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MULTIDISCIPLINARY GEOSCIENTIFIC EXPERIMENTS IN CENTRAL EUROPE

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14. Supplementary Notes First data have been made available in Oct. 1972. Therefore no Type I report has been submitted. This report has been prepared in cooperation with the Co-Is: Dr. MÜHLFELD, Prof. KRONBERG, Prof. FÖRSTNER, and Prof. SCHNEIDER. The first results will be presented on the Annual Meeting of the Remote Sensing Group of the German Research Council at Clausthal, W-Germany, on Febr. 2, 1973.

15. Abstract

The first analysis covered three different landscapes and three different disciplines: The lowlands of northern Germany, parts of the hills and basins of central Germany, and parts of the Alps. Geography, Cartography, and Geology are the disciplines involved. New data on structural geology showed new dimensions of fault zones previously unknown. In spite of a thick cover of glacial deposits in northern Germany, traces of important subsurface fault zones could be detected on ERTS imagery.

The results of this report are preliminary.

Preface:

1) The main objectives of the investigations so far carried out are

   - the identification of geographical units
   - a multispectral evaluation of selected scenes under the scope of regional influence of air-pollution
   - an inventary of structural linear elements in the pre-Mesozoic underground of northern Germany
   - identification of surficial geological structures and lithological units

2) After distribution of the material to the Co-Is, investigations with simple optical instruments as e.g. magnifying glasses and mirror stereoscopes, have been carried out in order to analyze the different MSS bands for their suitability. Multispectral evaluations on selected scenes were conducted. Sketchmaps of the main findings were prepared and added to this report.

3) The geographical analysis showed the geographical units known before. However, the gaps between different areas of investigations (on field surveys, map studying, and analysis of aerial photographs) carried out so far had to be interpolated over larger areas. The first analysis of a few scenes seems to prove, that the ERTS-1 imagery can be used to delineate geographical units for the purpose of regional planning. A multispectral survey showed encouraging results on the delineation of larger air-polluted areas in the Ruhr Region and the Rhine-Main Region. In the Alps, vegetation zones and zones without significant vegetation could be separated. In the coastal areas, structures of the submarine surface could be observed.

4) The first analysis shows that to all objectives as described in the submitted proposal, results could be obtained by the material provided through ERTS-1 operations. Most benefits receive studies on morphology, lineation tectonics, coastal processes, air pollution, and partly on lithological analysis of bedrocks.

5) It is recommended to achieve as many data on the site as possible, because weather conditions did not allow a complete coverage of the site so far. It can be demonstrated, that repetitive covering representing seasonal changes will allow to monitor dynamic processes and provide additional data for morphological studies.

1. Introduction

The first high resolution space imagery ever received over Central Europe has been notified by a wider public. Newspapers, radio stations and TV-stations reported several times on the surprisingly good quality of the imagery and on the scientific work which will be carried out with the help of these images.

The first copies arrived in Germany during the month of October 1972, almost 3 months after launch of ERTS-1 and between one and 2 1/2 months after imaging the site. Therefore, no Type I report has been submitted.

Weather conditions were quite favourable for large parts of the country and some frames show almost no cloud coverage. However, these conditions seem to be very rare. Repetitive coverage is almost non-existent. Seasonal changes and their information content could not be studied.

The first quick-look analysis revealed a great number of details mainly related to vegetational pattern. Since the type of vegetation cover is governed by morphology, soil, and bedrock, information on geographical, pedological, and geological units can be derived. A comparison with existent maps showed in some cases an extension of the present-day knowledge (mainly linear structural elements in the Alps and central Germany, partly related to volcanoes of Tertiary and Quaternary age).

When comparing the objectives of the proposal and the first results we feel, that all the objectives can be met in the way as predicted after a certain period of investigation and data collecting by ERTS-1 system.

