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GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND

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1 May 1973

Type I Progress Report for Period 15 January 1973 - 30 April 1973

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Prepared for:

Goddard Space Flight Center
Greenbelt, Maryland 20771

Publication authorized by the Director, U.S. Geological Survey

Type I Progress Report
ERTS-I

- a. Title: Geological and Geophysical Remote Sensing of Iceland
ERTS-A Proposal No.: SR 9651
- b. GSFC ID No. of P.I.: IN 079
- c. Statement and explanation of any problems that are impeding the progress of the investigation:

The most serious problem, of course, was the loss of the video tape recorder on 28 March 1973, thus precluding any additional ERTS-I imagery of Iceland. Some imagery was acquired in September, October, and November 1972 (41 frames), but only about 13 frames are usable because of clouds and/or low solar illumination. Imagery was also acquired in January, February, and March 1973, but only the 1972 imagery has been catalogued so far. Sufficient imagery exists to carry out part of 8 of the 10 experiments. The sea ice and spring flooding of rivers experiments cannot be carried out; however, a request has been made to NOAA (NESS) for NOAA-2 coverage of Iceland to carry out the sea ice studies. Much of the grasslands (rangelands) experiment has been lost, as has the persistence of winter snow into summer, mapping of glacier margins during minimum snowcover (August), etc. Even with this loss, however, a considerable amount of research on analysis of available ERTS-I imagery of Iceland will be carried out.

- d. Discussion of the accomplishments during the reporting period and those planned for the next reporting period:

(1) A paper on the preliminary results of the analysis of ERTS-I imagery of Iceland was presented at the "Symposium on Significant Results Obtained from ERTS-I" on 7 March 1973. (See abstract of paper under paragraph e. of this progress report.)

(2) A two-week trip to Iceland was accomplished from 3-15 February 1973 to meet four principal objectives: (a) to carry out the research objectives of the binational, multidisciplinary ERTS-I experiment with my six Icelandic co-investigators; (b) to discuss with these scientists the future research objectives of the ERTS-I and two proposed ERTS-B and NOAA-2/Nimbus-V experiments in Iceland; (c) to discuss all of the past, present, and future research in Iceland with Steingrímur Hermannsson, Director, National Research Council of Iceland (Rannsóknaráð Ríkisins); and (d) to carry out geological research, with Icelandic scientists, on the 23 January 1973 effusive volcanic eruption of Kirkjufell on the Island of Heimaey, Vestmannaeyjar (Vestmann Islands), Iceland. All of the objectives were reached during this trip.

(3) A priority request was made to NASA's Goddard Space Flight Center for continuing coverage of the volcanic eruption on Heimaey. Up to the time of video tape recorder failure imagery was being acquired. Cloud cover obscured all views of the island of imagery analyzed to date. Pre-eruption imagery exists of Heimaey, thus the objectives of the volcanic eruptive products experiments can be exceeded if the island is visible in any post-eruption imagery. Heimaey was imaged by the NOAA-2 satellite with the VHRR sensor (both visible and thermal infrared).

(4) Two combination ERTS-B and NOAA-2/Nimbus-V proposals on Iceland were prepared and submitted to NASA by 31 January 1973.

e. Discussion of significant scientific results and their relationship to practical applications or operational problems including estimates of the cost benefits of any significant results (to be prepared in scientific abstract form of 200 words or less):

