NATURAL RESOURCES PROGRAM

SPACE APPLICATIONS PROGRAMS

TECHNICAL LETTER NASA-56

U.S. Geological Survey
Department of the Interior

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Washington, D. C. 20242

Technical Letter
NASA-56
October 1966

Dr. Peter C. Badgley
Chief, Natural Resources Program
Office of Space Science and Applications
Code SAR, NASA Headquarters
Washington, D.C. 20546

Dear Peter:

Transmitted herewith are 3 copies of:

TECHNICAL LETTER NASA-56

GEOLOGICAL EVALUATION OF NIMBUS VIDICON IMAGERY

NORTHWEST GREENLAND*

by

William E. Davies**

Sincerely yours,

William A. Fischer
Research Coordinator
Earth Orbiter Program

*Work performed under NASA Contract No. R-09-020-011
**U.S. Geological Survey, Washington, D.C.

UNITED STATES
DEPARTMENT OF THE INTERIOR
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These data are preliminaty and should
not be quoted without permission

Prepared by the Geological Survey
for the National Aeronautics and
Space Administration (NASA)

*Work performed under NASA Contract No. R-09-020-011
**U.S. Geological Survey, Washington, D. C.

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Geological Evaluation of Nimbus Vidicon Imagery Northwest Greenland

by

William E. Davies

ABSTRACT

Two photos of Nimbus vidicon imagery cover northwest Greenland. They are characterized by extreme contrast between ice and land. Apparently exposure was keyed to the ice and as a result no tonal quality gradation exists on the land; also long shadows cover the lowlands. Because of this, the imagery contains little of geologic value. The extreme contrast emphasizes some valleys reflecting structural control and it is possible to discern major structural features. Scale distortion is small but relief on snow and ice is greatly exaggerated.

INTRODUCTION

The imagery used covers the area from Petermann Glacier, Hall Land to Wulff Land (Figure 1). Two photos are involved, 80N306 and 82N306. The first photo is of poor quality and in part, duplicates the second at a smaller scale. The extreme contrast between the Greenland ice sheet and the bare land areas was not accommodated by the imagery and as a result tonal variations are lacking on areas of bare land.

Scale variations. The photo has a scale of 1:2,150,000 at its center. On the north edge the scale is 1:2,500,000 and at the southwestern corner it is 1:2,250,000. The variation is apparently gradual away from the center point.

Image distortion. Checks against 1:250,000 standard topographic maps (AMS, 1957) indicate no image distortion.

Resolution of cultural features. None in area.

Resolution of topographic features. The resolution is good on large features such as glacial valleys because of the extreme contrast between ice and bare land. No minor topographic features can be discerned on the bare land because of the lack of tonal variation. However, some tonal variation is present on small icecaps which shows their surface features. Snow covers much of the area but the cover is thin. In general the snow cover is grayer in tone than the icecaps and ice sheets. Open leads in sea ice are clearly shown. Glacier fronts, unless ending in open water, are not distinct.

Effect of vertical polarization. The relief on small icecaps and on small areas of land with deep snow cover is greatly exaggerated in comparison with other areas.

Nimbus Imagery - Geological Application

Tonal rendition of rock units. The bare land areas are lacking in tonal variation and no rock or soil data are discernible. Because of the low angle of the sun extremely long shadows cover most of the lowlands and further reduce the chances of observing information pertaining to rocks.

Gross structure reflecting trends of major valleys stand out well because of the dark tone of the valleys in contrast to snow-covered uplands (Needleman, 1961).

CONCLUSIONS

This Nimbus imagery is about 25 years too late, for a quarter of a century ago it would have answered many questions about unexplored parts of Greenland. However, aerial photography flown since 1950 has eliminated many unknowns about Greenland topography. A picture or two spanning Peary Land, north Greenland from west to east would be of great use as there is a 16-mile error in geodetic positions in this area. Although two end points are accurately known (Nord and Alert), the distribution of the error across Peary Land is not known.

The extreme contrast between ice or snow cover and bare land is such that no tonal variations can be observed on the land. If this type of imagery is to be usable for geologic purposes, specific adjustment of exposures to emphasize bare land will be needed. This is a problem that also has arisen in standard aerial photography.