2. Image quality and interpretability

Channel 4:

Less spacial resolution than channel 6 and 7.
Best registration of haze, fog, thin cloud veils.
Best penetration into water.
At the coast even a thin vegetation cover gives good contrast to bar sand,
Dark tone is almost exclusively limited to forested areas.

Channel 5:

Less spatial resolution than channel 6 and 7.
Good registration of clouds and fog, poor registration of haze.
Less penetration into water than channel 4.
Best contrast between vegetation and bar sand.
Conifer forest and deciduous tree forest appear in the same dark tone.
In addition some phases of field use and field labour appear dark. In comparison with channel 4 the following units can be discriminated:

a) Forested areas
b) Agricultural fields and pastures (typical pattern)

Channel 6:

Good spatial resolution.
No penetration into water.
Sharp contrast between water and land surfaces.
Weak contrast between vegetation and bar sand.
In addition to forested areas and certain types of field use, moist areas, and larger towns appear dark-grey. Deciduous tree forest is not as dark as conifer forest. Pasture land in valleys and on marsh land appears light-grey. In comparison with channels 4 and 5 the following units can be discriminated:

a) Water surfaces
b) Moist areas
c) Pasture land
d) Conifer forest
e) Deciduous tree forest

Channel 7:

Similar to channel 6.
Contrast between water and land is even sharper. Also towns have better contrast. Shadows appear darker than in channel 7, probably due to lower temperatures.

3. Findings of different studies

3.1 Geology

3.11 Coastal Geology of the tidal flats off the western coast of northern Germany and southern Denmark

NASA ERTS E-1043-09590
NASA ERTS E-1043-09583 (Fig. 1)
Dr. P. Hoppe

The imagery was taken during high tide with tidal flats completely flooted. A comparison of channels 4 and 5 with different penetration into water gave information on the morphology of the sea bottom, about to the boundary between tidal flat and deeper sea bottom, which means a water penetration of about 4 m in channel 4. The network of tidal channels could be delineated. A comparison with aerial photographs of about 30 years' age show the possibility of studying changes in the relief of the tidal flats within the range of resolution (70 - 100 m), which may occur in a period of about 10 years. Channels 4 and 5 give good contrast between bar sand and vegetated areas.

3.12 Lowlands of northern Germany

NASA ERTS E-1060-09534 (Fig. 2)
C.I. Dr. R. Mühlfeld

By comparative studies of the channels 4, 5, 6, and 7, examples of the following units could be identified: marshlands, sandy uplands, peatbogs, areas with glacial drainage network. Very subtle indications in the land use and drainage pattern revealed a number of linear structural elements. By comparison with subsurface geophysical survey some of these were found to correspond to mayor fault lines (A - B, Fig. 2) covered with Tertiary and Quaternary sediments of several hundred meters' thickness. The mechanism by which these fault lines mark themselves at the surface is not yet fully understood. Field studies are planned for the coming field season.

Coast of southern Denmark and northern Germany

Parts of NASA ERTS E-1043-09583
NASA ERTS E-1043-09590

4. SEP. 1972

HOPPE, BfB, 1973

0 50 km

LEGEND

- Clouds
- Water, deeper than penetration of channel 4
- Visible seabottom, water covered
- Bar sand above water level
- Land surface, not specified

