

**UNDERSEA FEATURE NAME PROPOSAL**  
(Sea NOTE overleaf)

Note: The boxes will expand as you fill the form.

<b>Name Proposed:</b>	Pine Island Trough	<b>Ocean or Sea:</b>	Amundsen Sea, Southern Ocean
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<b>Geometry</b> that best defines the feature (Yes/No) :						
Point	Line	Polygon	Multiple points	Multiple lines*	Multiple polygons*	Combination of geometries*
No	No	Yes	No	No	No	No

\* Geometry should be clearly distinguished when providing the coordinates below.

	Lat. (e.g. 63°32.6'N)	Long. (e.g. 046°21.3'W)
Coordinates:	74° 43.712' S	101° 4.377' W
	75° 7.567' S	101° 40.552' W
	75° 5.938' S	102° 4.238' W
	75° 5.445' S	102° 32.681' W
	75° 1.470' S	103° 29.198' W
	74° 55.734' S	104° 8.457' W
	74° 46.298' S	104° 32.611' W
	74° 37.713' S	105° 21.199' W
	74° 29.693' S	105° 57.207' W
	74° 21.954' S	106° 49.273' W
	74° 9.495' S	106° 58.310' W
	74° 6.692' S	106° 46.445' W
	73° 57.313' S	106° 44.168' W
	73° 50.297' S	106° 54.750' W
	73° 31.445' S	107° 22.785' W
	73° 23.411' S	107° 27.303' W
	73° 13.992' S	107° 30.672' W
	73° 0.526' S	107° 31.955' W
	72° 48.094' S	107° 36.403' W
	72° 38.937' S	107° 33.864' W
	72° 30.820' S	107° 23.636' W
	72° 18.547' S	107° 6.442' W
	72° 3.541' S	106° 46.469' W
	71° 45.909' S	106° 25.607' W
	71° 50.435' S	105° 48.969' W
	72° 4.130' S	106° 7.128' W
	72° 18.180' S	106° 31.115' W
	72° 25.829' S	106° 38.141' W
	72° 32.696' S	106° 43.030' W
	72° 39.243' S	106° 55.581' W
	72° 46.230' S	106° 53.669' W
	73° 8.746' S	106° 44.209' W
	73° 20.426' S	106° 37.481' W
	73° 31.268' S	106° 9.168' W
	73° 49.016' S	105° 39.673' W
	73° 56.934' S	105° 35.824' W
	74° 6.579' S	105° 24.077' W
	74° 17.080' S	104° 36.544' W
	74° 25.368' S	104° 2.599' W
	74° 28.522' S	103° 30.763' W
74° 29.732' S	103° 12.235' W	
74° 36.036' S	102° 57.990' W	
74° 38.804' S	102° 47.595' W	
74° 38.999' S	102° 17.073' W	
74° 41.612' S	101° 46.182' W	
74° 42.454' S	101° 31.252' W	
74° 43.712' S	101° 4.377' W	

<b>Feature Description:</b>	Maximum Depth:	1653 m	Steepness :	Variable
	Minimum Depth :	157 m	Shape :	Trough
	Total Relief :	1496 m	Dimension/Size :	15,000 km <sup>2</sup>

<b>Associated Features:</b>	Pine Island Ice Shelf; Pine Island Glacier; Pine Island Bay
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<b>Chart/Map References:</b>	Shown Named on Map/Chart:	N/A (s. remarks)
	Shown Unnamed on Map/Chart:	N/A (s. remarks)
	Within Area of Map/Chart:	N/A

<b>Reason for Choice of Name</b> (if a person, state how associated with the feature to be named):	The trough is the extension from Pine Island Glacier and originates in Pine Island Bay. It was most likely formed by the Pine Island Ice Stream. (The bay and the glacier are named after the ship "Pine Island" , which was part of the fleet that first reached Pine Island Bay)
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<b>Discovery Facts:</b>	Discovery Date:	1985
	Discoverer (Individual, Ship):	Thomas B. Kellogg, USCGC GLACIER

<b>Supporting Survey Data, including Track Controls:</b>	Date of Survey:	1994,1999,2000,2003,2006,2007,2008, 2009, 2010
	Survey Ship:	NB Palmer, Polarstern, James C. Ross, Oden
	Sounding Equipment:	Seabeam 2112, Simrad EM120, EM122, Hydrosweep DS1, DS2
	Type of Navigation:	GPS
	Estimated Horizontal Accuracy (nm):	<0.005 nm
	Survey Track Spacing:	variable
	Supporting material can be submitted as Annex in analog or digital form.	

