U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
BRITISH ANTARCTIC SURVEY, CAMBRIDGE, UNITED KINGDOM
SCOTT POLAR RESEARCH INSTITUTE, UNIVERSITY OF CAMBRIDGE, UNITED KINGDOM
BUNDESAMT für KARTOGRAPHIE und GEODÄSIE, FRANKFURT AM MAIN, GERMANY

GEOLOGIC INVESTIGATIONS SERIES
MAP I–2600–B
Explanatory pamphlet accompanies map

Maps used in compilation and analysis:

British Antarctic Survey, BAS 250 Series (1:250,000 scale)
Cape Jeremy, 1978, Sheet SR 19-20/6
Crystal Sound, 1979, Sheet SQ 19-20/10
Marguerite Bay, 1978, Sheet SR 19-20/2
Rouen Mountains, 1978, Sheet SR 19-20/5 (Extended)

British Antarctic Survey, BAS Miscellaneous Series
Antarctic Peninsula and Weddell Sea, 2005, Sheet BAS (Misc) 13A, 1:3,000,000 scale
Graham Land and South Shetland Islands, 2005, Sheet BAS (Misc) 13B, 1:1,000,000 scale

Great Britain Directorate of Colonial Surveys (DCS) and Directorate of Overseas Surveys (DOS) maps, 1948–1963 (1:500,000 and 1:200,000 scales); for complete listing of maps, see table 2 in accompanying pamphlet

U.S. Geological Survey Antarctica Sketch Map Series (1:500,000 scale)
Ellsworth Land (east part)–Palmer Land (south part), 1969
Palmer Land (north part), 1979

Harris, J.S., 1979, Robertson Island, unpublished map, 1:250,000 scale (BAS reference number ES2/EV1000A/217)

Other information sources:

AVHRR imagery, scene dates: 28 Mar 1998 and 29 Jan 1999 (NOAA Polar-Orbiting Environmental Satellite (POES) Series).

Corona imagery, scene date: 1963 (Corona Satellite Series (declassified)).

Envisat ASAR imagery, scene date: 28 Mar 2002 (ERS Satellite Data).

MODIS imagery source:
Scambos, T., Bohlander, J., and Raup, B., comps., 2001 (updated to current year), Images of Antarctic ice shelves, March 2004: Boulder, Colo., National Snow and Ice Data Center, digital media (http://nsidc.org/data/iceshelves_images)

Alberts, F.G., comp. and ed., 1995, Geographic names of the Antarctic, second edition, 1995—Names approved by the United States Board on Geographic Names: Arlington, Va., National Science Foundation [Report] NSF 95–157, 834 p. (Antarctic place names can also be found online at http://geonames.usgs.gov/antarctic/)

Skvarca, P., 1993, Fast recession of the northern Larsen Ice Shelf monitored by space images: Annals of Glaciology, v. 17, p. 317–321.

Skvarca, P., 1994, Changes and surface features of the Larsen Ice Shelf, Antarctica, derived from Landsat and Kosmos mosaics: Annals of Glaciology, v. 20, p. 6–12.

Antarctic Digital Database (ADD) (British Antarctic Survey and others, 1993; see full reference citation in accompanying pamphlet). The Antarctic Digital Database project provides a digital coastline and other cartographic information of Antarctica.

Antarctic ice velocity data from Antarctic Glaciological Data Center of the National Snow and Ice Data Center (NSIDC) Web site: http://nsidc.org/data/velmap/vega_larsen/vega_larsen.html

U.S. Board on Geographic Names Web site:
http://geonames.usgs.gov/antarctic/index.html

Map projection parameters have been used in accordance with the recommendations of the Working Group on Geodesy and Geographic Information of the Scientific Committee on Antarctic Research (SCAR). The accuracy of topographic features in relation to the graticule and to the satellite observation stations is approximately 1 mm (equals 1 km on the ground).

Image base from the Landsat 4 and 5 TM image mosaic of the Antarctic Peninsula (30-meter pixel), digitally mosaicked and georeferenced by the former Institut für Angewandte Geodäsie (IfAG), now the Bundesamt für Kartographie und Geodäsie (BKG), and augmented by a Landsat 7 ETM+ scene. The accuracy of the mosaic was calculated by A.P.R. Cooper (British Antarctic Survey) to be ±150 m.

INDEX MAP OF MODIS IMAGES FROM THE EARLY TO MID-2000s, USED FOR FEATURE ANALYSIS

Area	NSIDC[1] Entity No.	Date
Larsen A	2002096_1310	07 Mar 02
Larsen B	2005008_1320	08 Jan 05
Larsen C	2005020_1345	20 Jan 05
Wilkins	2004366_1230	31 Dec 04

[1] National Snow and Ice Data Center.