A binational, multidisciplinary research effort in Iceland is directed at an analysis of MSS imagery from ERTS-1 to study a variety of geologic, hydrologic, oceanographic, and agricultural phenomena. A preliminary evaluation of available MSS imagery of Iceland has yielded several significant results - some of which may have direct importance to the Icelandic economy. Initial findings can be summarized as follows: (1) recent lava flows can be delineated from older flows at Askja and Hekla; (2) MSS imagery from ERTS-1 and VHRR visible and infrared imagery from NOAA-2 recorded the volcanic eruption on Heimaey, Vestmann Islands; (3) coastline changes, particularly changes in the position of bars and beaches along the south coast (e.g., north and west of Ingólfhöfði), are mappable; (4) areas covered with new and residual snow can be mapped, and the dark appearance of newly fallen snow on ERTS-1, MSS band 7 appears to be related to melting; (5) sediment plumes from the discharge of glacial rivers along the south coast can be delineated; (6) the area encompassed by glacial ice (ice caps, valley and outlet glaciers, etc.) can be mapped, including the new position of a surging glacier, Eyjabakkajökull, and such related phenomena as nunataks and moraines; (7) the plotting of changes in position of rivers, changes in size of lakes, and the occurrence of new lakes are feasible; (8) low sun-angle imagery, particularly of snow-covered terrain, markedly enhances the morphologic expression of constructional glacial and volcanic landforms, thus permitting the mapping of previously unrecognized structural features such as central or subglacial volcanoes; (9) the MSS color composites permit regional mapping of the distribution of vegetation in Iceland and its change with time; and (10) at least at 1:250,000 map scale and smaller, ERTS-1 imagery provides a means of updating various types of maps of Iceland and will permit the compilation of special maps specifically aimed at those dynamic environmental phenomena which impact on the Icelandic economy. (3C, 3I, 3K, 4G, 4H, 1C, 2D, & 10A)

- f. A listing of published articles, and/or papers, pre-prints, in-house reports, abstracts of talks, that were released during the reporting period:

Papers Published

- (A) Williams, R. S., Jr., 1972, Satellite geological and geophysical remote sensing of Iceland (abs.): in Summaries of Eighth International Symposium on Remote Sensing of Environment, Univ. of Mich., Ann Arbor, Mich., p. 146-147.
- (A) Williams, R. S., Jr., 1972, Satellite geological and geophysical remote sensing of Iceland (abs.): in Proc. Eighth Int. Symp. on Remote Sensing of Environment, Univ. of Mich., Ann Arbor, Mich., p. 1465-1466.
- (A) Williams, R. S., Jr., Bödvarsson, Á., Friðriksson, S., Pálmason, G., Rist, S., Sigtryggsson, H., Thórarinnsson, S., and Thórsteinsson, I., 1973, Satellite geological and geophysical remote sensing of Iceland - preliminary results from analysis of MSS imagery (abs.): in Abstracts, Symposium on Significant Results Obtained from ERTS-1, NASA, Goddard Space Flight Center, Greenbelt, Md., p. 36.

Papers In Press

- (P) Williams, R. S., Jr., Bödvarsson, Á., Friðriksson, S., Pálmason, G., Rist, S., Sigtryggsson, H., Thórarinnsson, S., and Thórsteinsson, I., 1973, Satellite geological and geophysical remote sensing of Iceland - preliminary results from analysis of MSS imagery: in Proceedings of Symposium on Significant Results obtained from ERTS-1, NASA, Goddard Space Flight Center, Greenbelt, Md., (in press).

Presentations

- Williams, R. S., Jr., 1972, Satellite geological and geophysical remote sensing of Iceland: Eighth Intl. Symp. on Remote Sensing of Environment, Univ. of Mich., Ann Arbor, Mich., 6 October.
- Williams, R. S., Jr., 1973, ERTS-1: A New Window on Our Planet: Lecture presented at University of Iceland, Reykjavík, Iceland, 13 February.

Williams, R. S., Jr., Böðvarsson, A., Friðriksson, S., Pálmason, G., Rist, S., Sigtryggsson, H., Thórarinnsson, S., and Thórsteinsson, I., 1973, Satellite geological and geophysical remote sensing of Iceland - Preliminary results from analysis of MSS imagery: Symposium on Significant Results Obtained from ERTS-1, NASA, Goddard Space Flight Center, Sheraton Motor Inn, New Carrollton, Maryland, 7 March.

Williams, R. S., Jr., 1973, Kirkjufell volcanic eruption, Heimaey, Vestmann Islands, Iceland: Lecture presented at EROS Program "Brown Bag Forum," U. S. Geological Survey, Matomic Bldg., Washington, D. C., 28 March.