<b>Proposer(s):</b>	Name(s):	Frank O. Nitsche
	Date:	21. August 2012
	E-mail:	fnitsche@ideo.columbia.edu
	Organization and Address:	Lamont-Doherty Earth Observatory of Columbia University Rte. 9W, Palisades NY 10964, U.S.A
	Concurrer (name, e-mail, organization and address):	Karsten Gohl, Karsten.Gohl@awi.de, Alfred-Wegener Institute for Polar and Marine Research, Am Alten Hafen 26 D-27568 Bremerhaven Germany

<p><b>Remarks:</b></p>	<p>This trough is a large, distinctive feature on the Amundsen Sea continental shelf that cuts deeply into the surrounding ~500m deep shelf. It probably formed by glacial erosion over several glacial periods and it reaches its greatest depth (&gt;1600m) in the inner shelf and gradually shoals towards the mid- and outer shelf (~700m - ~600m). Except for the outer shelf its shape well defined by extensive swath bathymetry coverage.</p> <p>The first indications of the trough was discovered by a Deep Freeze Cruise (USCGC Glacier) in 1985 and later in cruises with the NB Palmer (1994) based on echo sounding data. More detailed swath bathymetry data in 1999 and 2000 collected by the NB Palmer showed more details of the trough:</p> <p>Lowe, A.L. and Anderson, J.B., 2002. Reconstruction of the West Antarctic Ice Sheet in Pine Island Bay during the Last Glacial Maximum and its subsequent retreat history. <i>Quaternary Science Reviews</i>, 21: 1879-1897.</p> <p>Lowe, A.L. and Anderson, J.B., 2003. Evidence for abundant subglacial meltwater beneath the paleo-ice sheet in Pine Island Bay, Antarctica. <i>Journal of Glaciology</i>, 49: 125-138.</p> <p>During several cruises in 2006, 2007, 2009, 2010, 2011 additional multibeam data have been collected that cover most of the Pine Island Trough and outline in detail its boundaries. A first compilation of data showed the trough's shape:</p> <p>Nitsche, F.O., Jacobs, S., Larter, R.D. and Gohl, K., 2007. Bathymetry of the Amundsen Sea Continental Shelf: Implications for Geology, Oceanography, and Glaciology. <i>Geochemistry, Geophysics, Geosystems</i>, 8: Q10009, doi:10.1029/2007GC001694.</p> <p>The feature is commonly referred to as "Pine Island Trough" in the recent scientific literature including references listed in supplement A:</p>
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**NOTE :** This form should be forwarded, when completed :

- a) **If the undersea feature is located inside the external limit of the territorial sea :-**  
to your "National Authority for Approval of Undersea Feature Names" (see page 2-9) or, if this does not exist or is not known, either to the IHB or to the IOC (see addresses below);
- b) **If at least 50 % of the undersea feature is located outside the external limits of the territorial sea :-**  
to the IHB or to the IOC, at the following addresses :

<p>International Hydrographic Bureau (IHB) 4, Quai Antoine 1er B.P. 445 MC 98011 MONACO CEDEX <u>Principality of MONACO</u> Fax: +377 93 10 81 40 E-mail: <a href="mailto:info@ihb.mc">info@ihb.mc</a></p>	<p>Intergovernmental Oceanographic Commission (IOC) UNESCO Place de Fontenoy 75700 PARIS France Fax: +33 1 45 68 58 12 E-mail: <a href="mailto:info@unesco.org">info@unesco.org</a></p>
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## *Supporting documents*

### **A. Use of name in literature**

The trough lies on the eastern side of the Amundsen Sea continental shelf. It is frequently referred to in the literature as Pine Island Trough, e.g. in

Gohl, K., Teterin, D., Eagles, G., Netzeband, G., Grobys, J., Parsiegl, N., Schlüter, P., Leinweber, V., Larter, R.D., Uenzelmann-Neben, G. and Udintsev, G.B., 2007. Geophysical survey reveals tectonic structures in the Amundsen Sea embayment, West Antarctica. In: A.K. Cooper, C.R. Raymond and the ISAES Editorial Team (Eds.), *Antarctica: A Keystone in a Changing World—Proceedings for the Tenth International Symposium on Antarctic Earth Sciences*. U.S. Geological Survey and The National Academies; USGS OF-2007-1047, Short Research Paper 047; doi:10.3133/of2007-1047.srp047, pp. 4.