INDEX MAP OF LANDSAT 7 ETM+ IMAGES FROM THE EARLY 2000s, USED FOR FEATURE ANALYSIS

Path/Row	EDC[1] Entity No.	Date
214/109	7214109000134450	10 Dec 01
215/108	7215108000133550	01 Dec 01
216/106	7216106000005250	21 Feb 00
217/107	7217107000005250	24 Feb 00
218/109	7218109000135450	04 Jan 01
220/107	7220107000105650	19 Feb 01
220/109	7220109000105650	19 Feb 01
223/109	7223109000202650	26 Jan 02

[1] EROS Data Center, U.S. Geological Survey.

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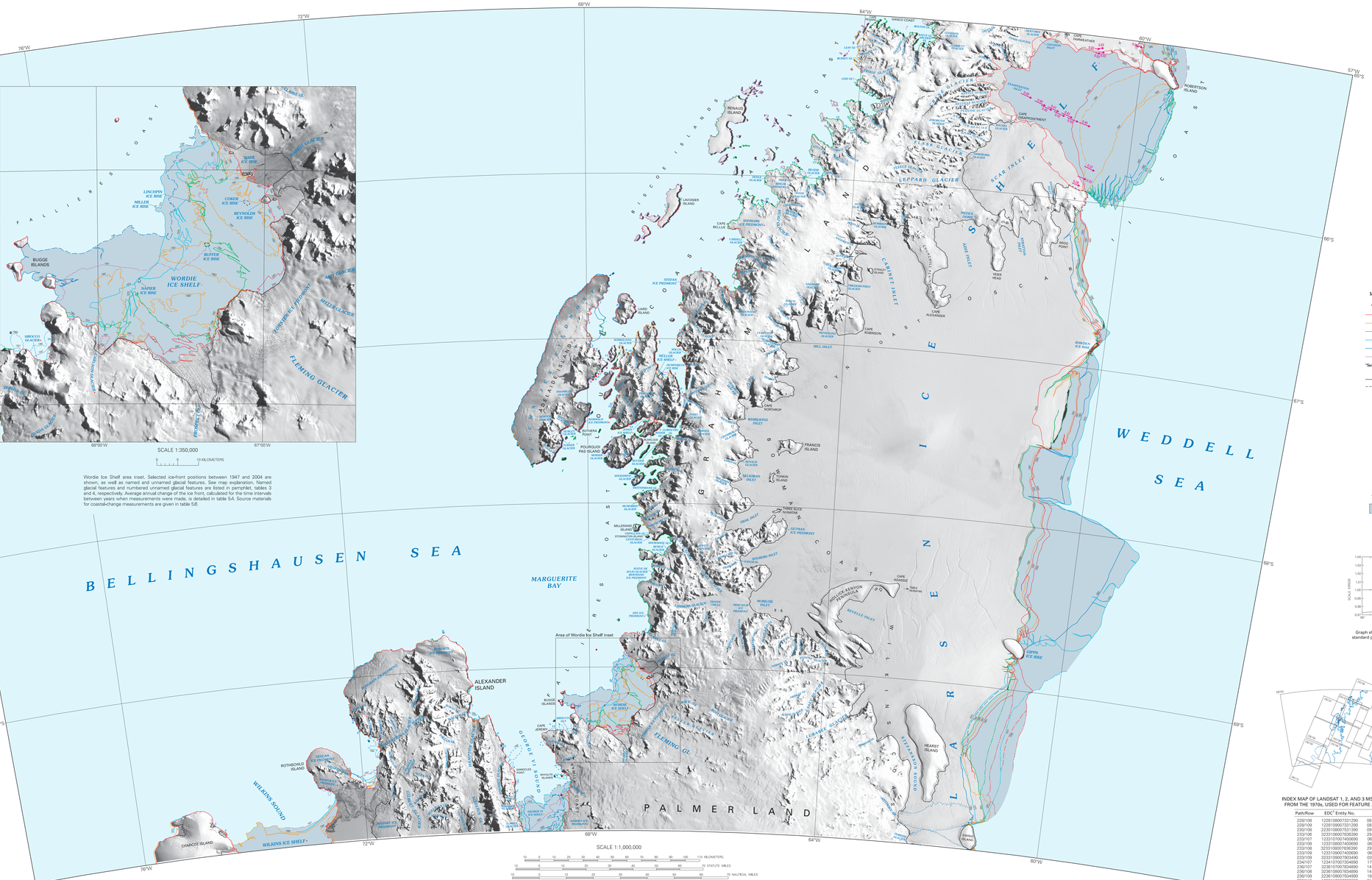
[5] Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge CB2 1ER, United Kingdom.
[6] Formerly with British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, United Kingdom.
[7] Bundesamt für Kartographie und Geodäsie (formerly Institut für Angewandte Geodäsie), Richard-Strauss-Allee 11, D-60598 Frankfurt am Main, Germany.

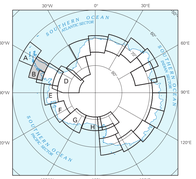
SCALE 1:350,000
0 5 10 KILOMETERS

Wordie Ice Shelf area inset. Selected ice-front positions between 1947 and 2004 are shown, as well as named and unnamed glacial features. See map explanation. Named glacial features and numbered unnamed glacial features are listed in pamphlet, tables 3 and 4, respectively. Average annual change of the ice front, calculated for the time intervals between years when measurements were made, is detailed in table 5A. Source materials for coastal-change measurements are given in table 5B.



