

WHITE GLACIER – AXEL HEIBERG ISLAND CANADIAN ARCTIC ARCHIPELAGO 1:10000

By D. Haumann and D. Honegger (1964)

Natural Resources Canada

Text compiled by L. Thomson (2015)

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Coverage, Surveying, and Plotting Information

This map was scanned in two sections that, together, illustrate an area of 70 km² covering White Glacier (-90.6670 W, 79.4450 N) and the stable terrain bordering the valley glacier and its terminus. Elevations range from 30 m a.s.l. in the proglacial region, which connects with the west-flowing Expedition river valley, to 1782 m a.s.l. at the northernmost peak above the glacier accumulation area. Features including crevasses (hidden and open), slush avalanches, abandoned and active drainage channels, moulins, transverse and longitudinal faults, and debris covers are mapped, as are survey sites and signal cairns used during ground control collection in 1960. The moraines formed at the Little Ice Age maximum are visible in the glacier forefield and along the glacier margins.

Contour intervals: 10 m, with supplementary 5 m contours in low slope areas

Field work: summer 1960

Aerial photography: August 2nd, 1960

Flying Height: 3050 metres a.s.l.

Air Photography by the Royal Canadian Air Force

Photogrammetric plotting by D. Haumann and D. Honegger, N.R.C.

Draughting & graphical representation by D. Honegger

Produced by the Photogrammetric Research Section of the National Research Council of Canada in conjunction with the Axel Heiberg Island Expedition of McGill University.

Map Reference

National Research Council, 1964, White Glacier, Axel Heiberg Island, Canadian Arctic Archipelago. Map at 1:10 000 scale in two sheets. Photogrammetric Research Section, National Research Council of Canada, Ottawa, in conjunction with Axel Heiberg Island Expedition, McGill University, Montreal.

Site Description

White Glacier, approximately 14 km long and 40 km² at the time of map production, is an alpine valley glacier located 7 km inland from the head of Expedition Fiord, Axel Heiberg Island, NU, Canada. It was the focus of numerous glaciological, meteorological, and hydrological studies from 1960 to present (e.g. Muller, 1963; Cogley et al., 2011). White Glacier was the site of several early breakthroughs in polar glaciology including defining work on glacier facies (Müller, 1962) and the detection of short-term velocity fluctuations from a mostly cold, polythermal glacier (Iken, 1974; Blatter, 1987). The mass balance record for White Glacier is available from 1960-1979, and 1984 to the present and it is one of the 37 reference glaciers recognized in the United Nations Global Terrestrial Network for Glaciers.

Blatter, H., 1987, On the thermal regime of an arctic valley glacier: a study of White Glacier, Axel Heiberg Island, N.W.T., Canada, Journal of Glaciology, 33, 200-211.

Cogley, J.G., W.P.Adams and M.A.Ecclestone, 2011, Half a century of measurements of glaciers on Axel Heiberg Island, Nunavut, Canada, Arctic, 64(3), 371-375.

Iken, A., 1974, Velocity Fluctuations of an Arctic Valley Glacier, A Study of the White Glacier, Axel Heiberg Island, Canadian Arctic Archipelago, Axel Heiberg Island Research Reports, Glaciology No. 5, McGill University, Montreal, Quebec, Canada. 115p.

Müller, F., 1962, Zonation of the accumulation area of the glaciers of Axel Heiberg Island, N.W.T., Journal of Glaciology, 4, 302-310.

Müller, F. et al., 1963a, Preliminary Report, 1961-1962, Axel Heiberg Island Research Reports, McGill University, Montreal. 241p.

GENERAL COMMENTS ON THE EXPEDITION FIORD MAP SERIES

Motivation

The maps covering the Expedition Fiord area of Axel Heiberg Island (1:100,000), including Baby Glacier (1:5,000), White Glacier (1:5,000 and 1:10,000), and Thompson glacier (1:5,000 and 1:50,000) were produced as part of a mapping campaign in support of the interdisciplinary research program initiated at the McGill Arctic Research Station under the leadership of Fritz Müller at McGill University (Müller, 1961; Müller, 1963a). These maps supported studies in geology, glaciology, meteorology, geophysics, zoology, permafrost geomorphology, and botany; together, they can be considered some of the best quality maps produced for the Canadian high Arctic during the 20th century. Cogley and Jung-Rothenhäusler (2002) offer a clear and useful explanation of the region's cartographic history, the plotting methods, and the associated uncertainties. It is the primary reference for this summary.