Graham, A.G.C., Larter, R.D., Gohl, K., Hillenbrand, C.-D., Smith, J.A. and Kuhn, G., 2009. Bedform signature of a West Antarctic palaeo-ice stream reveals a multi-temporal record of flow and substrate control. *Quaternary Science Reviews*, 28: 2774-2793.

Graham, A.G.C., Larter, R.D., Gohl, K., Dowdeswell, J.A., Hillenbrand, C.-D., Smith, J.A., Evans, J., Kuhn, G. and Deen, T., 2010. Flow and retreat of the Late Quaternary Pine Island-Thwaites palaeo-ice stream, West Antarctica. *J. Geophys. Res.*, 115: F03025.

Jakobsson, M., Anderson, J.B., Nitsche, F.O., Dowdeswell, J.A., Gyllencreutz, R., Kirchner, N., Mohammad, R., O'Regan, M., Alley, R.B., Anandakrishnan, S., Eriksson, B., Kirshner, A., Fernandez, R., Stollendorf, T., Minzoni, R. and Majewski, W., 2011. Geological record of ice shelf break-up and grounding line retreat, Pine Island Bay, West Antarctica. *Geology*, 39: 691-694.

Jakobsson, M., Anderson, J.B., Nitsche, F.O., Gyllencreutz, R., Kirshner, A.E., Kirchner, N., O'Regan, M., Mohammad, R. and Eriksson, B., 2012. Ice sheet retreat dynamics inferred from glacial morphology of the central Pine Island Bay Trough, West Antarctica. *Quaternary Science Reviews*, 38: 1-10.

Kirshner, A.E., Anderson, J.B., Jakobsson, M., O'Regan, M., Majewski, W. and Nitsche, F.O., 2012. Post-LGM deglaciation in Pine Island Bay, West Antarctica. *Quaternary Science Reviews*, 38: 11-26.

Kellogg, T.B. and Kellogg, D.E., 1987. Late Quaternary deglaciation of the Amundsen Sea: implications for ice sheet modelling. In: E.D. Waddington and J.S. Walder (Eds.), *The Physical Basis of Ice Sheet Modelling. Proceedings of the Vancouver Symposium, Vancouver, IAHS Publication No. 170*. IAHS Publication, pp. 349-357.