Williams, R. S., Jr., 1973, Kirkjufell volcanic eruption: Destruction of the town of Vestmannaeyjar: Lecture presented to Herra and Frú Haraldur Kröyer, Icelandic Ambassador to the United States, Embassy of Iceland (Residence), 2443 Kalorama Road, Washington, D. C., 29 March.

Williams, R. S., Jr., 1973, Geology and geomorphology of Iceland: Land of fire and ice: Lecture presented as part of Barbour-Schramm Memorial Lectures, Department of Geology, University of Nebraska, Lincoln, Nebraska, 9 April.

Williams, R. S., Jr., 1973, ERTS-1: A new window on our planet: Lecture presented as part of Barbour-Schramm Memorial Lectures, Department of Geology, University of Nebraska, Lincoln, Nebraska, 9 April.

Williams, R. S., Jr., 1973, Kirkjufell volcanic eruption: Destruction of the town of Vestmannaeyjar: Lecture presented to Department of Geology, University of Nebraska, Lincoln, Nebraska, 10 April.

Williams, R. S., Jr., 1973, Geological remote sensing: Lecture presented as part of Barbour-Schramm Memorial lectures, Department of Geology, University of Nebraska, Lincoln, Nebraska, 10 April.

New Releases

*Photos/Text (U.S. Geological Survey)

1. Pre-Eruption View of Icelandic Volcano (24 January 1973)
2. Site of Icelandic Volcano [Oblique Aerial Photo] (24 January 1973)
3. Site of Icelandic Volcano [Vertical Aerial Photo] (2 February 1973)
4. Iceland Volcano Eruption Shows Up On Space Image [NOAA-2] (2 February 1973)
5. View of Iceland Volcano From Space [NOAA-2] (2 February 1973)
6. Iceland Volcano Eruption On Space Image [NOAA-2] (2 February 1973)
7. Plan Satellite Experiment for Iceland Volcano [ERTS-1 and NOAA-2] (2 February 1973)

*Available from U.S. Geological Survey Information Office, Washington, D.C. 20244, ATTN: Frank H. Forrester (202-343-4646)

*Text/Photos (U.S. Geological Survey)

Iceland Helped by Space Imagery (10 April 1973)

Newspaper Article (Based on interview and scientific lecture)

Morgunblaðið (Reykjavík Daily Newspaper), 14 February 1973, p. 3,
"Icelandic Research from Satellite."

- g. Recommendation concerning practical changes in operations, additional investigative effort, correlation of effort and/or results as related to a maximum utilization of the ERTS system:

It is hoped that the loss of the video tape recorder will motivate NASA to modify the Madrid (Spain) and other overseas tracking stations to receive ERTS-1 imagery of foreign areas. Although there is considerable research to be carried out with available ERTS-1 imagery of Iceland, two additional experiments in the discipline of cartography are being developed and will be tested and reported on during the next reporting period.

- h. A listing by date of any changes in Standing Order Forms:

N/A

- i. ERTS Image Descriptor Forms:

Two forms provided as attachment to this report.

- j. Listing by date of any changed Data Request Forms submitted to Goddard Space Flight Center/NDPF during the reporting period:

Because of the late contractual start date all 1972 ERTS-1 imagery of Iceland was individually ordered on separate Data Request Forms which were submitted to Arthur Fihelly on 4 January 1973, 26 January 1973, and 20 April 1973.

*Available from U.S. Geological Survey Information Office, Washington, D.C. 20244, ATTN: Frank H. Forrester (202-343-4646)

ERTS IMAGE DESCRIPTOR FORM
(See Instructions on Back)

DATE 1 May 1973

PRINCIPAL INVESTIGATOR Richard S. Williams, Jr.

GSFC IN 079

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D _____
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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1083-12021-5				EEO Caldera Active Volcano EEO Active Glacier (Icecap) EEO Advancing Glacier Braided Stream Fiord Crater Moraine Outwash Plain Snow Volcano EEO Mountain (Móberg) Lava Flows
1083-12021-5B				Rangeland Dormant Vegetation

***FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).**

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1088-12305-4				Snow Volcano (Central) EEO Volcano (Shield) Moraine EEO Nunatak EEO Active Glacier (Icecap) Crater Fiord

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