

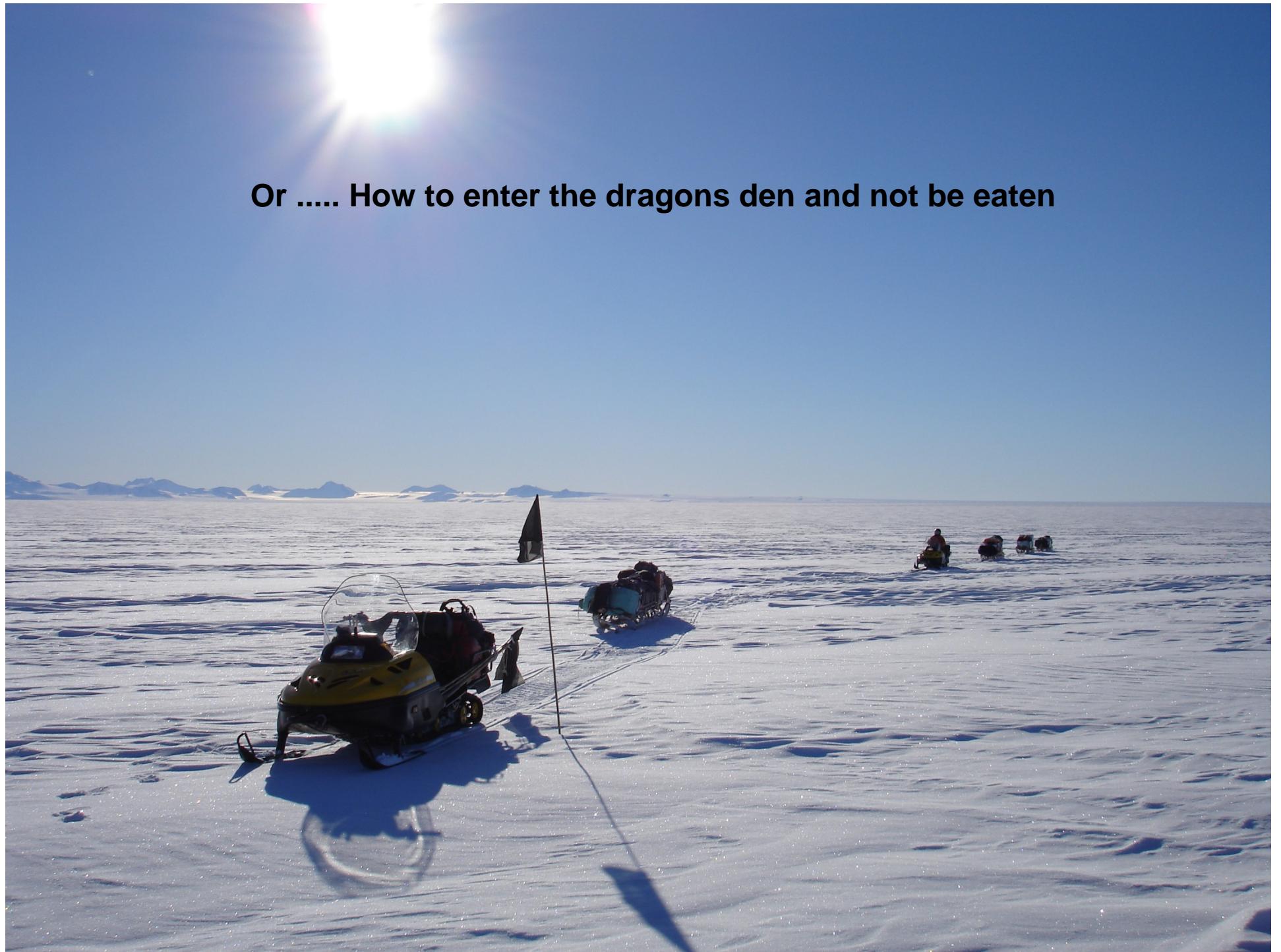
A photograph showing a team of snowmobiles and sleds traveling across a vast, sunlit ice field. In the foreground, a yellow and black snowmobile with a clear canopy is moving towards the left. Behind it, a sled is being pulled by a person. Further back, another sled is being pulled by a person, and a third sled is visible further to the right. The ice field is flat and extends to a distant range of mountains under a clear blue sky. The sun is bright in the upper left corner, creating a lens flare effect.

**Analysis of a high resolution, three-dimensional GPR dataset
from the margin of Rutford Ice Stream, West Antarctica.**

Edward King and David Vaughan

British Antarctic Survey, Cambridge, UK

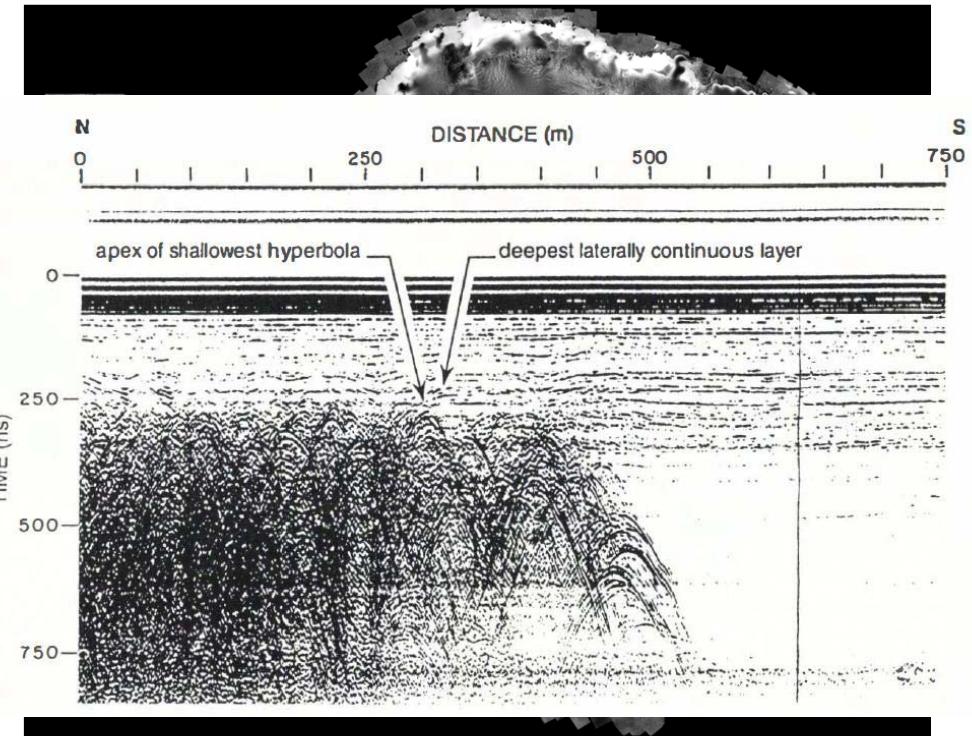
Or How to enter the dragons den and not be eaten



Ice stream margin crevasse zones:

History:

- Depth to the shallowest crevasses has been used to date the cessation of flow
- Underlying assumption is that crevasses in an active margin are open to the surface
- Interpretation of the depth to the crevasse was based on time to the crest of hyperbolae on the unmigrated radar profile