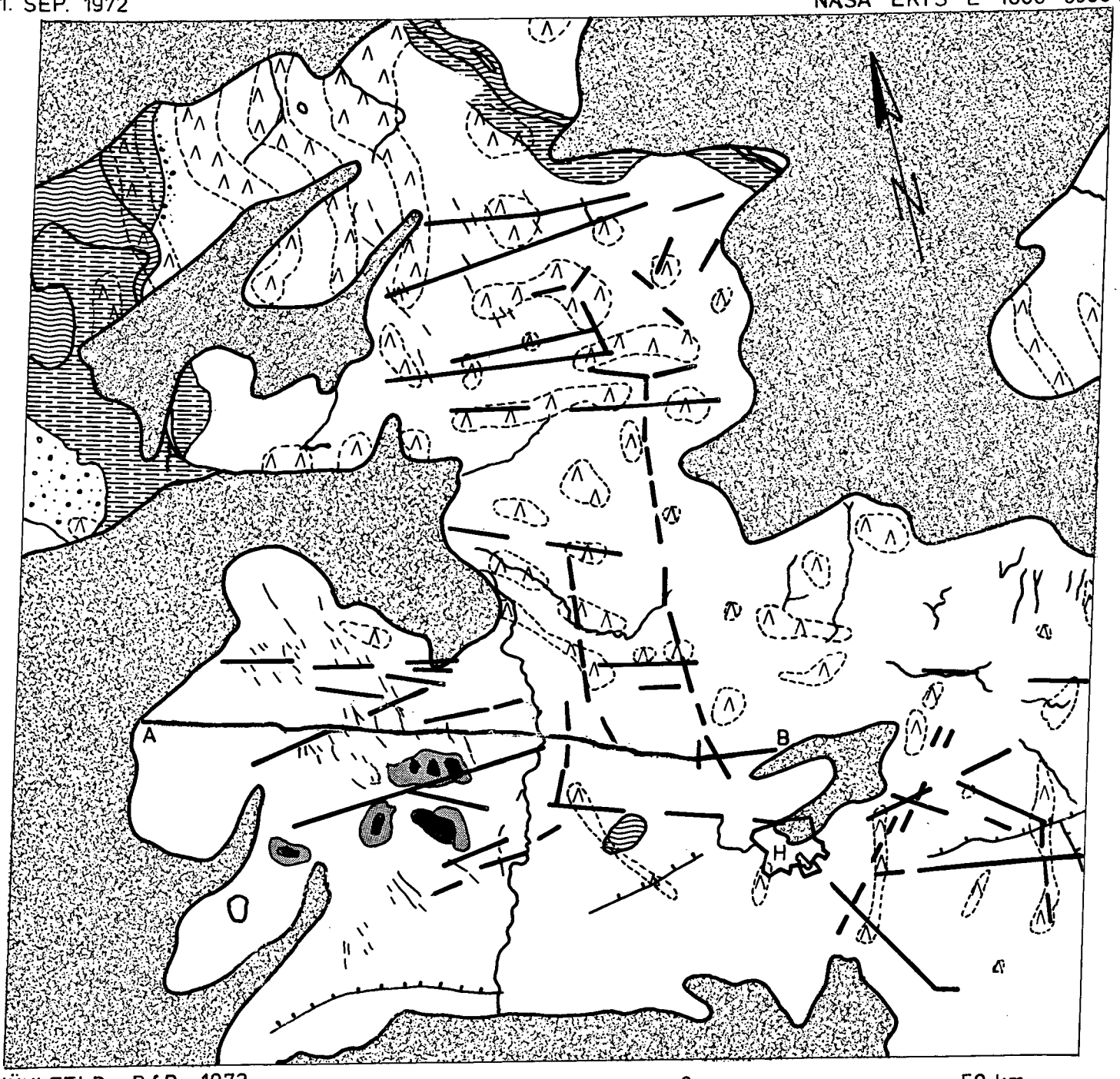
Fig. 1

6 (a)

Parts of NW-German Lowland

21. SEP. 1972

NASA ERTS E-1060-09534



MÜHLFELD, BfB, 1973

0 50 km

LEGEND

- Clouds
- Water surface
- River
- Canal
- Marshlands
- Sandy uplands
- Peatbog
- Glacial drainage network
- Photolineations and faults
- Salt diapirs (from geophysical investigastion)
- H HANNOVER
- A B (Explanation compare with the text)

6(b)

Fig. 2

3.13 Uplands of central Germany

NASA ERTS E-1059-09482

NASA ERTS E-1060-09540 (Fig. 3)

C.I. Prof. P. Kronberg

Mainly from the distribution of conifer forest, deciduous tree forest, and agricultural fields the position of known geological synclines and anticlines can be seen. In some cases lithological units can be delineated (for instance Cretaceous limestone by typical land use, Triassic sandstone by drainage pattern). Information on linear structural elements is much more complete than on the existing geological maps (Fig. 3). In the Eifel Mountains volcanic maars have been found to be positioned along so far unknown structural lines.