Selected References

Army Map Service (U. S.), 1957, Greenland 1:250,000; Series C501, sheets NJ 19, 20, 21, 22, 23, 24-6, 7, 10, 11.

Needleman, S. M. (ed.), 1961, Evaluation of the Arctic ice-free land site - - Polaris Promontory, north Greenland 1958-1959: Air Force Surveys in Geophysics no. 132, 70 p.

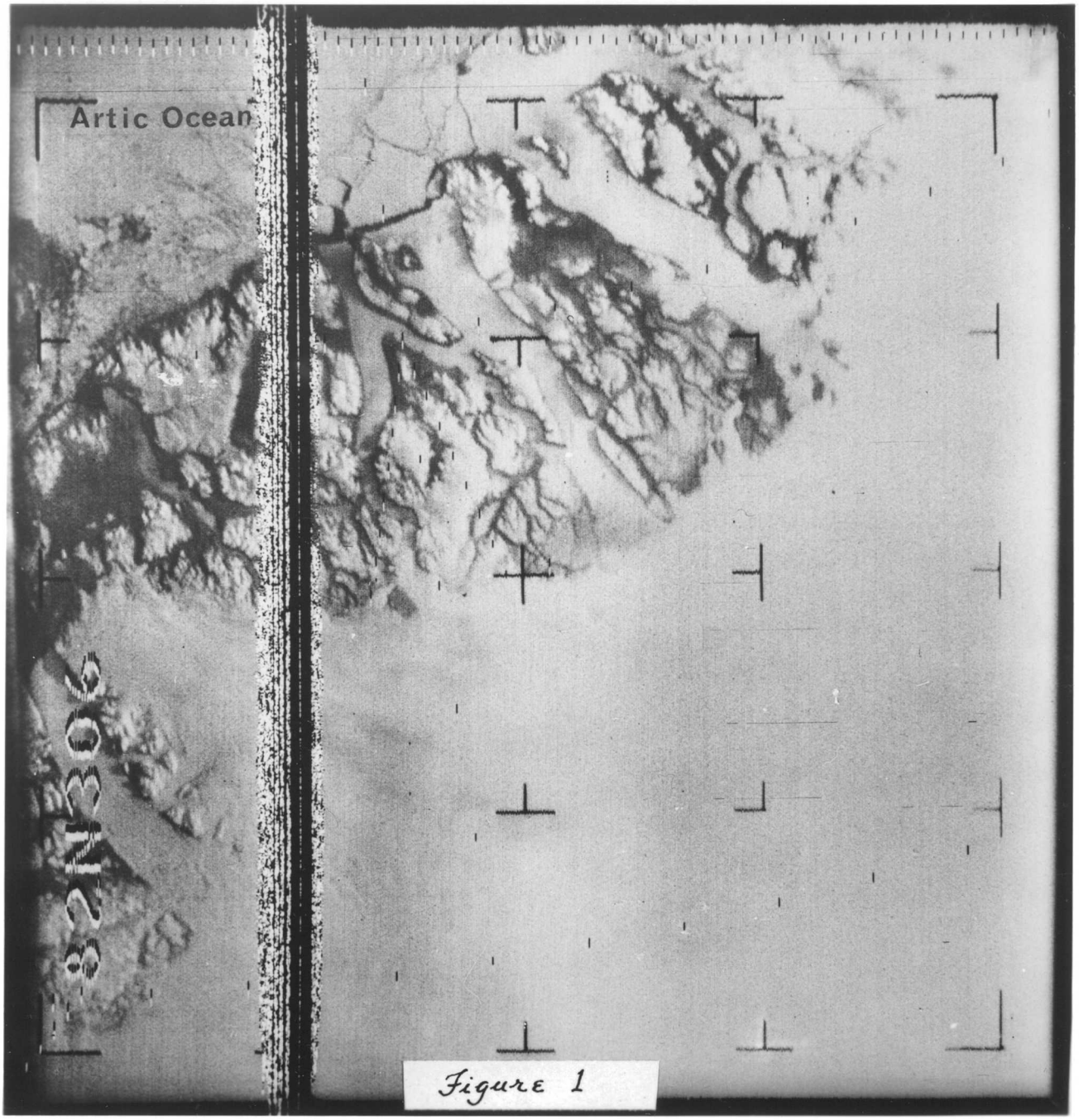