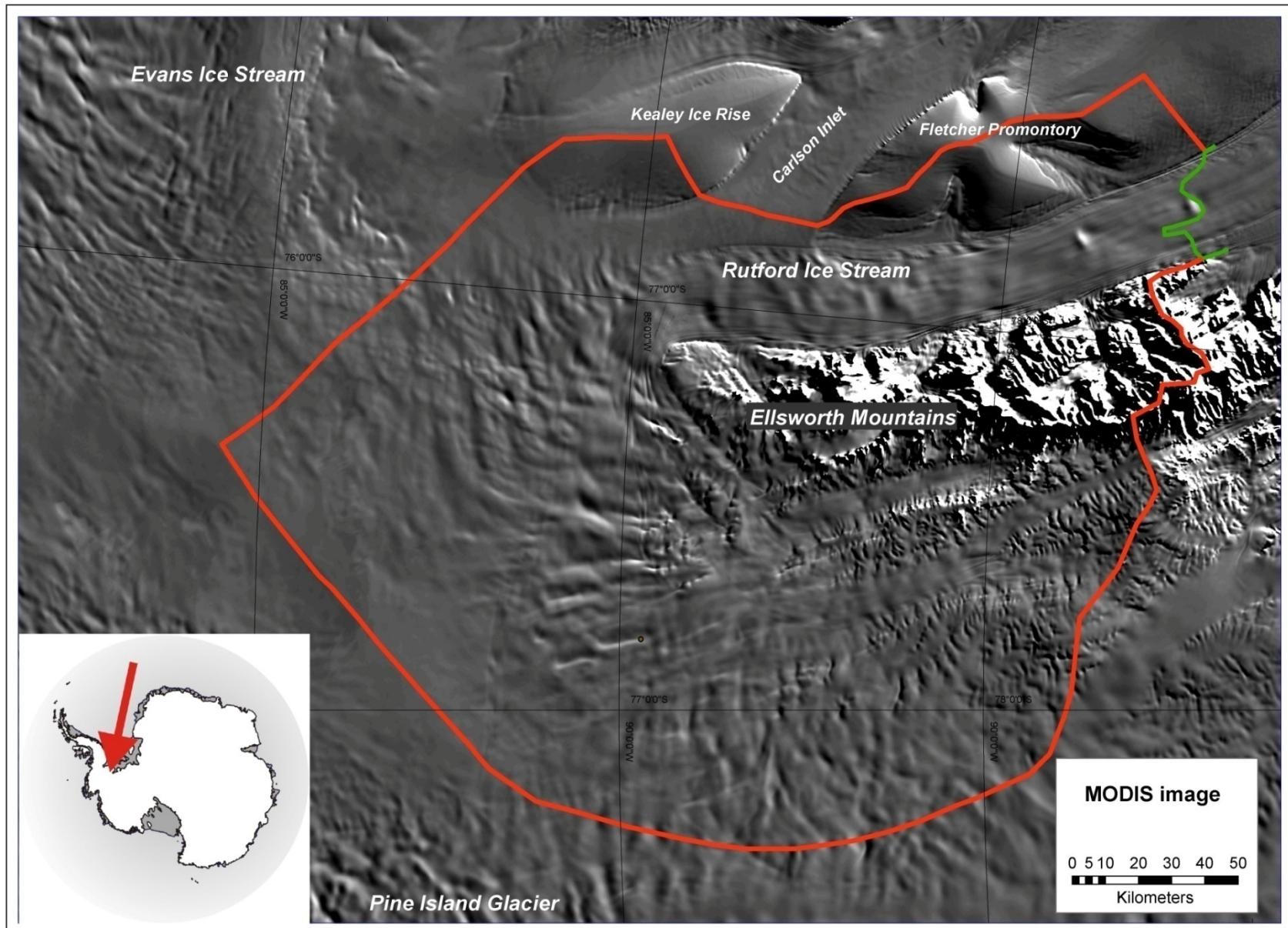


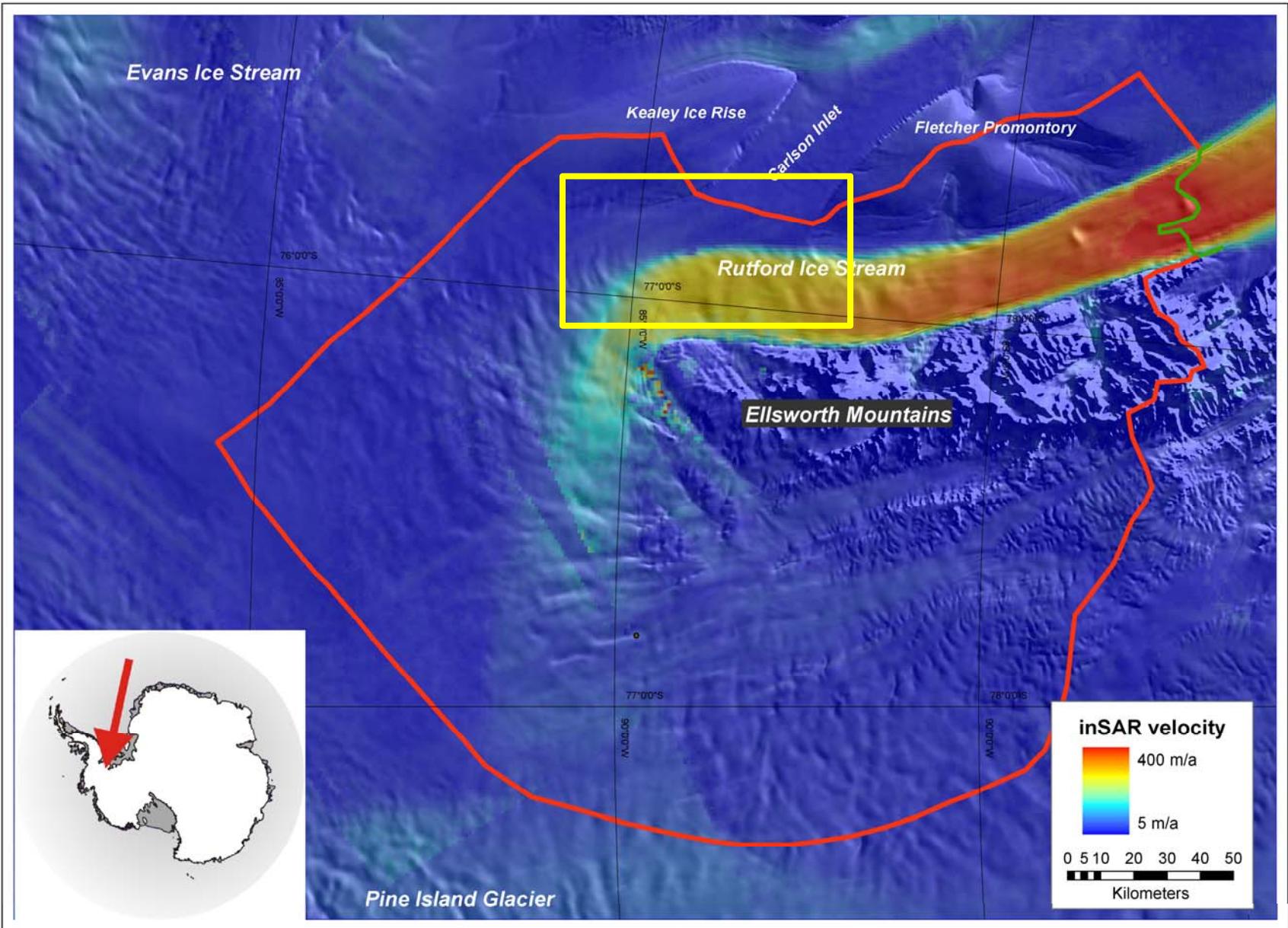
Retzlaff and Bentley (1993)

Objective and questions:

