Paper G 28

PRELIMINARY RESULTS OF ERTS-INVESTIGATIONS BY W-GERMAN INVESTIGATORS

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INTRODUCTION

This report deals with the results of the following ERTS-proposals.

SR No. 328 "Multidisciplinary geoscientific experiments in Central Europe"
PI: D. Bannert
CIs: J. Bodechtel, F. Fezer, H.-G. Gierloff-Emden, H. Knorr, P. Kronberg, R. Mühlfeld, S. Schneider

MMC No. 330 "Hydrogeological Investigations in the Pampa of Argentina"
PI: D. Bannert
CIs: H. Bender, W. Kruck

For several reasons this is only a preliminary report:

1. Delivery of existing ERTS-imagery was very incomplete until recently.
2. Repeated coverage showing different seasonal conditions is very poor.
3. NASA-processing of 1 : 1 million imagery results in the loss of an important part of the information existing on the tapes. Only recently has processing in Germany reached the point where it is possible to produce 1 : 200,000 scale prints directly from the tape without loss of information.

MULTIDISCIPLINARY GEOSCIENTIFIC EXPERIMENTS IN CENTRAL EUROPE

Original Aims of the Proposal

Geology: Structural and lithological interpretation;
Study of sediment transport in coastal areas.

Pedology: Mapping of soil units in glacially affected areas.

Geography: Study of field patterns and land use, pollution monitoring.

Cartography: Investigation of suitability of space imagery for small-scale map production.

Data processing: Automated map production, sensor calibration.

Results of the Studies

Central Europe is almost completely covered by vegetation. Since the type of vegetation is governed by morphology, soil, and bedrock, information on geological and soil units can only be derived from the type and distribution pattern of the vegetation.

Three main types of vegetation can be discriminated on imagery taken in September 1972 by comparison of MSS bands 4-7; pasture land (light toned in band 6 and 7), coniferous trees (dark toned in all 4 bands), and deciduous trees (light in band 6 and 7, dark in band 4 and 5).

From the distribution pattern of these vegetation types it is possible to identify a number of geological units, marshlands, sandy uplands, river terraces, peatbog, sandstone, and limestone (in part represented in Fig. 1 and 2). These units coincide with typical soil types.

In areas where the vegetation delineates the outcrop pattern of dipping sedimentary rocks, subsurface structure can be inferred.

Two findings resulted from the study of linear tectonic features.

The present knowledge of linear tectonics, especially in mountainous regions of Central Germany and the Alps, could and will be considerably improved. The significance of this improvement for the understanding of the tectonic history of the area will be object of future studies. In the Alps the obvious persistence of long, linear features even through faulted and overthrust zones has impact on the concepts of the mechanism of orogeny.

In the North German Lowlands a linear anomaly was found which corresponded to a major fault buried beneath unfaulted Tertiary and Quaternary sediments (A - B in Fig. 2). A seismic cross-section shows the lineation following the downthrown block (C - D in Fig. 2 and Fig. 3). At the surface the lineation is marked by vegetation anomalies caused by relatively high soil moisture content. Experience in other sedimentary basins would suggest that differential compaction of sediments in the upthrown and the downthrown blocks has caused a slightly greater subsidence in a narrow zone following the downthrown block.

Studies of the tidal flats off the German coast showed the suitability of ERTS-imagery taken during high tide for mapping the topography with better accuracy than existing maps. Sediment transportation could not be studied because neither imagery taken during low tide nor repeated coverage where available.

The study of land use and field patterns resulted in a very detailed subdivision into small geographical units which makes the imagery suitable for regional planning.

The smog of industrial areas could be monitored with additive color techniques. The influence of air pollution on land use was difficult to recognize because of small field size, limited resolution, and lack of repetitive coverage over an extended period of time.

Studies on the preparation of small scale photomaps show an incomplete registration of the traffic network. Possible improvement with recently received imagery taken in different seasons is being investigated.

Experiments with data processing developed ratio-methods which can identify 10 different surface signatures with 90% accuracy. In addition an electron beam recorder was designed which produces imagery without loss of resolution inherent in the system. In the future it will allow more accurate studies than was so far possible with NASA-furnished imagery.