SCALE 1:1,000,000
0 10 20 30 40 50 60 70 80 90 100 110 KILOMETERS
0 10 20 30 40 50 60 70 STATUTE MILES
0 10 20 30 40 50 60 NAUTICAL MILES

POLAR STEREOGRAPHIC PROJECTION; STANDARD PARALLEL 71°S



Index map of the planned coastal-change and glaciological maps of Antarctica at 1:1,000,000 scale. Larsen Ice Shelf area map is shaded. Maps published to date are indicated by letter and are described in table 6 of the accompanying pamphlet.

EXPLANATION

Ice Wall or Ice Front* Reliability: Good	Poor	Thin-ice Front	Iceberg Tongue*	Floating Glacier Tongue*	
					2000s
					1990s
					1980s
					1970s
					1960s
					1950s and 1940s

*Selected ice fronts, iceberg tongues, and floating glacier tongues show date of observation

Grounding line

Former grounding line

+1 **Location of fluctuating unnamed glacier or ice front**—Number corresponds to numbered listing in table 4 in pamphlet

* **Named and unnamed glaciers and (or) ice fronts that have had a net average advance during the period of measurements**—Named and unnamed features are listed in pamphlet, tables 3 and 4, respectively. Where feature is unnamed, number corresponds to listing in table 4

* **Named and unnamed glaciers and (or) ice fronts that have fluctuated an average of more than 200 meters per year (m a^{-1}) during some time interval since the 1940s**—Named and unnamed features are listed in pamphlet, tables 3 and 4, respectively. Where feature is unnamed, number corresponds to listing in table 4

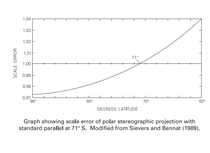
Retreat

Advance

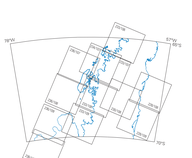
Retreat and advance

0.81 **Ice-velocity vector**—Number shows ice velocity in kilometers per year (km a^{-1})

Former Larsen and other major ice shelves—Farthest extent observed since the 1940s



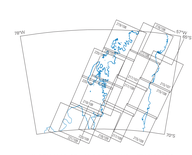
Graph showing scale error of polar stereographic projection with standard parallel at 71° S. Modified from Sievers and Bennat (1989).



INDEX MAP OF LANDSAT 1, 2, AND 3 MSS IMAGES FROM THE 1970s, USED FOR FEATURE ANALYSIS

Path/Row	EDC[1] Entity No.	Date
228/108	1228108007331290	08 Nov 73
228/109	1228109007331290	08 Nov 73
231/108	2231108007531390	09 Nov 75
233/106	3233106007636390	29 Dec 76
233/107	1233107007400690	06 Jan 74
233/108	1233108007400690	06 Jan 74
233/109	3233108007636390	29 Dec 76
233/109	1233109007400690	06 Jan 74
233/109	3233109007903490	03 Feb 79
234/107	1234107007304890	17 Feb 73
236/107	3236107007934890	14 Dec 79
236/108	3236108007834890	14 Dec 78
236/109	3236109007834890	14 Dec 78
236/110	1236110007232690	21 Nov 72

[1] EROS Data Center, U.S. Geological Survey.



INDEX MAP OF LANDSAT 4 AND 5 TM IMAGES FROM THE MID-1980s TO EARLY 1990s, USED FOR MAP BASE AND FEATURE ANALYSIS

Path/Row	EDC[1] Entity No.	Date
215/107	4215107008301210	12 Jan 88
215/108	4215108008902810	28 Jan 89
215/109	4215109008902810	28 Jan 89
216/106	4216106008902910	29 Jan 89
216/107	4216107008902910	29 Jan 89
217/107	5217107009609010	01 Mar 96
217/108	5217108009609010	01 Mar 96
217/109	4217109009001510	15 Jan 90
218/109	4218109008905110	20 Feb 89
219/106	4219106008905010	19 Feb 89
219/106	4219106008933010	26 Nov 89
219/107	4219107008928510	28 Jan 89
219/108	4219108008910410	09 Feb 91
220/107	5220107009609910	18 Feb 96
220/108	5220108009609510	06 Mar 96
220/109	4220109008902710	27 Jan 89
221/109	4221109008902710	27 Jan 90

[1] EROS Data Center, U.S. Geological Survey.

COASTAL-CHANGE AND GLACIOLOGICAL MAP OF THE LARSEN ICE SHELF AREA, ANTARCTICA: 1940–2005

By
Jane G. Ferrigno,[1] Alison J. Cook,[2] Amy M. Mathie,[3] Richard S. Williams, Jr.,[4] Charles Swithinbank,[5] Kevin M. Foley,[1] Adrian J. Fox,[2] Janet W. Thomson,[6] and Jörn Sievers[7]

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