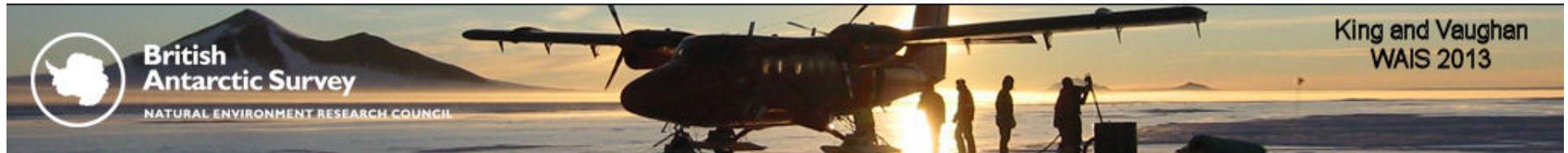
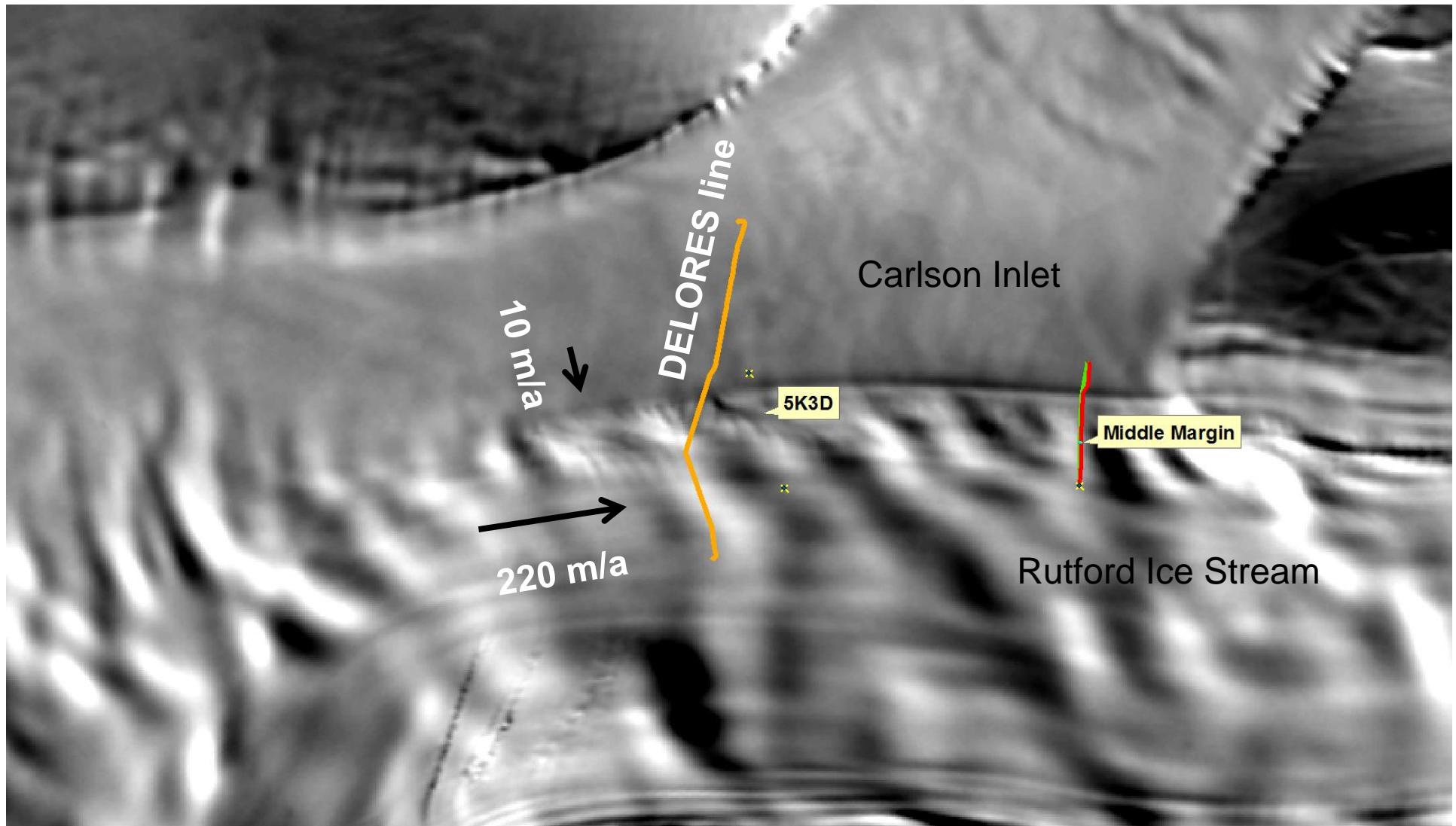
- Establish the radar signature of crevasses in a *currently-active* ice stream margin
 - Can a margin be active and have no open crevasses?
 - What gives rise to hyperbolae in GPR profiles over crevasses?
 - At what depth are the point diffractors that give rise to hyperbolae?
 - What is the orientation of crevasses within an active margin?



