E77-10055
NASA-CR-149273

LANDSAT Follow-on Investigation 28600[x]

Investigation of LANDSAT Imagery on Correlations between Ore Deposits and Major Shield Structures in Finland

Quarterly Progress Report IV for the Period April-June 1976

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[x]Secondary discipline "Ice Investigation in the Gulf of Bothnia": Attachment A.

(E77-10055) INVESTIGATION OF LANDSAT IMAGERY ON CORRELATIONS BETWEEN ORE DEPOSITS AND MAJOR SHIELD STRUCTURES IN FINLAND Quarterly Progress Report, Apr. - Jun. 1976 (Helsinki Univ.) 14 p HC A02/MF A01 G3/43
N77-14554
Unclas 00055

ABSTRACT

Major linears of LANDSAT winter-image mosaic of Finland have been compared with respective features in morphological and geophysical maps and LANDSAT summer-image mosaic.

CONTENTS

1 INTRODUCTION

In the Baltic Shield several types of important ore deposits and indications of ore are distributed along or near major fracture zones. Owing to glacial drift cover, shallow topography and great width of the zones (up to 50 km) these zones are not easily detected in the field by ground or airborne methods. The purpose of the investigation is to examine the expected advantages of LANDSAT imagery in exploring these structures. The test area for the study represents the central parts of the Shield.

A great number of linears and lineaments of different magnitudes are visible in the LANDSAT images. The most extensive lineaments , however, are observable only in image mosaics. Winter mosaics, particularly, have been found useful in this respect.

A map of the most conspicuous lineaments observed in the LANDSAT winter mosaic over Finland was presented in Progress Report III (Tuominen and Kuosmanen 1976). A revised version of this map is included in the present report (Fig. 2). During the reporting period the work has been concentrated mainly in attemps to study the possible correlations of this lineament map with morphological and geophysical maps.

2 TECHNIQUES

In Fig. 3 of Progress report III (Tuominen and Kuosmanen 1976) the linears were presented as rows of the "in-linear" figures. In Fig. 2 of the present report the high-figure-density parts of these linears were joined by a line symbolizing the axis of the linear. Some linears, not observed earlier, have been added.

The map of LANDSAT linears (Fig. 2) was compared with color-composite pictures (Figs. 3 - 4) made by aid of a 4-channel additive color viewer. Positive and negative B & W films of the bog and water map and a mosaic of the aeromagnetic maps of Finland were used as four different color components. The most informative color combinations of the maps were photographed from the viewer screen. These photographs were used to supervise silk screen printing of analogous color composite maps (Figs. 3 - 4).

Because of additive color production in the viewer and subtractive color production in the printing, the pictures produced in the two ways have unequal colors (no color separation was made for the printig). In Fig. 3 the colors are:

Bog and water map, positive = turkose blue
Bog and water map, negative = monastery blue
Mosaic of aeromagnetic maps, negative = yellow

In Fig. 4 the colors are:

Bog and water map, positive = white

Bog and water map, negative = monastery blue

Mosaic of aeromagnetic maps, negative = violet

Notice that aeromagnetic maps are still not available for some northern and eastern border areas of Finland. Inhomogeneity of the reprints of the aeromagnetic sheets produces sharp E-W and N-S lines in the color composite maps (Figs. 3 - 4).

By superposing the map of LANDSAT linears (Fig. 1) on the color composite maps (F igs. 3 and 4) their correlations become recognizable.

3 ACCOMPLISHMENTS

The winter-image mosaic has been used to find major linear features. The detected new ones are shorter and narrower than the main linears shown in report III (Tuominen and Kuosmanen 1976).

In the following the major linears (Fig. 2) of the LANDSAT winter-image mosaic are called "winter linears" and those of the summer-image mosaic "summer linears".

The winter linears more than 300 km long do not show up in the summer mosaic. The 100-300 km long winter linears freguently appear in the latter as boundaries between areas of different image texture. 50-100 km long winter linears are usually also visible as summer linears. In Fig. 2 this correlation is indicated by a dot on the linear.

Nearly all the winter linears correlate with linears in the bog and water map.

The winter linears seldom show up as continuous linears in the aeromagnetic map. However, short aeromagnetic gradient zones, or breaks and bends of such zones, occur systematically along many of the winter linears. (In Fig. 2 these correlations are indicated by a small open circle).