HYDROGEOLOGICAL INVESTIGATIONS IN THE PAMPA OF ARGENTINA

It was proposed to map the distribution of fresh and salt contaminated groundwater mainly by type and pattern of vegetation.

A first investigation of the imagery proved their value for the proposed study (Fig. 4): Areas having patterns of agricultural fields have fresh groundwater. The dark areas indicated with an S are depressions where the water table is so close to the surface that high evaporation results in high groundwater salinity. Narrow elongated depressions without surface drainage called "bajos" collect surface rainfall runoff. The water percolates into the ground and forms fresh water bodies which are mainly used for cattle raising. On the river terraces areas covered by sand dunes are also favorable for the accumulation of fresh groundwater. Tectonic lineations most of them never before observed, also influence the groundwater conditions. They can be mapped readily from the imagery.

As has been checked with data gathered on the ground, the imagery shows all major elements necessary for a reconnaissance hydrogeologic study. The

work will be extended further South into a less known area, to prepare an experimental hydrogeological map based on the results from the ongoing studies.

CONCLUSIONS

The main goals of the investigation were achieved. The studies have given a good idea of the possibilities and limitations of ERTS-imagery depending on the objectives in question and on the geographical conditions of the areas under investigation. Even in the well known region of Central Europe, ERTS has proven its ability of improving our present knowledge. This ability is by no means fully explored. Therefore future coverage is highly desirable. In fields such as pollution monitoring and regional planning the satellite techniques should have distinct practical value. For any regional study of less known areas, the value of ERTS-imagery can hardly be overestimated.

