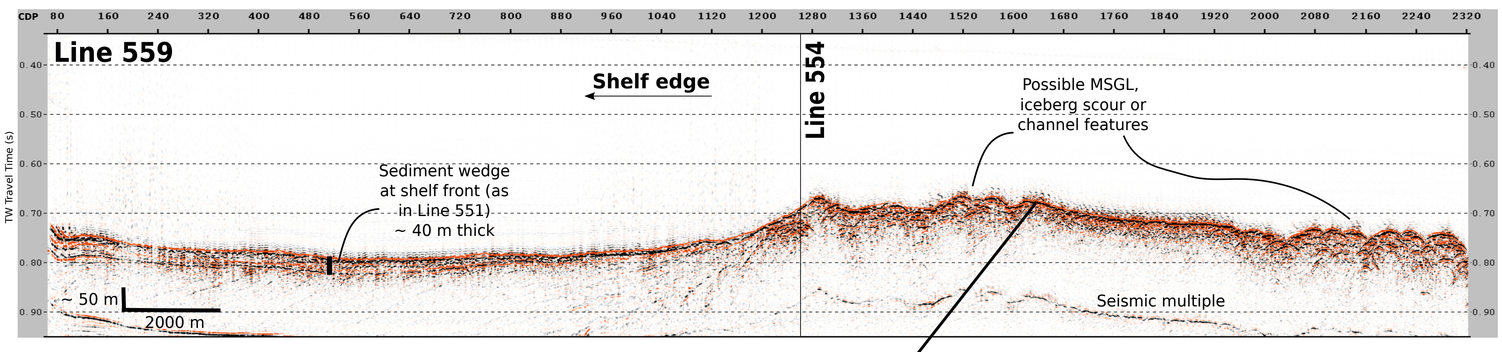
2. Data

Data were acquired between 2010 and 2017 using an on-ice vibroseis source combined with a snow streamer - a fast and effective method of high volume data collection. Here we focus on a grid of data (~280 km) on the floating ice shelf from the 2016/17 field season (***Fig. 1***).

- **Seismic source:** 9 tonne EnviroVibe vibroseis truck, mounted on a polysled. Sweep 10-220 Hz. Shot point interval for all data shown here is 125 m
- **Receivers:** All data was acquired using a 1500 m long AWI snow-streamer (*Eisen et al., 2015*) containing 60 channels at 25 m spacings. Source-receiver offset was 52.5 m
- **Recording parameters:** 15 s record with 1 ms sample interval

Flow Lines - 551, 559, 556





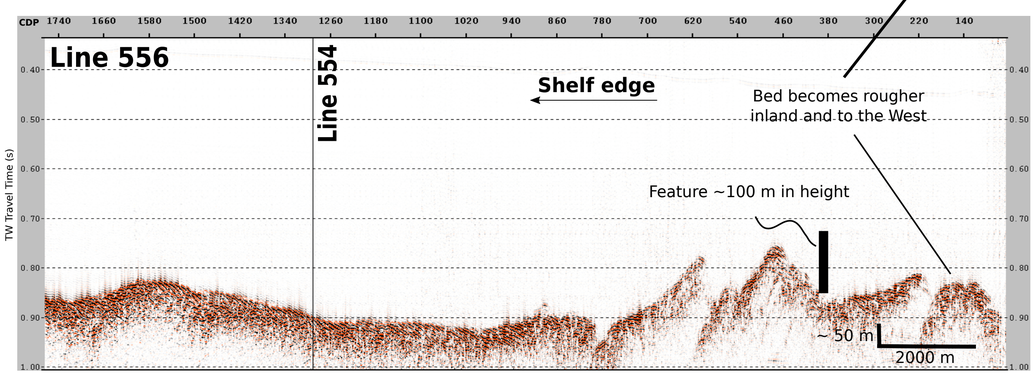
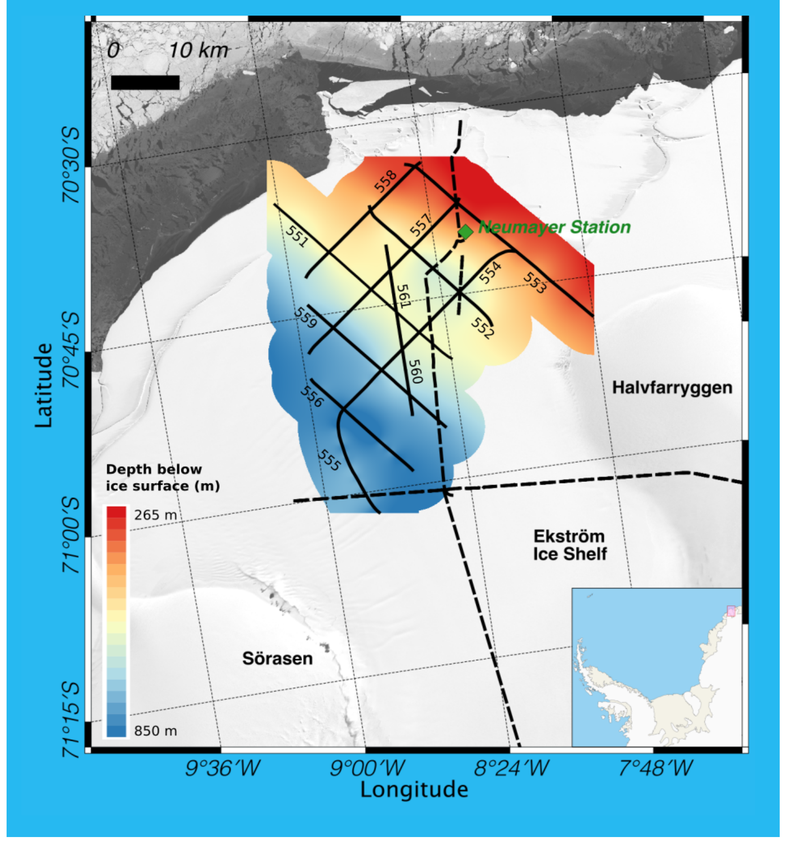
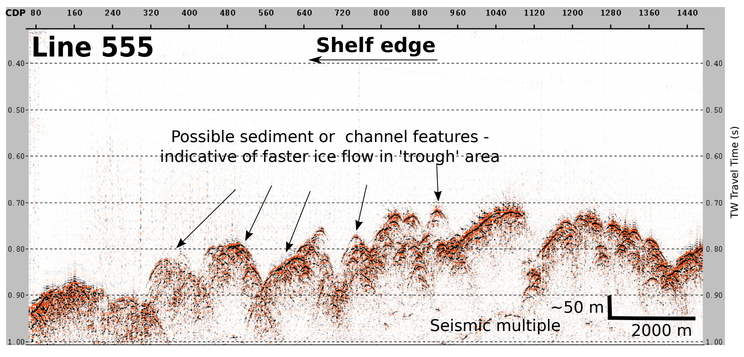