The linears seen in the bog and water map are often complemented by the aeromagnetic linears. In the color composite pictures (Figs. 4 and 1), where both of these maps are seen simultaneously, the linears thus complemented become more evident. Experiments with various composite maps and pictures are continued.

4 SIGNIFICANT RESULTS

The test of significance of LANDSAT linears is greatly facilitated by color composite pictures, where the

reference data can be seen simultaneously.

On the basis of the test made, it is obvious that practically all the major LANDSAT winter linears found are geologically significant features (Fig. 2). Most of them are chains of bogs, lakes, rivers and cultivated areas covered by ice and/or snow, i.e. unforested linear topographic lows. They hardly admit of any explanation other than that they are extensive fracture zones of the basement.

5 DATA QUALITY AND DELIVERY

The LANDSAT-2 imagery recieved during the reporting period is listed in Table 1. Coverage of the images is presented in Fig. 1.

The author has estimated the cloudiness of the images deviating from what is stated in the standard cataloques or in the standing request processing reports.

6 ACKNOWLEDGEMENT

We thank Mr. Charles Stempfel for printing the color composite maps.

7 REFERENCES

Tuominen, H.V. and Kuosmanen, V. (1976) Investigation of LANDSAT imagery on correlations between ore deposits and major shield structures in Finland. NASA-CR-148204.

8 ILLUSTRATIONS AND TABLES

TABLE 1. List of recieved LANDSAT-2 images by P.I. during April-June 1976 [x]

number in fig.	image ID	clouds % a	b	date acquired	date recieved by P.I.	principal point of image	discipline
36[+]	2407-08434	10		76-03-04	76-04-22	N 65 17 E 030 56	geology
37[+]	2407-08440	0		76-03-04	76-04-22	N 63 56 E 029 37	"
38[+]	2407-08443	0		76-03-04	76-04-22	N 62 35 E 028 34	"
39[+]	2407-08445	0		76-03-04	76-04-22	N 61 13 E 027 26	"
40	2408-08494	10		76-03-05	76-05-03	N 63 54 E 028 03	"
41	2408-08501	0		76-03-05	76-05-03	N 62 33 E 026 50	"
42	2408-08503	0		76-03-05	76-05-03	N 61 11 E 025 43	"
43	2409-08544	20		76-03-06	76-06-18	N 66 38 E 029 33	"
44	2409-08550	20	(40)	76-03-06	76-06-18	N 65 18 E 028 16	"
45	2409-08553	20		76-03-06	76-06-18	N 63 58 E 026 46	"
46	2409-08555	10		76-03-06	76-06-18	N 62 36 E 025 33	"
47	2409-08562	30		76-03-06	76-06-18	N 61 14 E 024 25	"
48[+]	2410-09011		(0)	76-03-07	76-04-22	N 63 55 E 025 22	ice study
49	2410-09013	10		76-03-07	76-04-22	N 62 34 E 024 09	geology
50[+]	2412-09114	0	(20)	76-03-09	76-06-22	N 66 37 E 025 18	"
51	2412-09121	10		76-03-09	76-06-22	N 65 17 E 023 50	"
52[+]	2414-09233	30	(50)	76-03-11	76-05-03	N 65 20 E 021 01	ice study
53[+]	2414-09240	20		76-03-11	76-05-03	N 64 00 E 019 41	"
54[+]	2415-09294	30	(60)	76-03-12	76-06-15	N 64 02 E 018 14	"

TABLE 1. continued

number in fig.	image ID	cld % a	b	date acquired	date recieved by P.I.	principal point of image	discipline
55	2424-08381	10		76-03-21	76-04-22	N 62 43 E 030 07	geology
56	2424-08384	0		76-03-21	76-04-22	N 61 19 E 028 59	"
57	2426-08484	10	(40)	76-03-23	76-06-22	N 65 27 E 029 40	"
58	2443-08432	10		76-04-09	76-05-29	N 62 52 E 028 38	"
59+	2448-09110	20		76-04-18	76-06-18	N 65 37 E 024 12	ice study
60+	2448-09112	10		76-04-14	76-06-18	N 64 16 E 022 50	"
61+	2448-09115	10		76-04-14	76-06-18	N 62 54 E 021 35	"
62+	2449-09162	10	(50)	76-04-15	76-06-22	N 66 55 E 024 10	"
63	2449-09164	10		76-04-15	76-06-22	N 65 35 E 022 41	"
64	2459-08315	20		76-04-25	76-06-22	N 61 32 E 030 29	"

xContinuation to Table 1 in Quartely Progress Report II, Investigation Number 28600