## B. Maps and cross-section examples

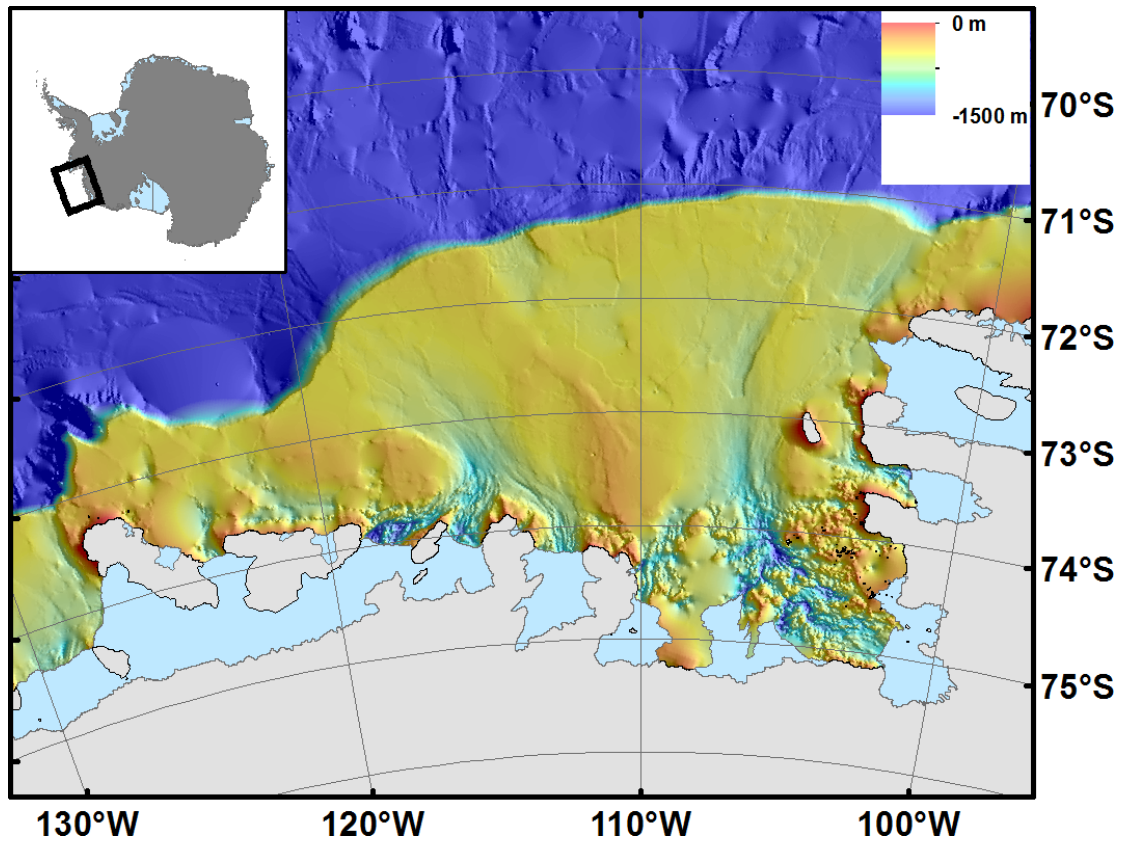


Figure B1: Overview map showing an interpolated grid of the Amundsen Sea continental shelf area. The proposed feature is the clearly identifiable trough between 100°W and 110°W. See Nitsche et al. 2007 for details on the interpolation routine and data processing.