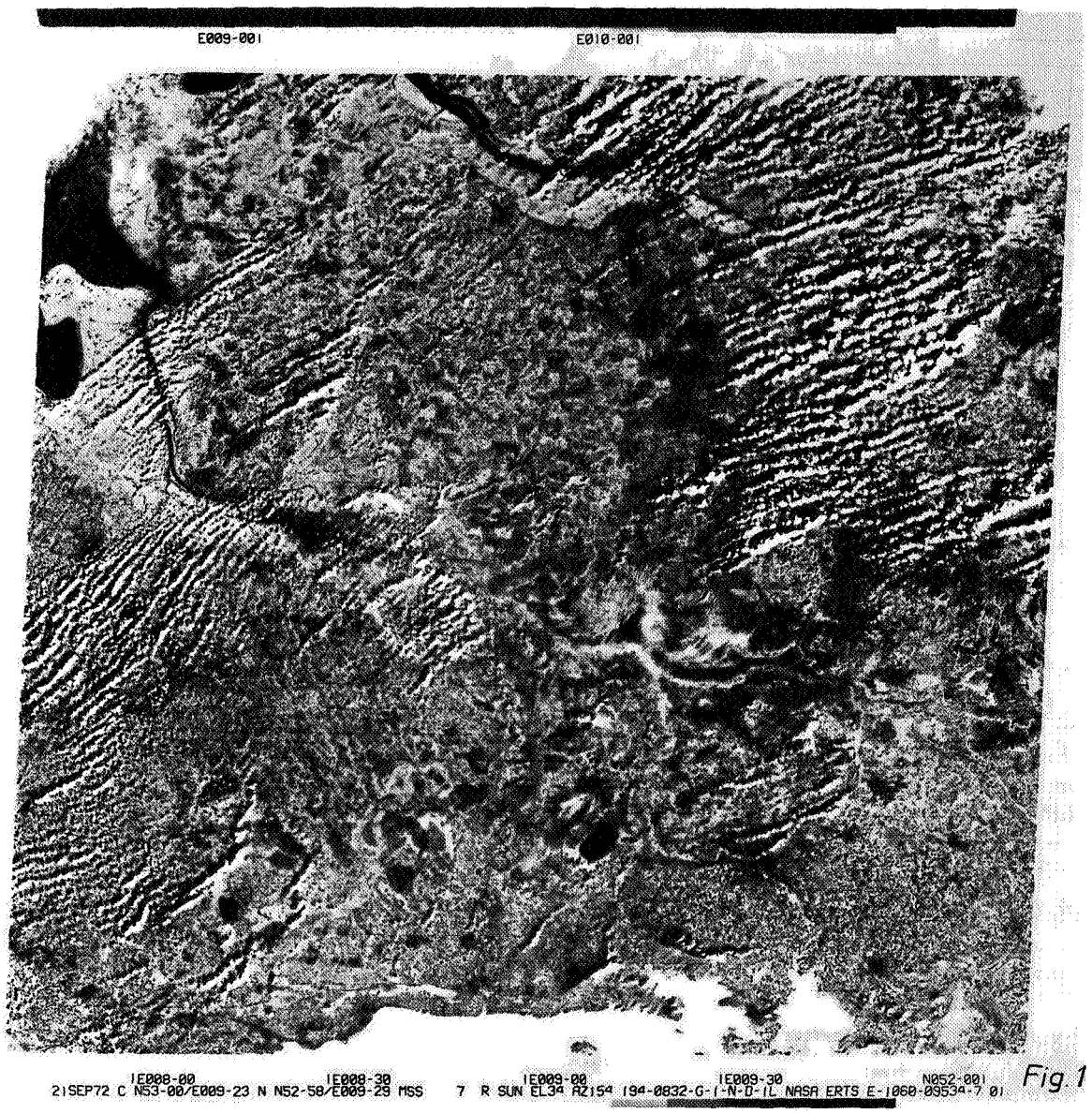


Figure 1. ERTS-1-Image of Parts of NW-German Lowlands

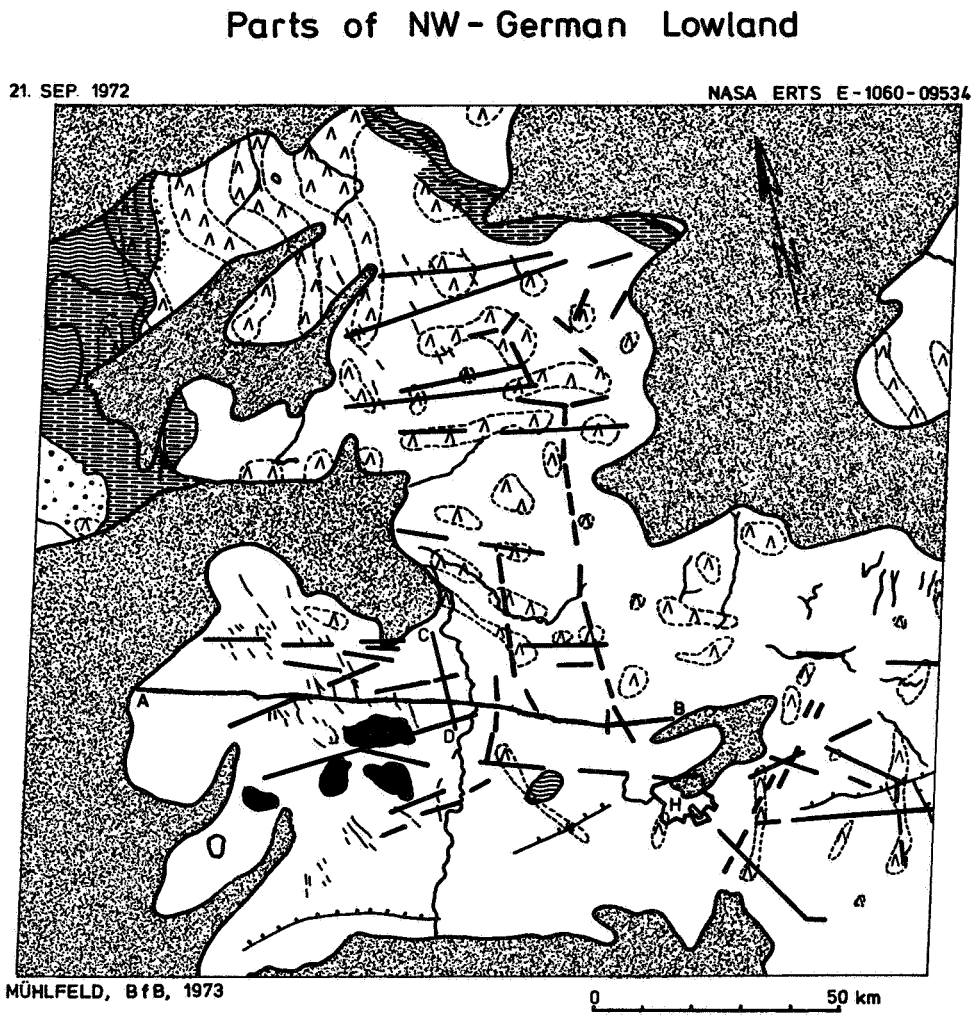


Figure 2. Interpretation of ERTS-1-Image of Fig. 1 Combined With Distribution of Salt Diapirs (After Geophysical Data)