+ Remarks:

No

36,37, 38,39 70 mm positives are lacking

48 discipline is defined 'ice-study' though there is only 5 % sea-area in the image

50,62 70 mm films, band 5 is lacking

52,53,54,59,60,61 only 9'' diapositives exist

cloud cover:

a. given by catalogue

b. estimated by author if contradictory

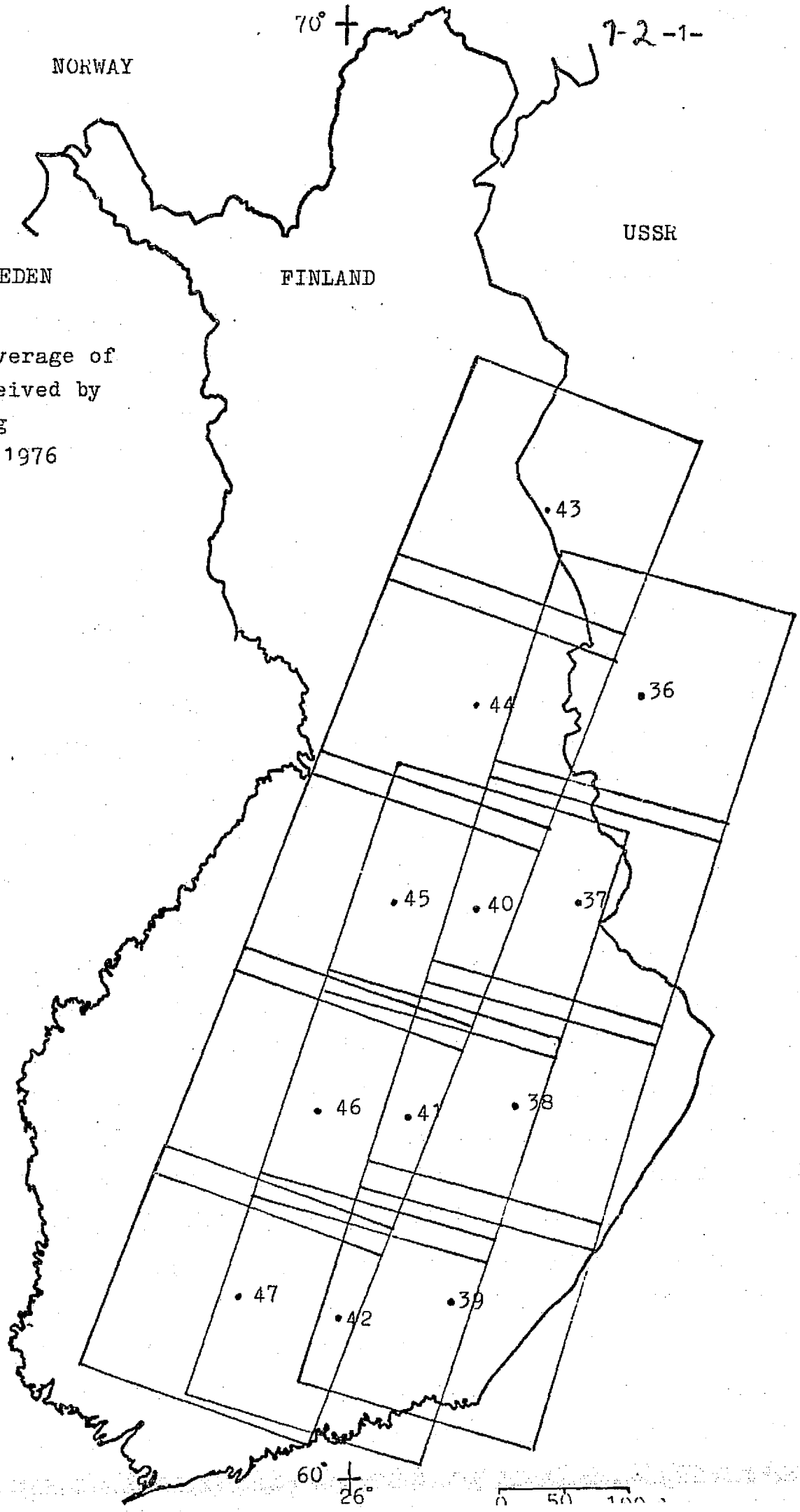


Fig.1. Coverage of images received by P.I. during April-June 1976

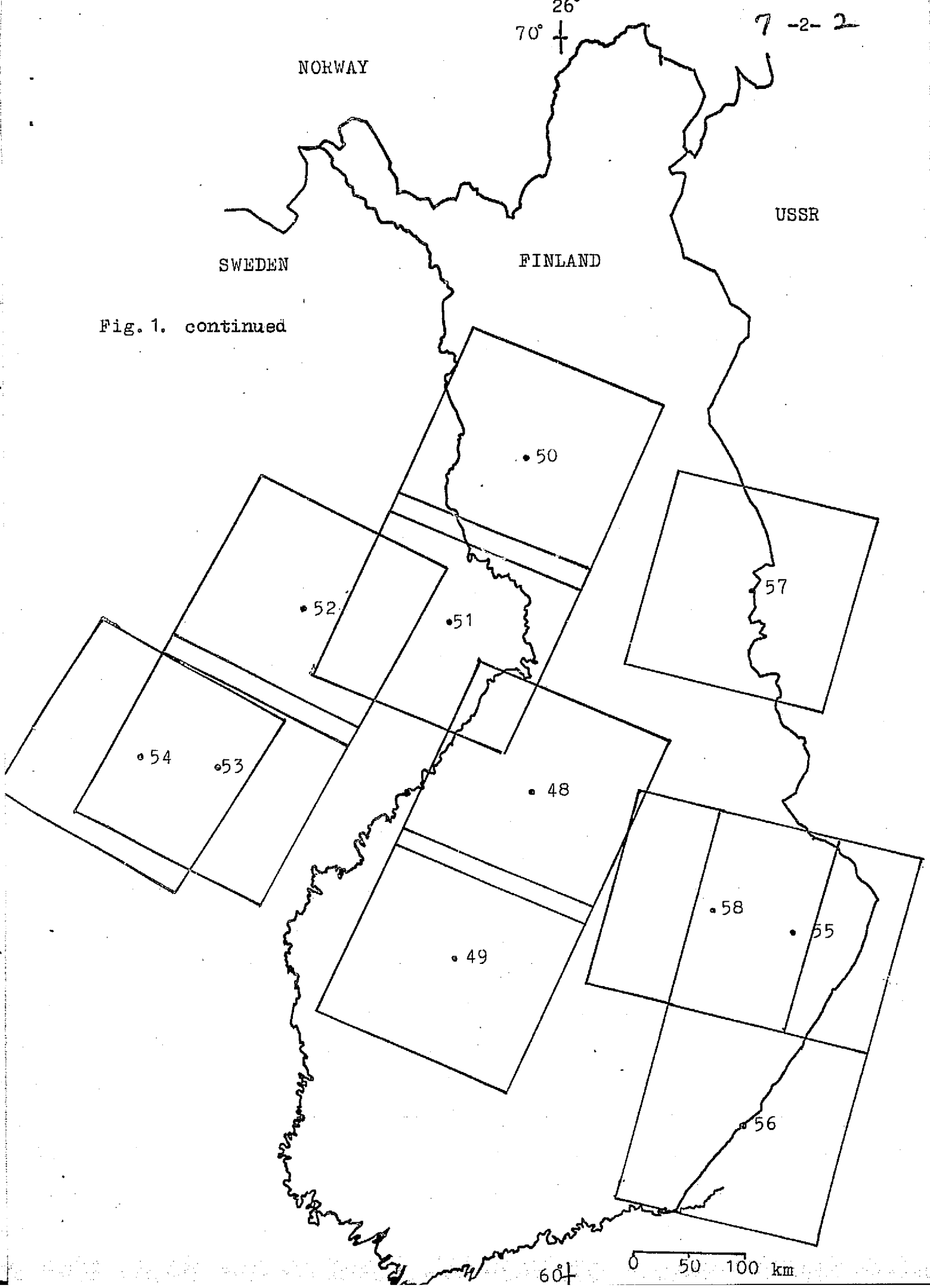