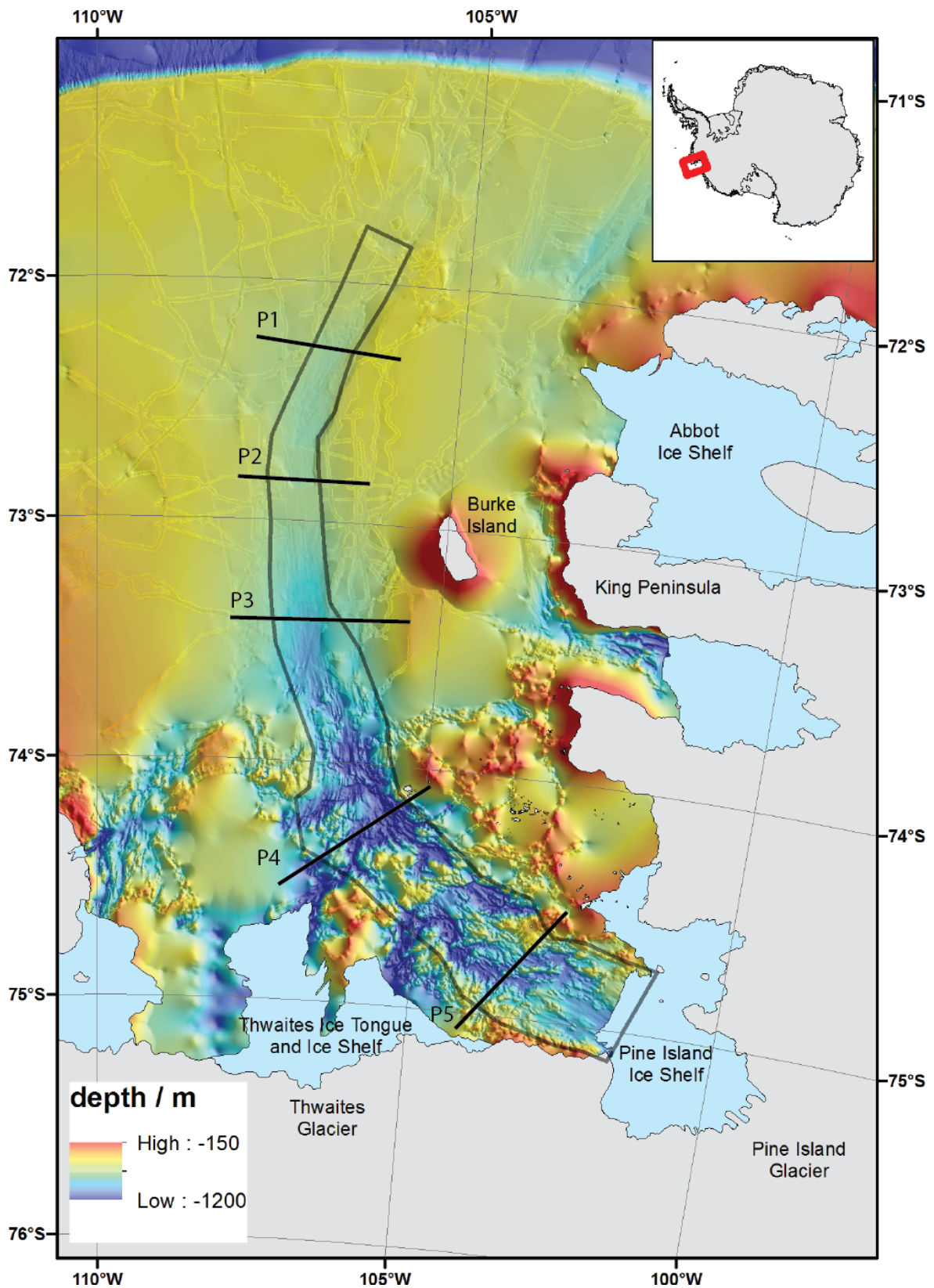


Figure B2: Bathymetry detail of the proposed Pine Island Trough (outlined in gray line) with interpolated bathymetry in the background. Lines P1 to P5 indicate locations of profiles shown in Fig. B4.