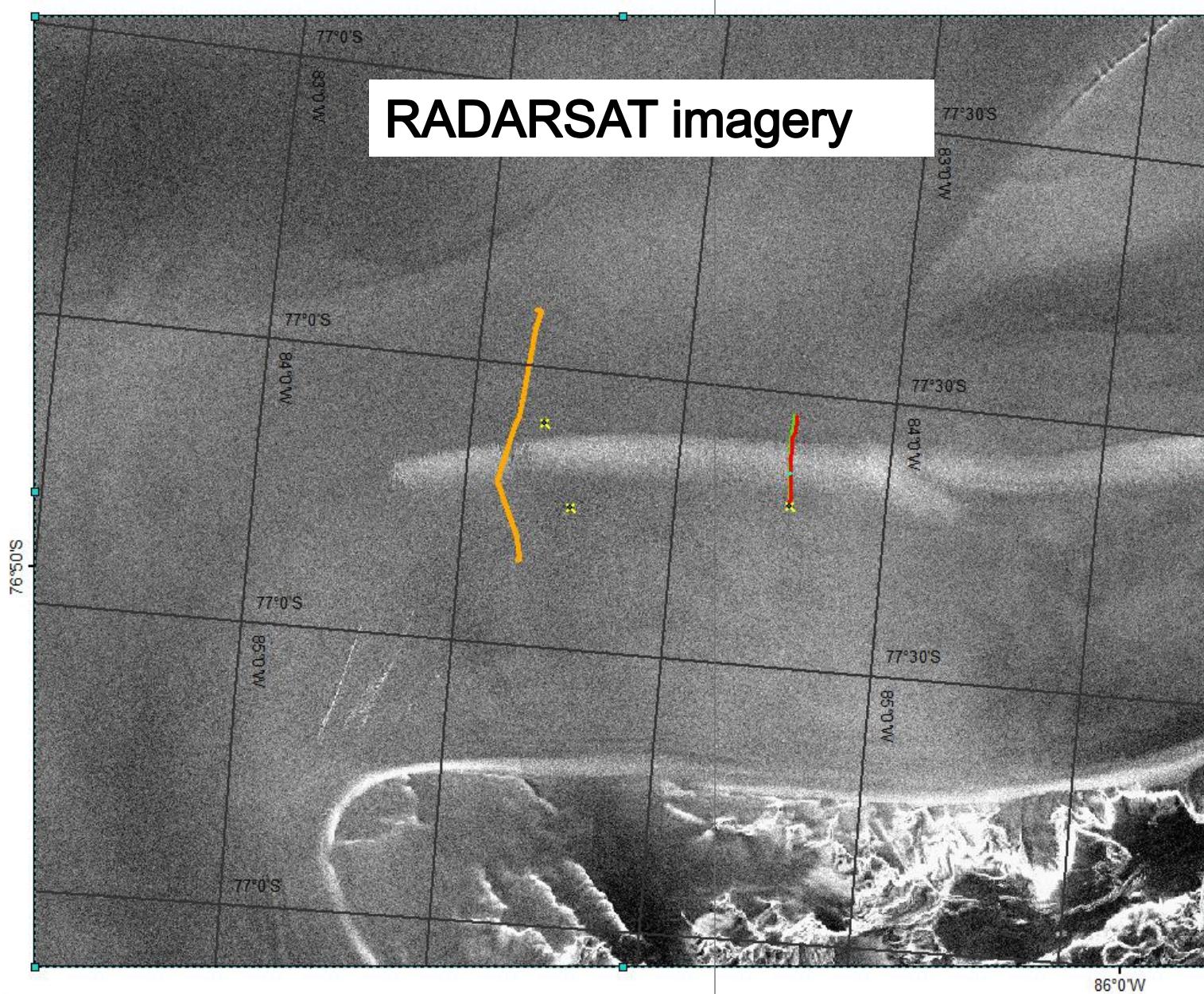




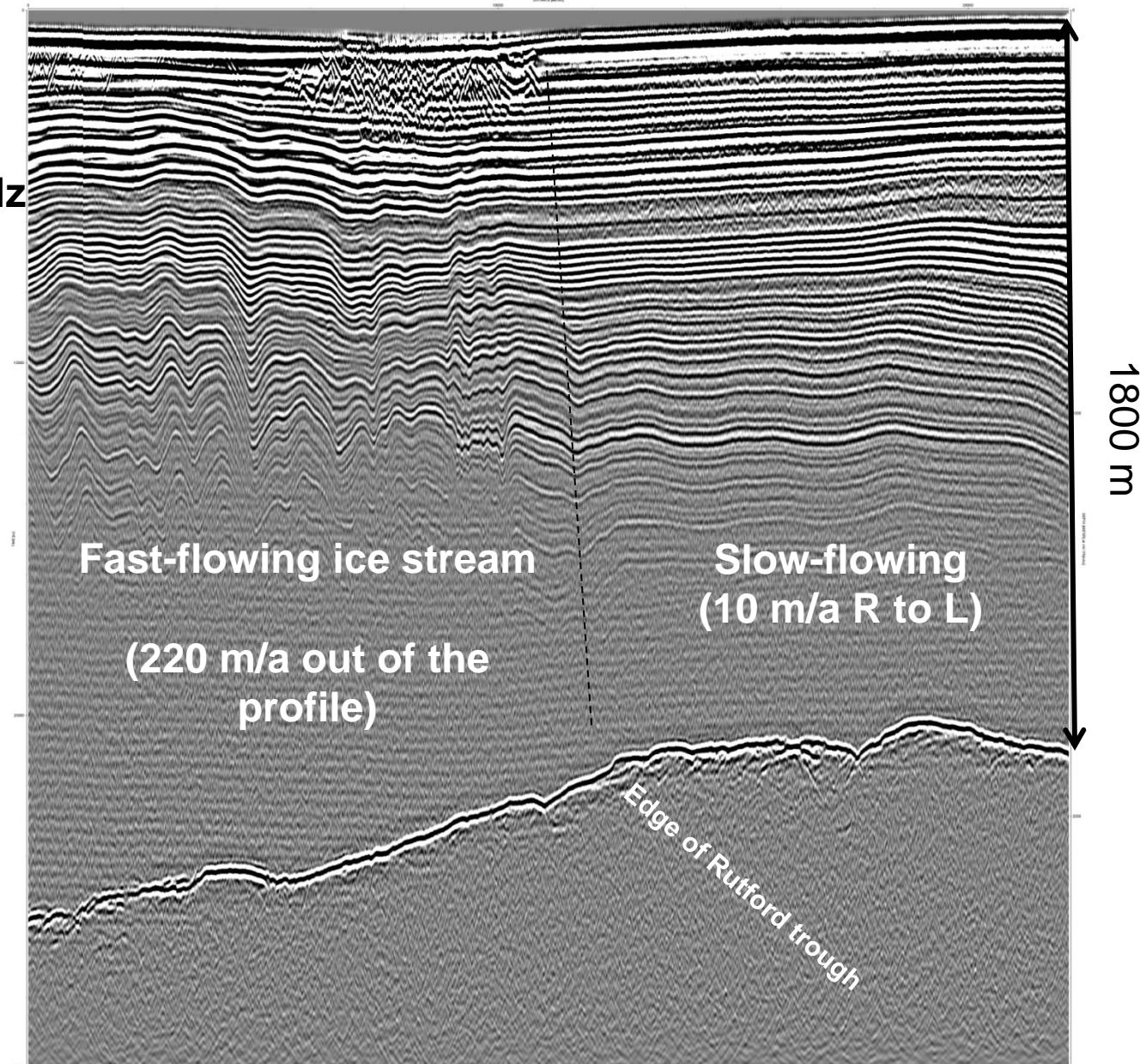
Ground radar locations on Rutford Margin – MODIS imagery