Figure 1: *Map of the survey area on Ekström ice shelf. The solid black lines indicate data acquired during the 2016/17 season. Dashed lines indicated older data from 2010, 2011 (Kristoffersen et al., 2014) and 2014 (Eisen et al., 2015) field campains. Neumayer Station is marked in green for reference. The coloured underlay is the sea-floor bathymetry, mapped from seismic data (shown). Inset: Location of study area in red box.*



Diagonal Line - 555



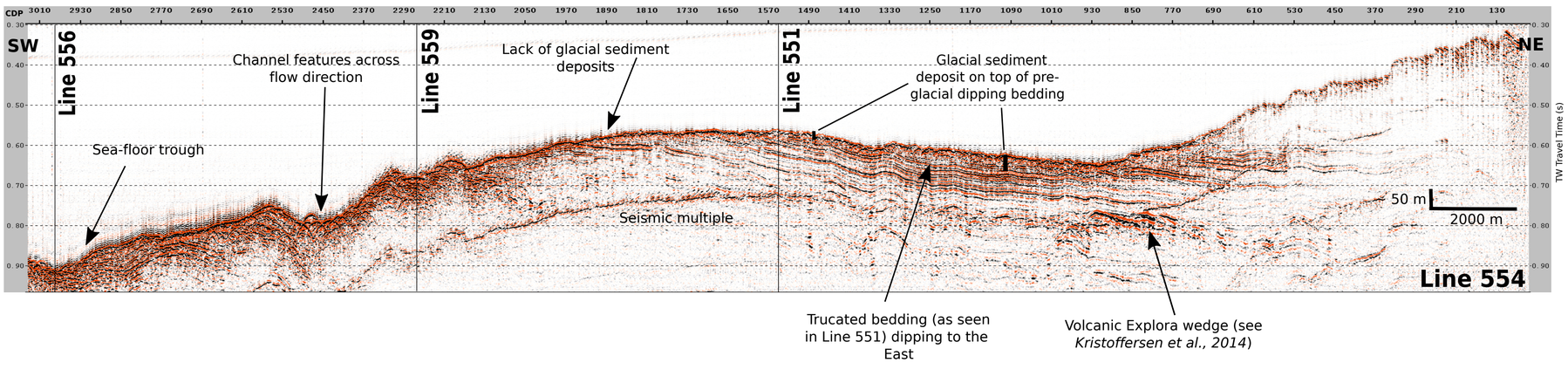
3. Summary of Bathymetric Features

Bathymetry of the sea floor has been determined from seismic reflection data by tracing the sea-floor reflection and converting this to depth (***Fig. 1***) using seismic interval velocities.

- The general trend is of bed deepening from East to West. Bed becomes rougher inland in to the West of survey area (***Lines 554, 556, 554, 555***)
- Basin containing sediment infill to the West of Neumayer (see ***Line 554*** and ***Fig. 1***)
- Possible sea-floor trough (***Lines 554. 555***) indicative of a palaeo-ice stream at the western edge of survey area, more data is needed to confirm this
- Glacial sediment deposits between 10-50 m thick on top of pre-glacial dipping sediments across the majority of the eastern part of the survey area (***Lines 551, 554***)
- Sediment wedge at ice front possible ice retreat feature (***Lines 551, 559***)

Further processing of this data and new data acquisiton this season (December 2017 to the West of the ice shelf will help build this picture.

Cross Flow Line - 554



References

Eisen, O., C. Hofstede, A. Diez, Y. Kristoffersen, A. Lambrecht, C. Mayer, R. Blenker, S. Hilmarsson (2015), On-ice vibroseis and snowstreamer system for geoscientific research, *Polar Science*, 9, 51-65, 10.1016/j.polar.2014.10.003

Kristoffersen, Y., C. Hofstede, A. Diez, R. Blenker, A. Lambrecht, C. Mayer, O.Eisen (2014), Reassembling Gondwana: A new high quality constraint from vibroseis exploration of the sub-ice shelf geology of the East Antarctic continental margin, *J. Geophys. Res Solid Earth*, 119, 9171-9182, doi:10.1002/2014JB011479

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