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Quarterly Progress Report, September - November 1974

SKYLAB EREP Investigation 475, Contract Number NAS 9-13406

INTERDISCIPLINARY APPLICATION AND INTERPRETATION OF  
EREP DATA WITHIN THE SUSQUEHANNA RIVER BASIN

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## RESEARCH ACTIVITIES

Mr. Krohn is nearing completion of a study on the relationship between lineaments and mineralized zones, gossans, and fractured and brecciated zones along Bald Eagle Mountain from north of State College to its intersection with the Tyrone lineament (SL4, S190A, Roll 55, Frame 317). This study will be material for a master's thesis; a shorter version is being prepared as an ORSER-SSEL Technical Report.

Compilation of the mineral deposits map of Pennsylvania is continuing, assisted by the release of new mineral localities in open file reports of the Pennsylvania Geological Survey.

Two SKYLAB scenes (SL3, S190A, Roll 44, Frames 30 and 31) are being studied for the relationship of ore deposits to lineaments in the Harrisburg to Bethlehem area, along the Great Valley and the Triassic Basin.

Mr. Kowalik is continuing work on the ore deposits of southeastern Pennsylvania, correlating these statistically with the occurrence of lineaments. He presented a lecture on this study during an ORSER seminar in October.

The state-wide mapping of intermediate length lineaments on an ERTS mosaic base, supplemented by SKYLAB and U2 photography where available, is still in progress. Mr. Schasse, a graduate student in geology, has completed his geological and structural mapping of the Huntingdon area, across the Tyrone lineament; he is currently writing a master's thesis on this work. Dr. Gold has advised in the structural and fracture analysis.

In the study of the applications of SKYLAB and ERTS lineaments to groundwater and engineering problems, the 100 wells previously selected for pumping tests are being ranked according to their location on or off of fracture traces (lineaments less than one mile in length) and fracture trace intersections. This work has been done on aircraft photography, due to the large scale required; however, a similar location inventory, using SKYLAB photographs and ERTS images with lineaments greater than 1 mile in length, has been started. USDA 1:20,000 photographs from 1957 and 1949 are being used for the plots because they are significantly easier to handle and write on than the NASA aircraft support photography for SKYLAB. Their age is not of importance due to the relatively non-changing aspect of the topography - in fact, it may be an advantage in areas which have been built up

in the last 10 to 20 years. However, the aircraft support photography supplied by NASA, with its significantly greater resolution, is being used to verify these plots.

The locations of wells located on and off major lineaments, as seen on SKYLAB and ERTS images, has begun. It is planned that the yields of these wells will be compared statistically for their relationship to position with respect to the lineaments. Despite the wide range in field conditions encountered at each well site in the study area, it is hoped that data points will be sufficiently numerous to permit a relationship to be established. Ideally, data points will be so located as to allow some variables to be held constant (i.e., rock type, topographic setting, dip of beds, etc.) because these variables tend to interact and each enhances well yields to an unknown extent.

An assessment of SKYLAB photography is being initiated by Dr. Weeden, with the assistance of two graduate students (Scott Daelhausen and Charles Kleeman) and an undergraduate student (Gary Hessler). The objective of this study is to establish the level of refinement at which one can determine the physical nature of the terrain from SKYLAB photography (the study may later be expanded to include computer processing of MSS data).

A study guide will be prepared for three geographic areas in Pennsylvania centering around Reading, Harrisburg, and Lockhaven. Each study guide will include a summary statement of the geologic, pedologic, and hydrologic data extracted from the published literature. Following this, a first analysis will be made of scenes from selected orbits. The source data will be from both the S190A and the S190B camera systems, in both original and enlarged forms. Portions of orbit 73, covering an area including Lock Haven and State College, and orbit 44, covering Reading and Harrisburg, will be analyzed. The photo analyst will be using the Bausch and Lomb zoom stereoscope to look at normal color, infrared color, and black and white images. Data will be recorded for each frame studied. The detailed study will be of a selected 26 by 34 mile strip of the area which cuts across the maximum number of terrain types to be encountered.