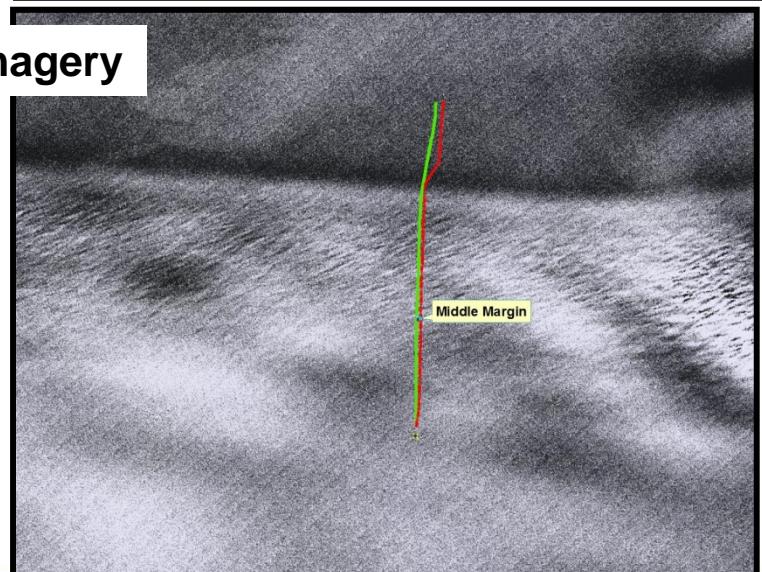
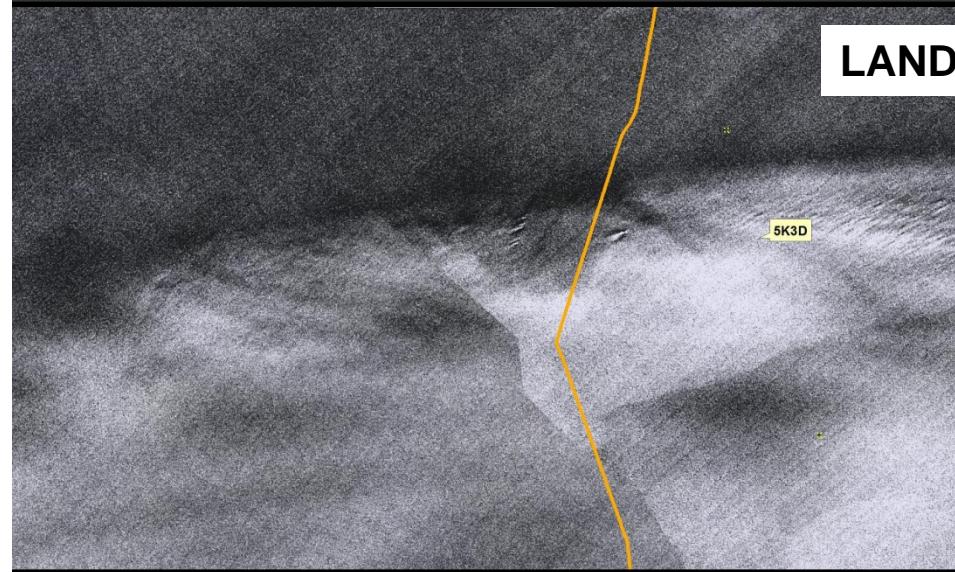
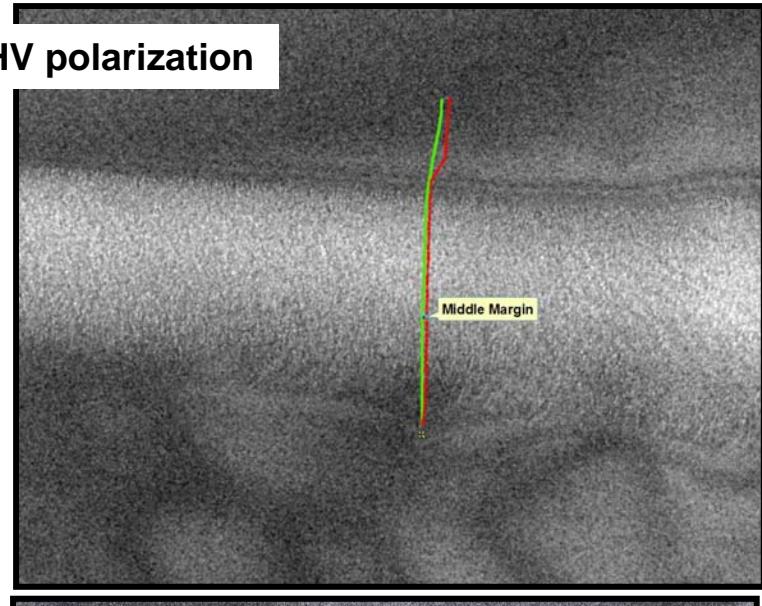
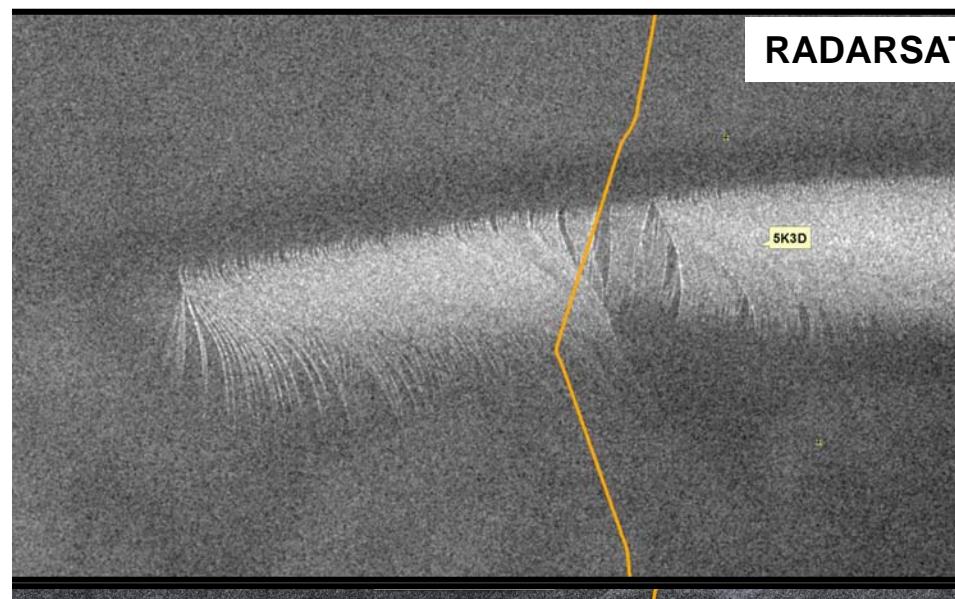


