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LANDSAT Follow-on Investigation 28600x

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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xSecondary discipline "Ice Investigation in the Gulf of Bothnia": Attachment A.
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.

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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 attempts to study the possible correlations of this lineament map with morphological and geophysical maps.
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 printing). 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 (Figs. 3 and 4) their correlations become recognizable.

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 frequently 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 received 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 catalogues or in the standing request processing reports.

6 ACKNOWLEDGEMENT

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


ILLUSTRATIONS AND TABLES
### Table 1. List of received LANDSAT-2 images by P.I. during April–June 1976

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Continuation to Table 1 in Quarterly Progress Report II, Investigation Number 28600

Remarks:
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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
ICE INVESTIGATION IN THE GULF OF BOTHNIA

The Finnish-Swedish sea 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 availability of the LANDSAT information. It is obtained only 2-3 times every 18th day and only on request from NASA."