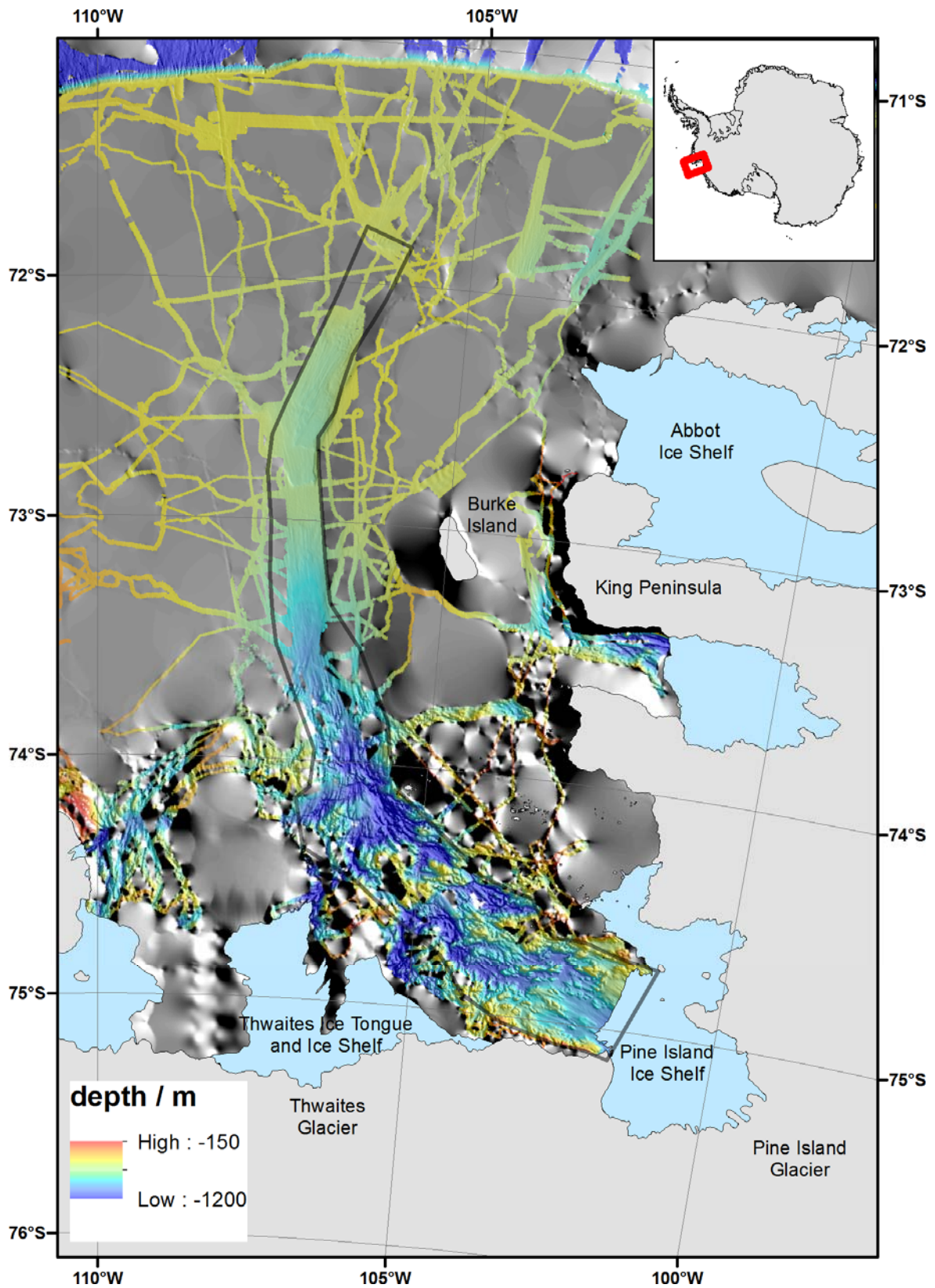


Figure B3: Bathymetry detail of the proposed Pine Island Trough (outlined in gray line) showing only the available multibeam coverage (background shading is based on interpolated grid shown above. While the trough itself is defined by multibeam bathymetry data, the interpolation of the surrounding shelf areas also incorporated older echo sounding data not shown here.