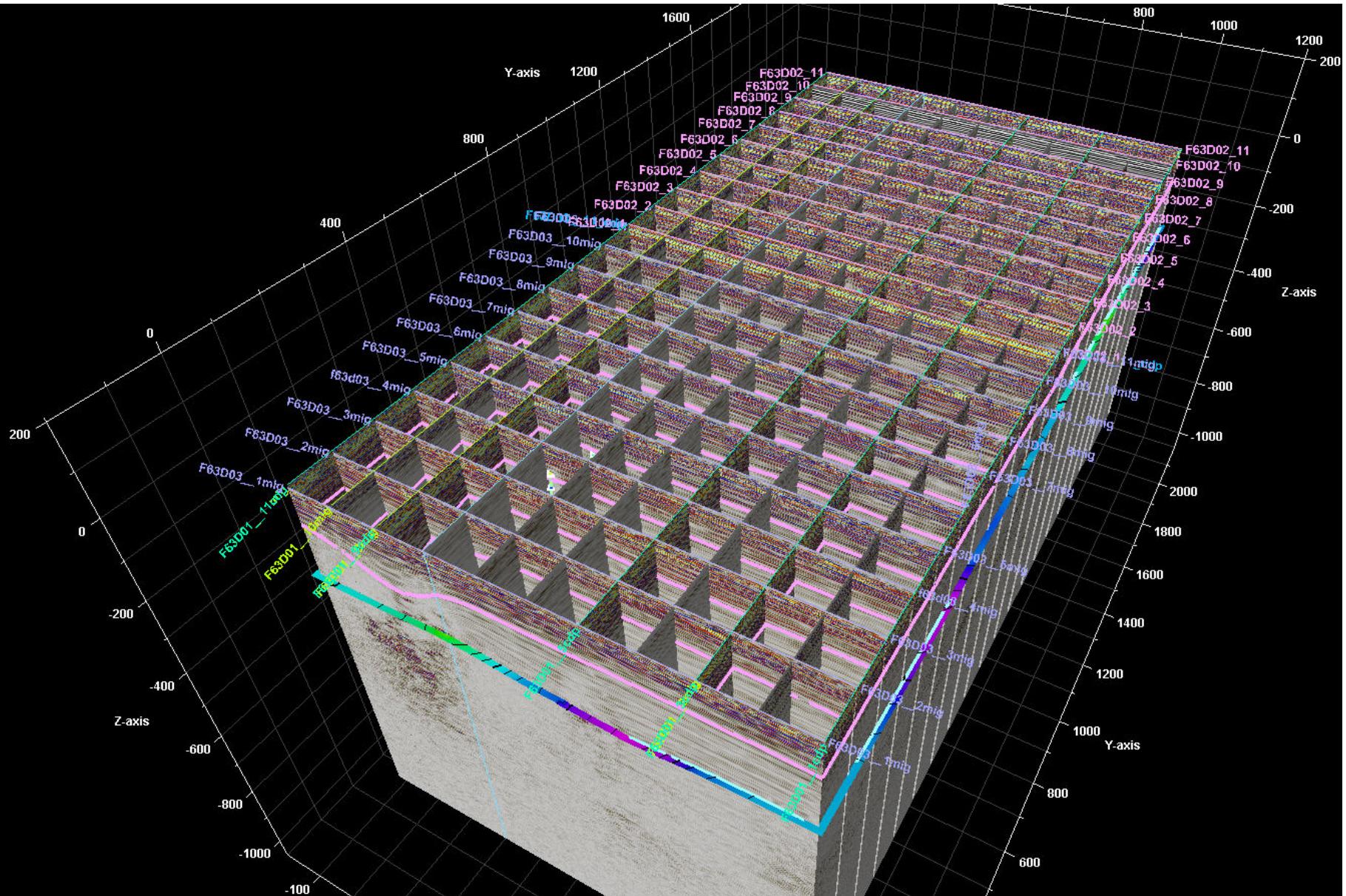
RADARSAT imagery



DELORES profile, 3 MHz





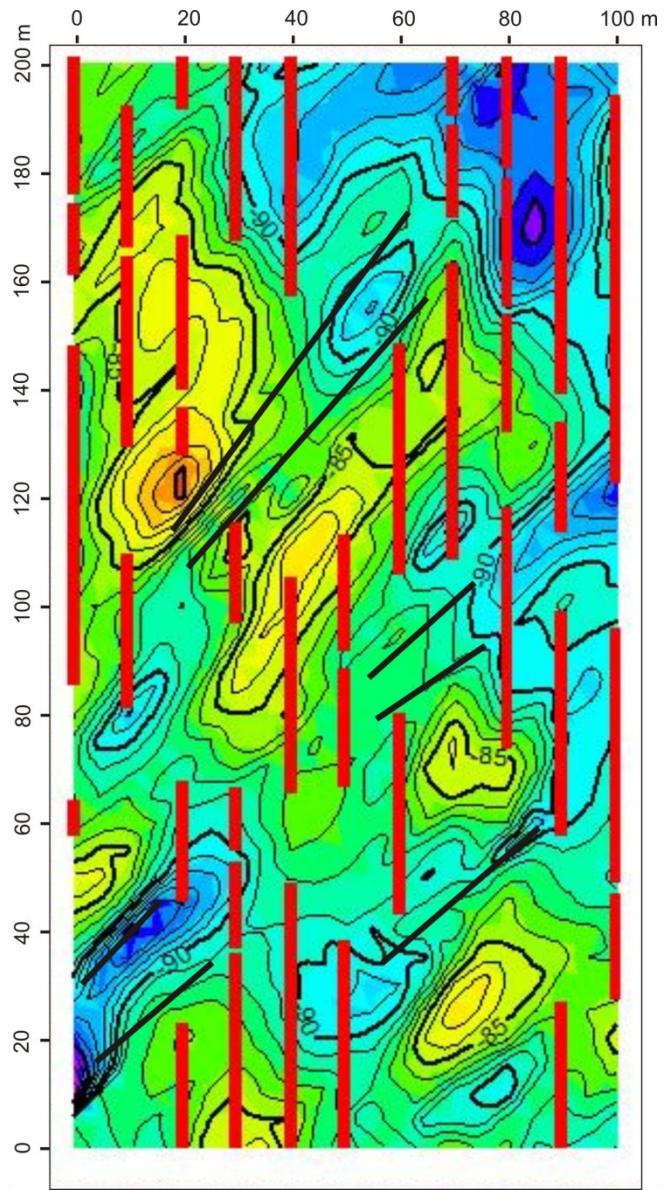
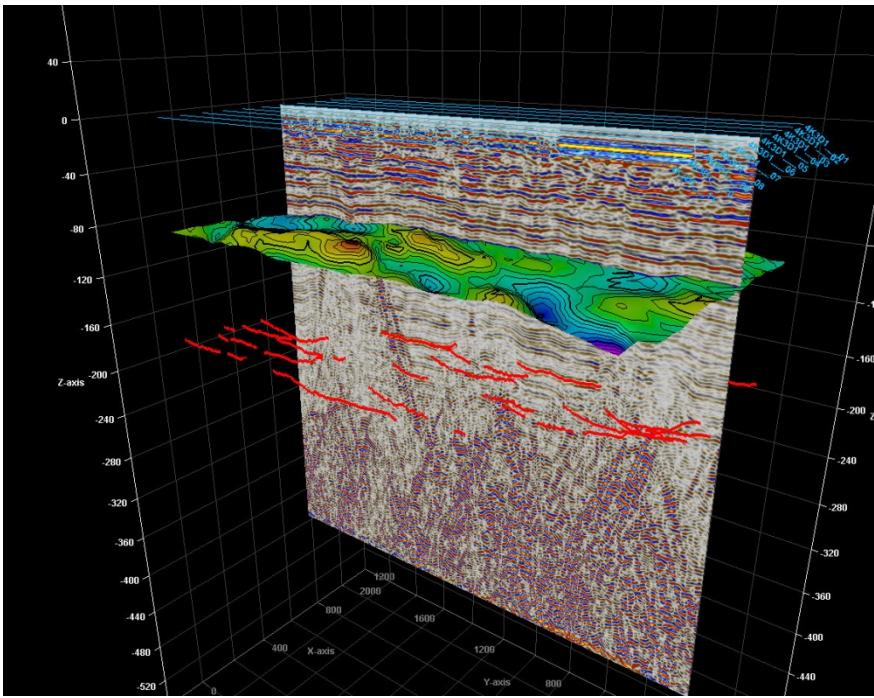


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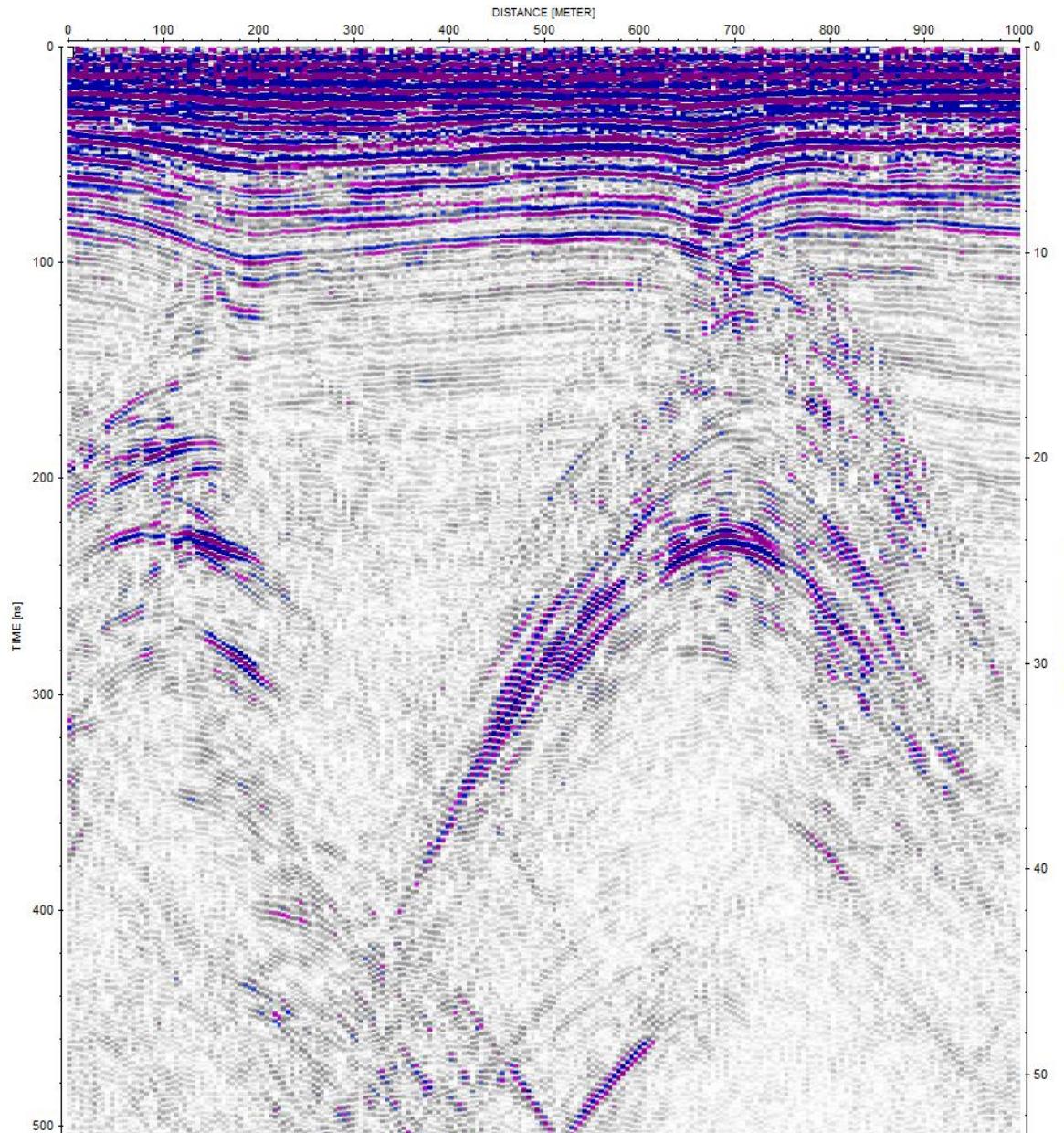
- Contoured map shows troughs above crevasses
- Red lines = reflectors traceable between crevasses
- Black lines = interpreted trends of crevasses



Data acquired with
Pulse Ekko GPR
Operating at 200 MHz.