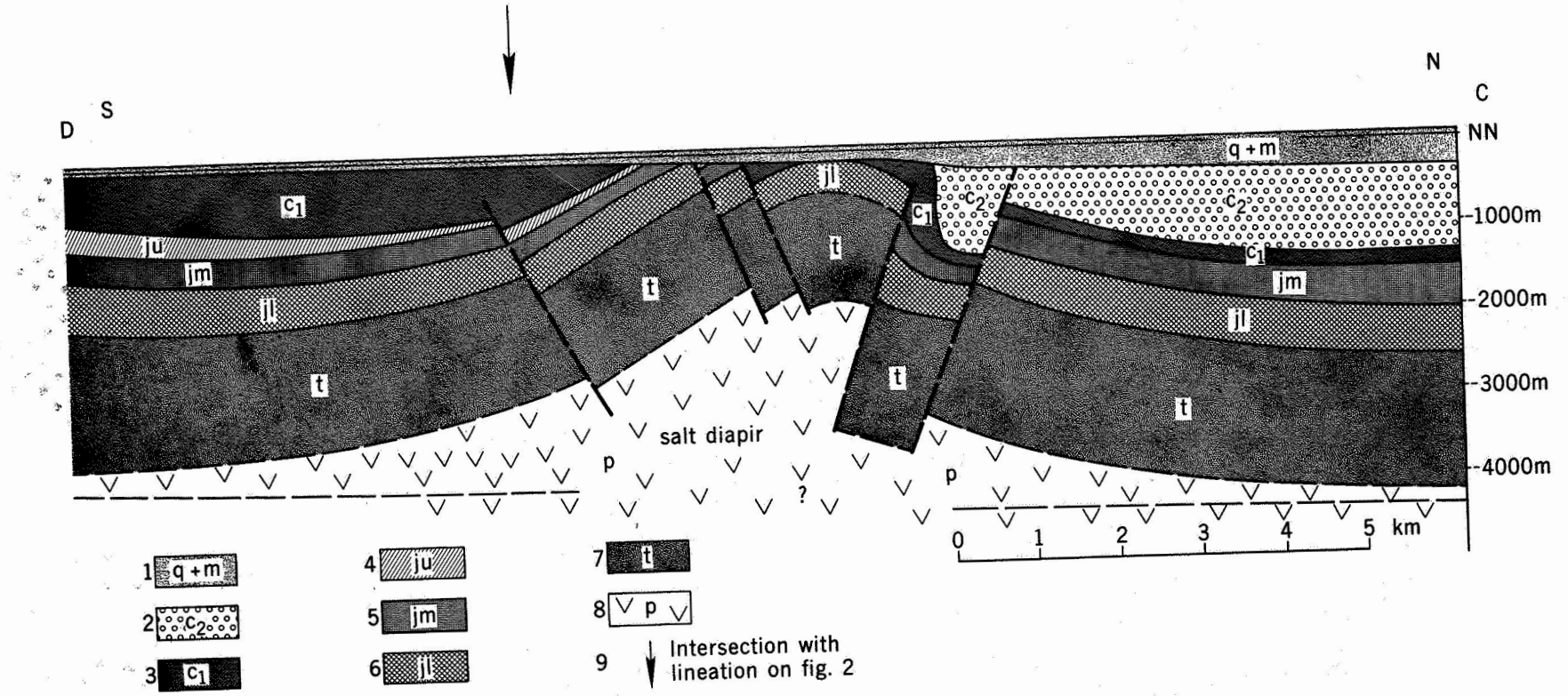
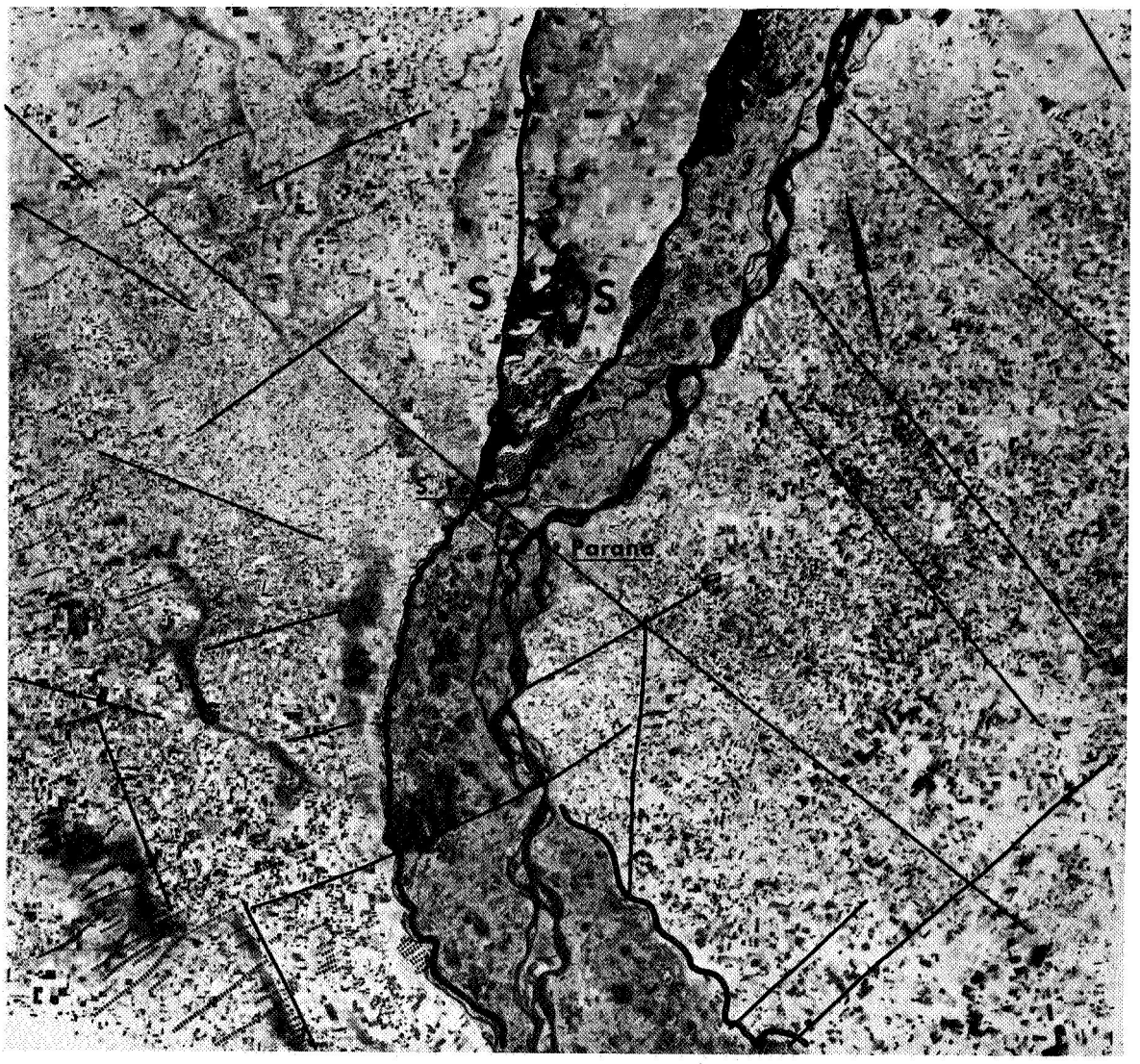


Figure 3. Seismic Section Across Lineation Observed on ERTS-Image Fig. 1



LEGEND

- LINEATIONS
- TERRACE MARGINS
- DUNES
- BAJOS (ELONGATED DEPRESSIONS)
- S AREA WITH HIGH GROUND-WATER LEVEL, SALINE GROUND-WATER

Figure 4. Hydrogeologic Evaluation of ERTS–1–Image of Parts of NE–Argentina