3.14 Alps

NASA ERTS E-1039-09381

NASA ERTS E-1021-09380

NASA ERTS E-1060-09554

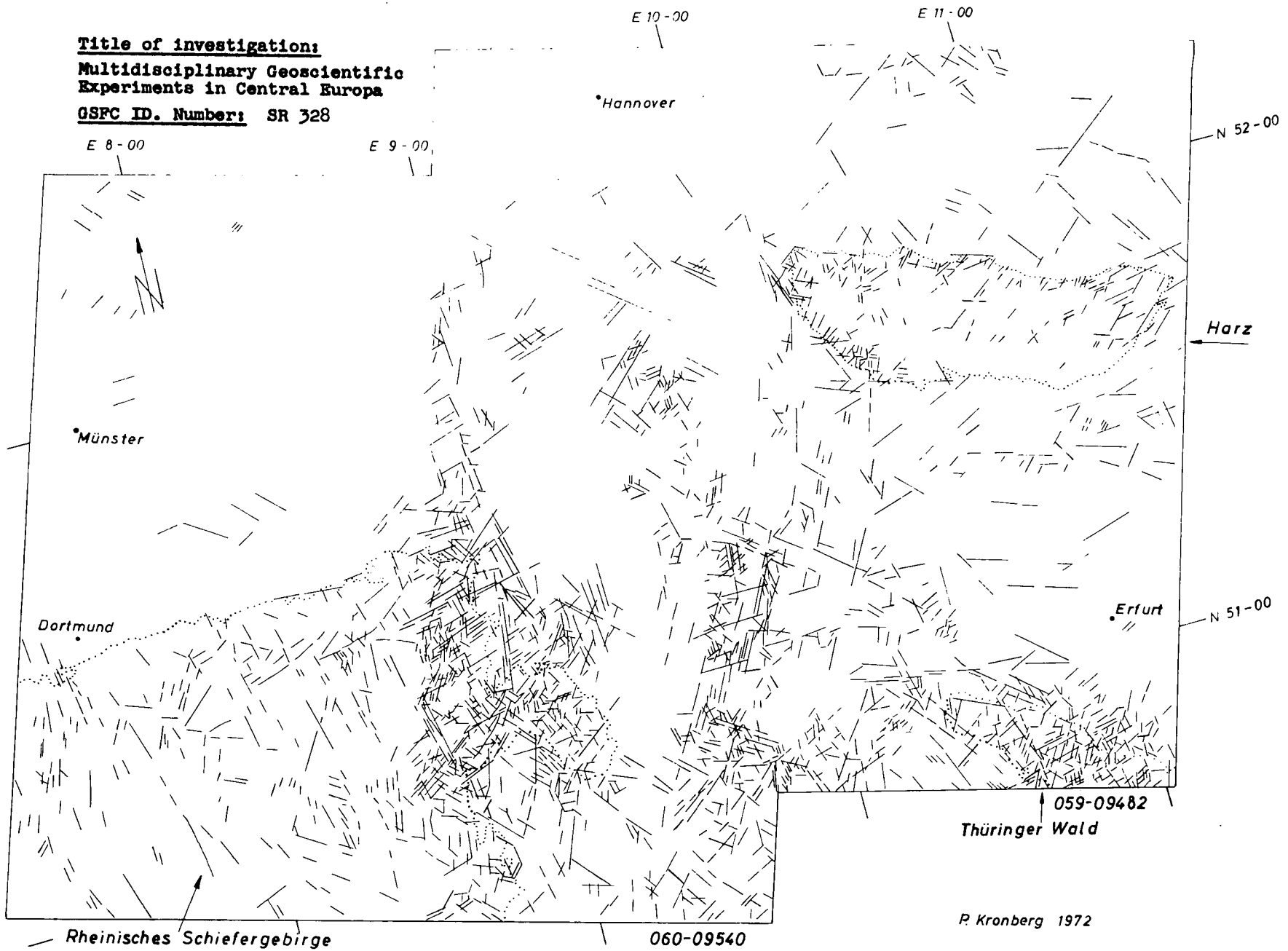
A first look revealed so far unknown major structural elements which can contribute to a better understanding of tectonical events. Also connections between known long lineations are now clearly visible. Different groups will work on these problems, because the wealth of ground truth data already available on most parts of this region has to be incorporated into the investigations.