Processed with
bandpass filter and
spherical divergence
compensation.

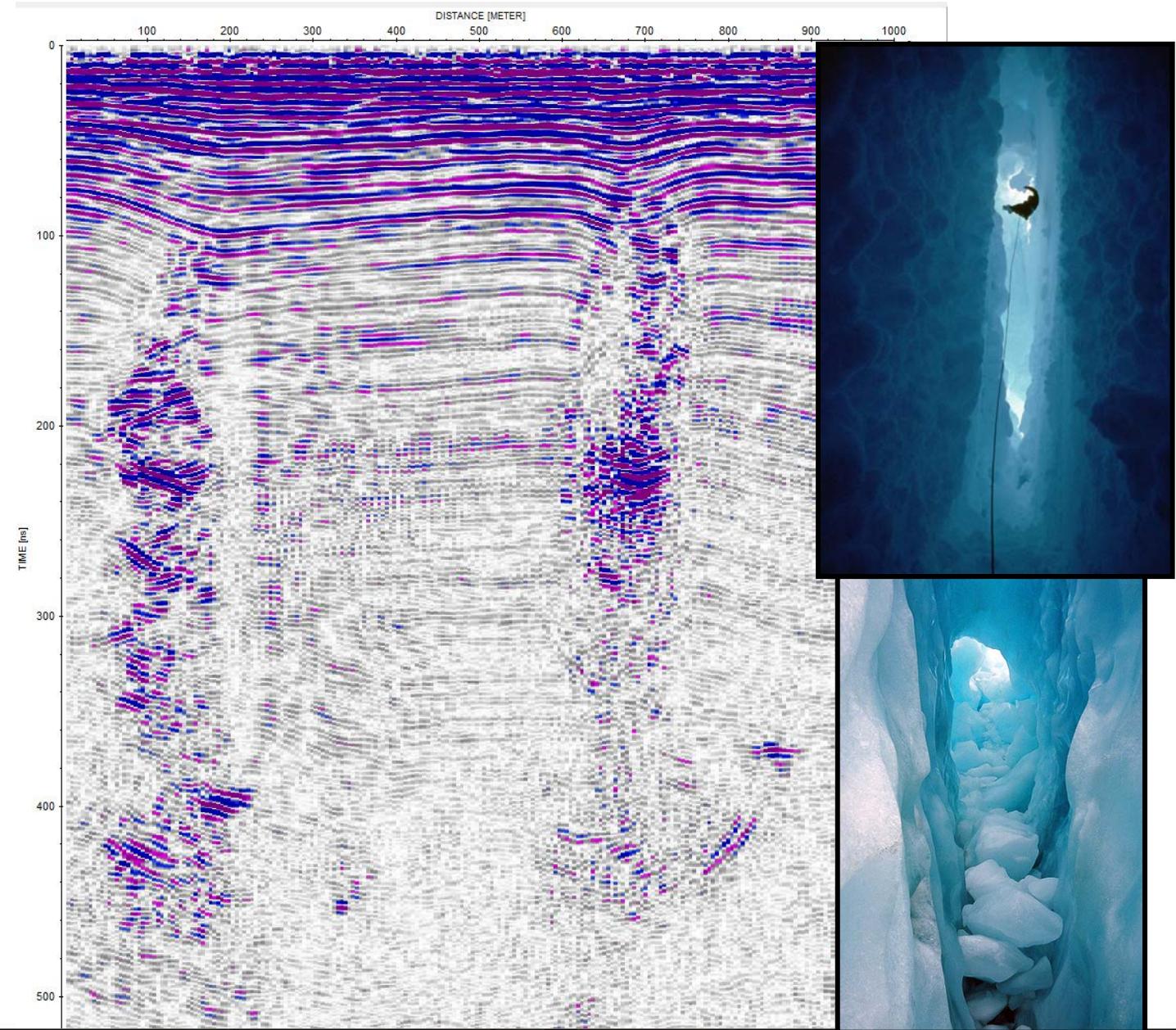
This profile unmigrated.



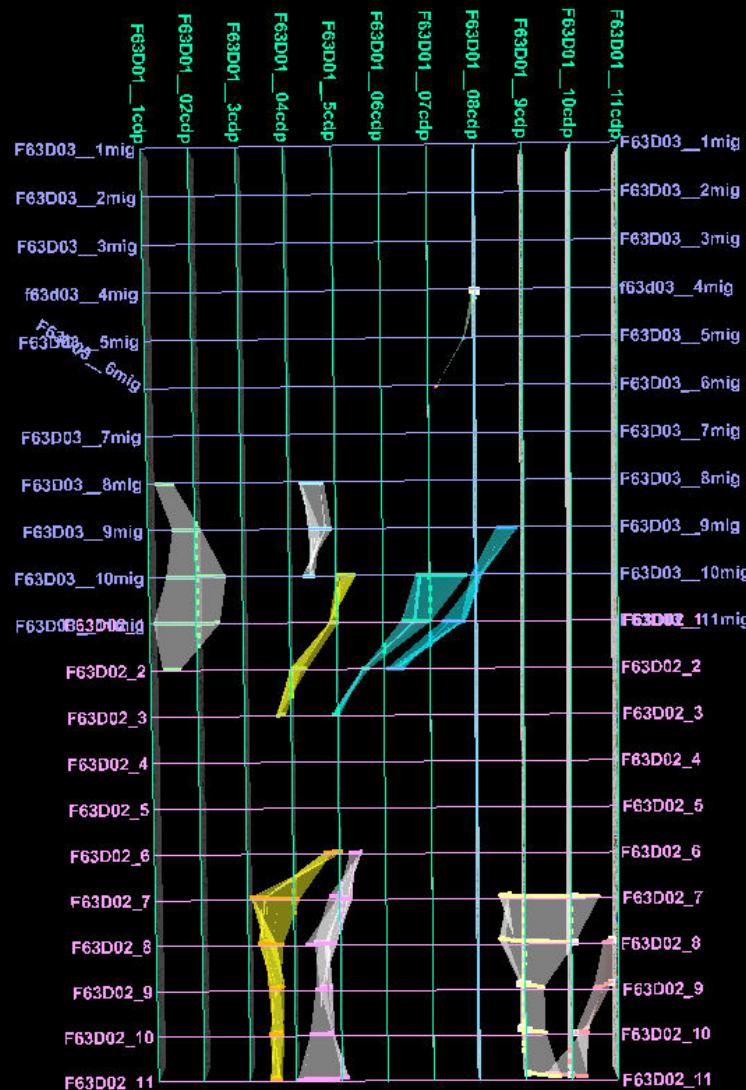
Data acquired with
Pulse Ekko GPR
Operating at 200 MHz.

Processed with
bandpass filter and
spherical divergence
compensation.

This profile migrated.