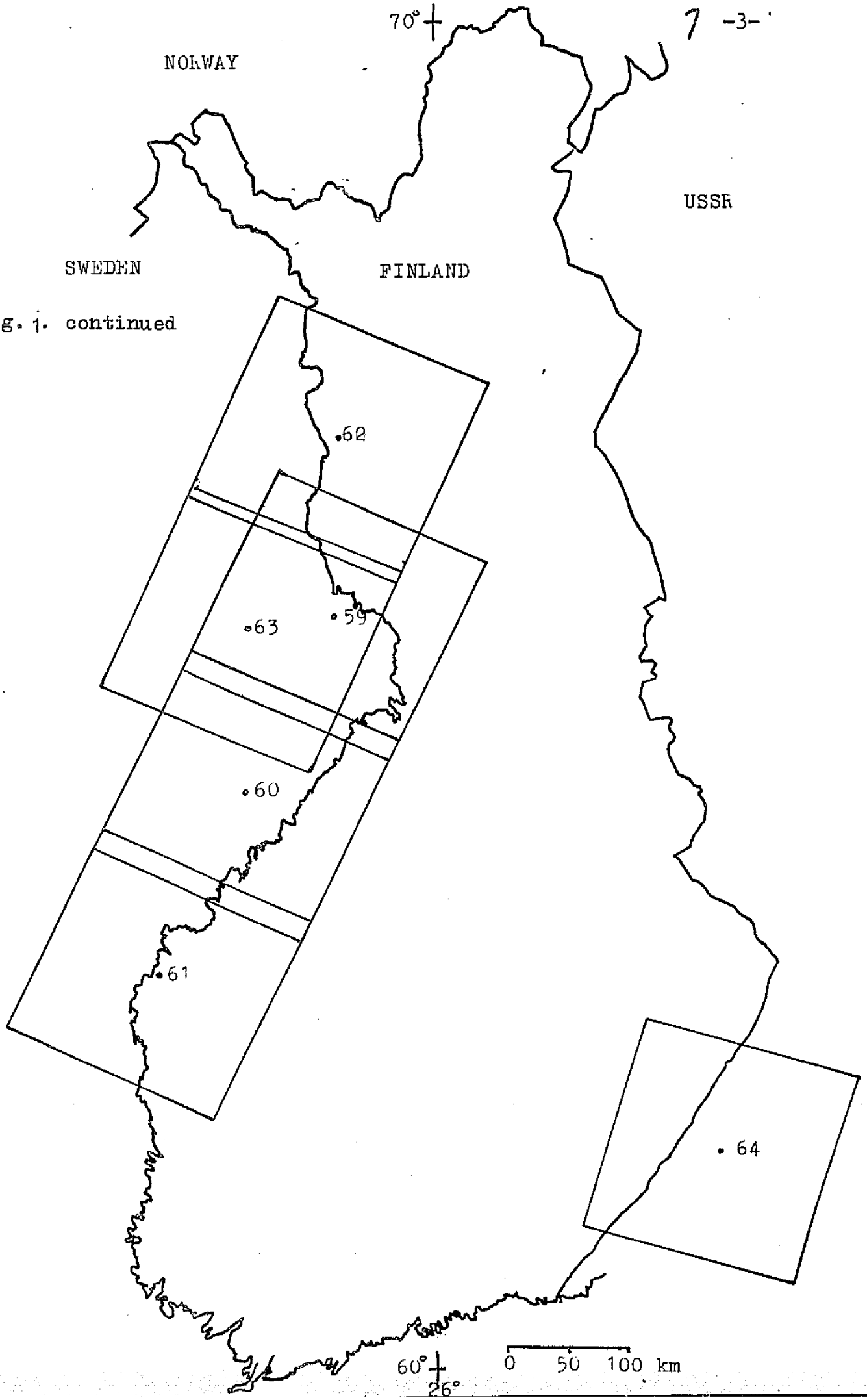


Fig. 1. continued

Fig. 1. continued



Attachment A to Quarterly Progress Report IV,
Landsat Investigation 28600

Ice investigation in the Gulf of Bothnia

The Finnish-Swedish see ice investigation project in the Gulf of Bothnia, called "See Ice 75", has now been completed. For the part based on Landsat-2 data the program was included as a secondary discipline in the Landsat follow-on investigation no. 28600. The investigators report following:

"The information from LANDSAT-2 is of very good quality. The resolution is about 80 m which makes it possible to identify different ice parameters, such as large ice floes and leads. The areal coverage is good enabling large-scale mapping for ice forecasting. However, there are severe restrictions in the availabilty of the LANDSAT information. It is obtained only 2-3 times every 18th day and only on request from NASA."