3.2 Cartography

NASA ERTS E-1060-09543

C.I. Prof. Förstner

A preliminary study of the Rhine-Main region concentrated on the transportation network. Major traffic connections like the Autobahn are visible in large parts.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E 11 - 00
N 52 - 00
N 51 - 00
Hannover
Münster
Dortmund
Erfurt
Harz
059-09482
Thüringer Wald
Rheinisches Schiefergebirge
060-09540
P. Kronberg 1972

Fig. 3

Larger towns, the Rhine-Main Airport, largest airport on the sence, can be clearly identified, even the runways in band 7. MSS-bands 6 and 7 seem to be the best for intensified cartographical studies, due to their good haze penetration.

3. 3 Geography

3. 31 Uplands of central Germany
NASA ERTS E-1060-09540
NASA ERTS E-1060-09543
C.I.: Prof. S. Schneider, M. Bürgener, Dr. H. Schamp

On the basis of land use interpretation and recognition of morphological elements a very detailed subdivision of the area into small geographical units could be achieved. Lakes, valleys and medium- to larger-sized towns can be identified without major difficulties. Perceptibility of traffic network changes from one region to the other. The conditions governing these changes are not yet understood.

3. 32 Environmental studies in the Rhine-Main and in the Rhine-Ruhr Region
NASA ERTS E-1060-09543
NASA ERTS E-1043-09595
Dr. D. Bannert

Both areas are heavily industrialized agglomerations of larger towns. With additive color techniques using an I^2S-Mini Adcol Viewer differentiation between haze and smog could be determined (mainly based on channels 4 and 5). With repetitive coverage origin and spreading of smog can be studied as an aid for regional planning (selection of housing and recreation areas).

4. Program for the next reporting period

During the next reporting time the achieved results will be intensively compared with published literature, especially geological maps. Field studies to control the observations made in the imagery are planned. Incoming new imagery will be analyzed in the same mode. The studies will be extended to the Alps in Austria and Switzerland, where high-quality imagery is available already. A request form will be submitted in the near future to require the tapes for selected scenes to start with playbacks on the computer facilities of the Prakla Company in Hannover.

5. Conclusions and recommendations

The first attempt of evaluating ERTS-imagery of central Europe has confirmed in large parts the anticipated value for geoscientific studies of quite diversified scope. Many known features could be identified on the imagery. But in spite of the thorough state of knowledge in central Europe also a great number of new observations could be made, mainly in the field of linear tectonics. In addition the study of dynamic processes seems to be promising (coastal sedimentation, air pollution). However, for short time survey of sediment transport off the coast better spatial resolution of imagery is needed.

A limiting factor during the investigations was the poor coverage of the test site. Some parts are not covered at all. Repetitive coverage exists only for a few percent of the area, achieved only during a small period of time. Since important results can be expected from the study of seasonal and other environmental changes, the program can only be completed by obtaining additional data through the ERTS B and Skylab experiments. The material

received up to now is not sufficient for a complete assessment of its value for geoschientific studies and practical use in Central Europe with its special conditions with regard to climate, influence of man, and state of research.

We therefore intend to submit a proposal for the ERTS-B data on the basis of the ERTS-A proposal.