Middle Margin survey crevasse trends



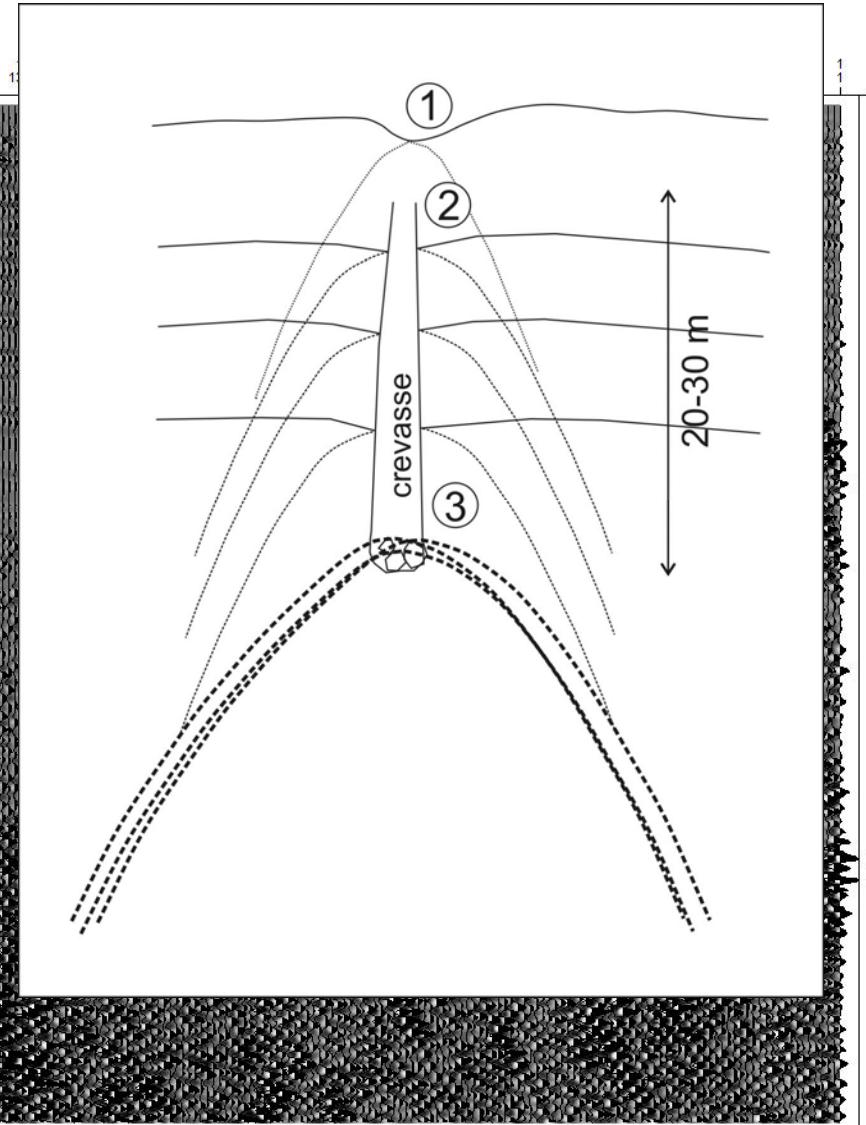
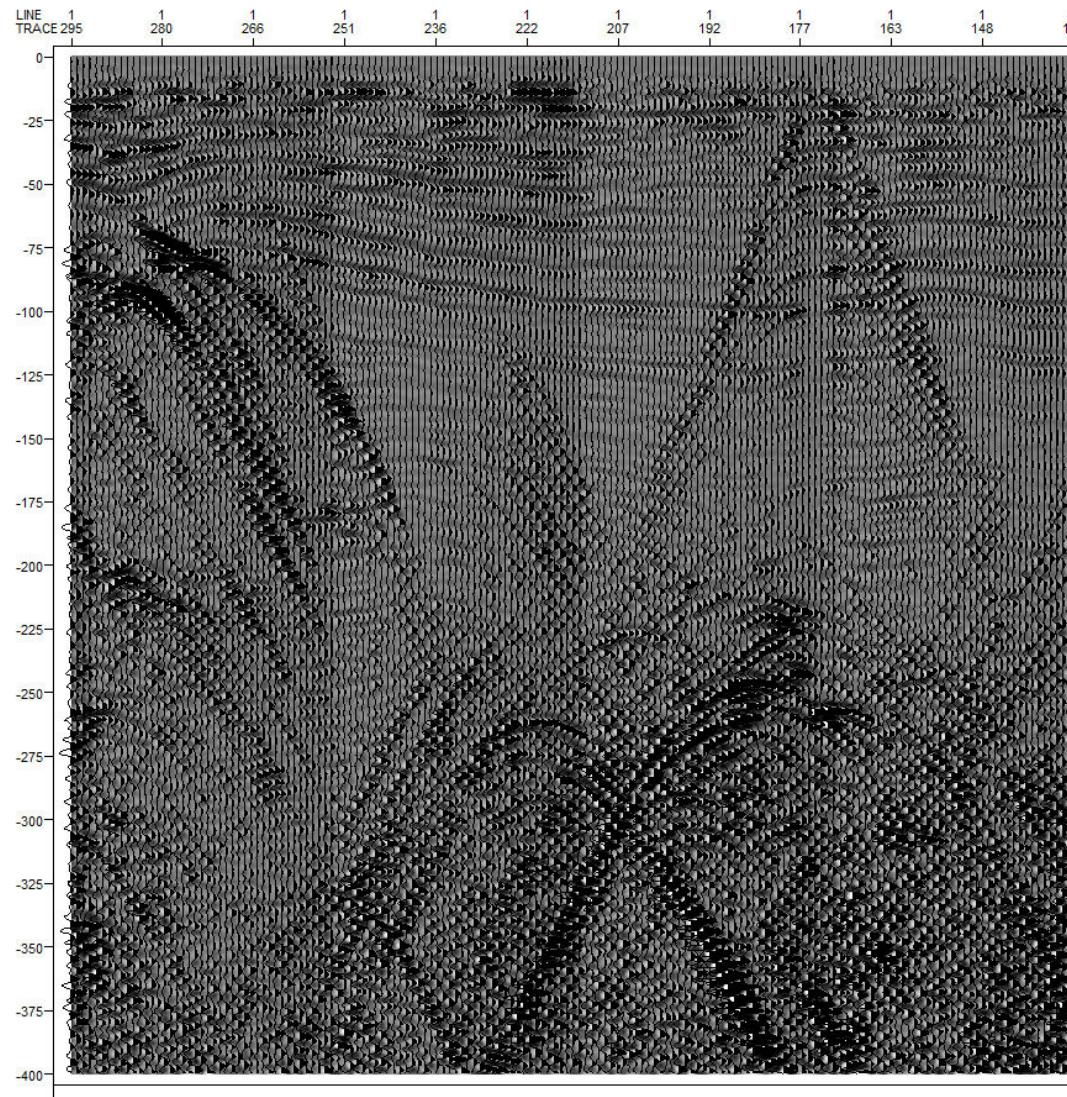
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Conclusions:

1. Active margins do not necessarily have crevasses open to the surface.
2. Radar hyperbolae arise from at least three locations (and depths) within a crevasse:
 - Synclines above the crevasse (i.e. Sagging bridges)
 - Reflector terminations in the side wall of the crevasse
 - Debris blocks in the base of the crevasse
3. The highest amplitude hyperbolae arise from the collapsed blocks at the bottom of the crevasse – not from the top.

Implications:

- Don't assume that the crest of an hyperbola = the top of a crevasse
- Don't assume that because crevasses are buried, the margin is inactive
- Don't assume that because a margin is active, you can't get radar data there
- Don't assume that the crevasses in a margin will all be at 45 degrees



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*Thanks to all the operations staff and
field assistants who made this happen*