Figure 1

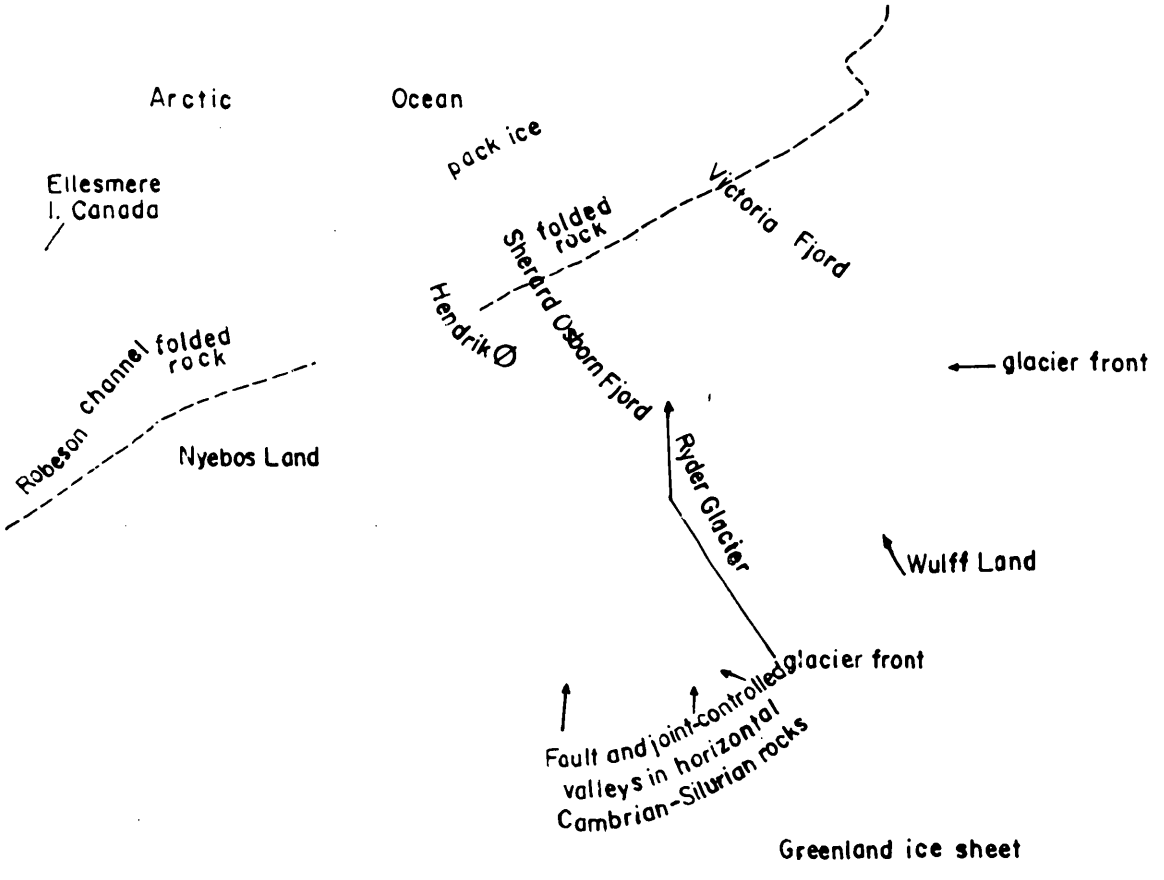
Arctic
Ocean
pack ice
Ellesmere
I. Canada
Victoria Fjord
folded rock
Sherard Osborn Fjord
Hendrik Ø
Robeson channel folded rock
Nyebos Land
glacier front
Ryder Glacier
Wulff Land
glacier front
Fault and joint-controlled valleys in horizontal Cambrian-Silurian rocks
Greenland ice sheet

Figure 2