Surveying, Photogrammetry, and Plotting

Fritz Müller and Peter Adams conducted the first surveys of the Expedition Fiord area in McGill University's reconnaissance campaign of Western Axel Heiberg Island in the summer of 1959 (Müller, 1961; Adams, 2007). The maps were produced using photogrammetry techniques alongside intensive ground surveys conducted throughout the summer of 1960 (Blachut, 1961; Haumann, 1961). The Royal Canadian Air Force carried out the air photo survey in August, 1960, and a particular effort was made to improve contrast in the glacier accumulation (snow covered) areas by surveying multiple times with the sun at different angles. As noted in the Preliminary Report: 1961-1962, "A detailed discussion of the factors pertaining to the production of these maps has been given in a series of articles in the 'Canadian Surveyor' (Blachut, 1963; Haumann, 1963; McKortel, 1963; Müller, 1963b)." Plotting of the maps was overseen by T. J. Blachut at the Photogrammetric Research Section of the National Research Council (of Canada) and the Army Survey Establishment supported printing of the maps. The digital copies of the maps provided here were scanned at the Canada Centre for Remote Sensing, Natural Resources Canada (Budkewitsch, 2002).

Coordinate System

The Expedition Fiord maps were plotted in a local plane coordinate system with a baseline defined by the coordinates of Astro 1 (Local: 30,000 m E, 60,000 m N; Geographic: 90.74280563 W, 79.41003063 N) and Astro 2 (Local: 36764.06 m E, 69598.47 m N; Geographic: 90.41190283 W, 79.49597503 N). Detailed information is missing from the earlier publications, however it has been estimated that the maps were plotted under a transverse Mercator projection (centered on Astro 1) on a Clarke 1866 ellipsoid (NAD27) (Cogley and Jung-Rothenhäusler, 2002). With these assumptions, Cogley and Jung-Rothenhäusler (2002) provide equations that will enable users to convert the local planar coordinate system to geographic coordinates.

SELECTED REFERENCES

- Adams, P. 2007, Trent, McGill, and the North: A Story of Canada's Growth as a Sovereign Polar Nation. Peterborough, Ont. Cover to Cover Publication Services, p. 221.
- Blachut, T.J., 1961, Participation of the Photogrammetric Research Section of the N.R.C. in the Jacobsen-McGill University expedition to Axel Heiberg Island in 1960, in Müller, B.S., ed., 1961, Preliminary Report of 1959-60, Jacobsen-McGill Arctic Research Expedition to Axel Heiberg Island, Queen Elizabeth Islands, 27-33. McGill University, Montreal.
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- Budkewitsch, P., 2002, Scanned Maps, Expedition Fiord, Canada Centre for Remote Sensing, Natural Resources Canada, 588 Booth Street, Ottawa, ON, Canada K1A 0Y7. Four CD-ROMs.
- Cogley, J.G., and F. Jung-Rothenhäusler, 2002, Digital Elevation Models of Axel Heiberg Island Glaciers, Trent Technical Note 2002-1, Department of Geography, Trent University, Peterborough, Canada. 45p.
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- Haumann, D., 1963, Surveying glaciers in Axel Heiberg Island, Canadian Surveyor, 17(2), 81-93.
- McKortel, T.A., 1963, The reproduction of the Thompson Glacier map, Canadian Surveyor, 17(2), 93-95.
- Müller, B.S., ed., 1961, Preliminary Report of 1959-60, Jacobsen-McGill Arctic Research Expedition to Axel Heiberg Island, Queen Elizabeth Islands, McGill University, Montreal. 219p.
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- Müller, F., 1963b, An arctic research expedition and its reliance on large-scale maps, Canadian Surveyor, 17(2), 96-112.
- Access to many of these references is available through the Glaciology at Trent website: <http://people.trentu.ca/~gcogley/glaciology/index.htm>