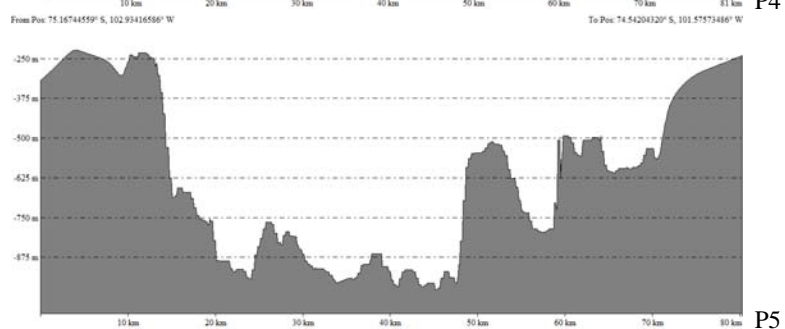
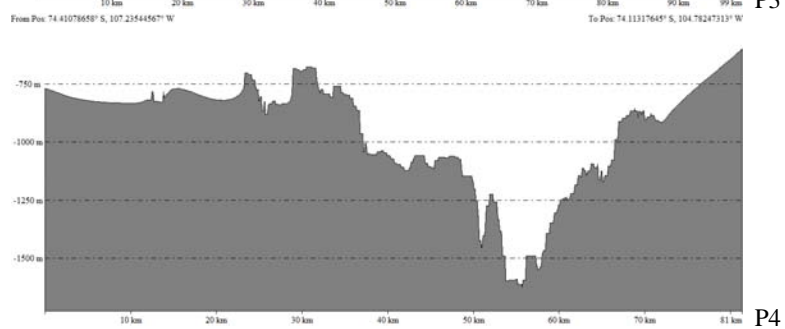
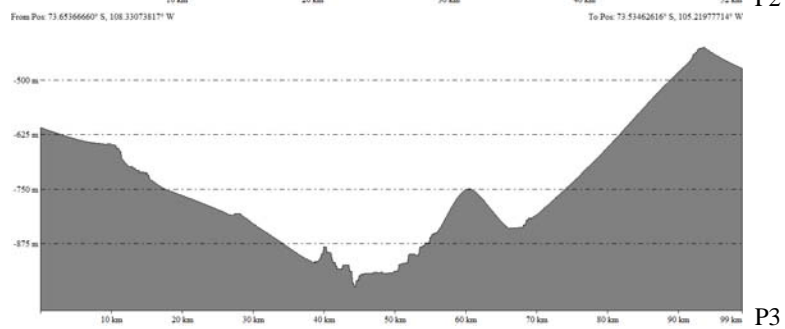
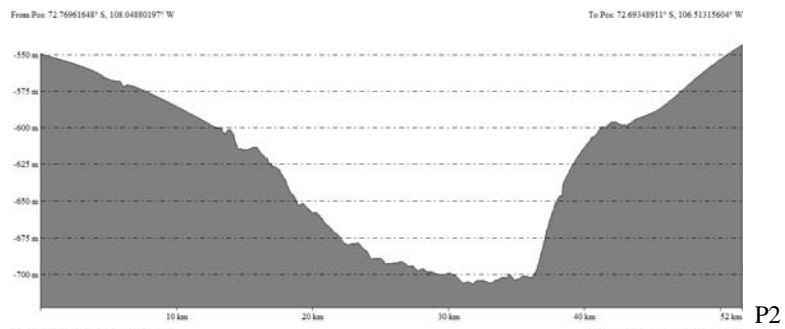
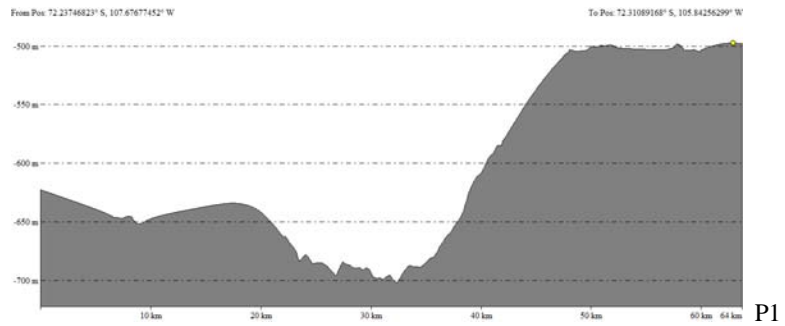


Figure B4: Series of cross-sections from north to south showing the varying, but distinctive relief of the trough on the shelf. Note that horizontal and vertical scales differ.



## C. List of survey dates and ships

Table 1: Expeditions with multibeam data used to outline the trough.

<b>Cruise</b>	<b>Ship</b>	<b>Year</b>	<b>System</b>	<b>PI</b>
ANT-XI/3	Polarstern	1994	HydroSweep DS1	H. Miller/K. Gohl (AWI)
NBP9902*	NB Palmer	1999	SeaBeam 2112	J. Anderson (Rice U.)
NBP0001*	NB Palmer	2000	SeaBeam 2112	S. Jacobs (LDEO)
JR84	James C. Ross	2003	EM 120	J. Dowdeswell (U. Cambridge)
ANT-XXIII/4	Polarstern	2006	HydroSweep DS2	K. Gohl (AWI)
JR141	James C. Ross	2006	EM 120	R. Larter (BAS)
NBP0702*	NB Palmer	2007	EM 120	S. Jacobs (LDEO)
JR179	James C. Ross	2008	EM 120	R. Larter (BAS)
OSO0708**	Oden	2008	EM 120	M. Jakobsson (U. Stockholm)
NBP0901*	NB Palmer	2009	EM 120	S. Jacobs (LDEO)
ANT-XXVI/3	Polarstern	2010	HydroSweep DS2	K.Gohl (AWI)
OSO0910**	Oden	2010	EM122	M. Jakobsson (U. Stockholm)

\*from Antarctic and Southern Ocean Data Portal (<http://www.marine-geo.org/>)

\*\* from Oden Mapping Data Repository (<http://oden.geo.su.se/>)