Following the first study of SKYLAB photography, detailed analysis will be made of aircraft underflight photographs, on file in the ORSER film library, in order to fully exploit the photo-analytic technique for terrain evaluation. Again data will be recorded for each frame studied. Then the analyst will return to the best SKYLAB photographs to ascertain whether additional data could have been recorded. This is a test of whether or not the data was there to be observed if the analyst had been keen enough to perceive it. This second look at SKYLAB photographs should provide the final assessment of their true utility for photo analysis. A final summary statement with supporting documentation will be prepared.

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#### RELATED ACTIVITIES

The ORSER digital data user's manual has been updated to include program modifications designed for the processing of SKYLAB data. This updated manual has been issued as ORSER-SSEL Technical Report 16-74. Another manual, "Storage

and Handling of Satellite and Aircraft Imagery in ORSER," has also been updated and issued as ORSER-SSEL Technical Report 18-74. A copy of this report is appended.

SKYLAB and aircraft photography have become increasingly useful to students, both on the graduate and the undergraduate level. For example, an agronomy professor has reproduced six C130 frames for use in his undergraduate class, and several undergraduates in Landscape Architecture have been using C130 photography for a class project in vegetation analysis. Two graduate students in Landscape Architecture are considering using SKYLAB photography in their thesis projects.

A group of exceptionally talented high school students from throughout Pennsylvania attended the Pennsylvania Junior Science and Humanities Symposium at Penn State. During their two day visit, in November, they saw a slide show and laboratory demonstration, conducted by ORSER personnel, which included SKYLAB photography and methods used for analysis of such photography. The computer terminal was also demonstrated, although digital data from SKYLAB were not available for the demonstration.

Papers were presented by Dr. Gold and by Dr. Parizek, at the Geological Society of America Annual Meeting in Miami Beach, Florida, in November. Dr. Gold presented the paper, "The Surface Geometry of Inherited Fracture Patterns Resulting from Active and Passive Deformation," co-authored by Dr. Melvin E. Podwysocki. An abstract of this paper, issued by NASA as document X-923-74-222, was appended to our Quarterly Progress Report for June - August 1974. An abstract of this paper has also been published in Geological Society of America Abstracts with Programs, Vol. 6, No. 7, p. 758.

Dr. Parizek presented the paper "Coal and Water Resources; Eastern United States." This paper included a discussion of acid mine drainage pollution abatement techniques which might be used for active and abandoned deep and strip coal mines east of the Mississippi River. Also discussed was the nature of lineaments of various sizes as mapped on black and white photos obtained from SKYLAB and aircraft, and on images obtained from ERTS-1, and the evidence that these features are underlain by zones of increased permeability, weathering and solution. It was indicated that mappable features could be used to locate 1) zones of potential mine roof instability, 2) potential blow out zones that can result when mines are flooded above stream grade in an attempt to abate acid mine drainage, and 3) drill sites at which efficient mine dewatering wells can be located to reduce groundwater leakage to underlying mines. The significance of gravity wells and their location at lineament intersections was stressed because these sites should both increase the efficiency of dewatering wells while at the same time increase the efficiency of recharge wells used in the gravity or connector well abatement procedure.

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A similar application of connector wells employing lineament mapping was presented before a water pollution control seminar held at University Park earlier in the summer. This was attended by water works engineers; consulting hydrologists, geologists, and engineers; regulatory agency personnel and mine operators.

In October, Dr. McMurtry gave a talk, "Applications for Remote Sensing in Pennsylvania," at a banquet of the Pennsylvania Earth Science Teachers Society, in Camp Hill. In the same month, Dr. Petersen described "Remote Sensing Activities and Penn State" at the Environmental Monitoring Seminar at the University of Wisconsin. In November, Dr. Petersen gave a seminar to the Soil Science Department at the University of Wisconsin, titled, "The Role of Remote Sensing in Resource Management," and Dr. McMurtry addressed the Pittsburgh Geological Society Meeting on "Satellite and Aircraft Remote Sensing of Earth Resources."

In September Dr. Weeden attended the sessions on remote sensing at the American Congress on Surveying and Mapping, jointly sponsored by ASP and ACSM, in Washington, D. C. He also attended sessions on remote sensing applications to mapping at the meetings of the International Society of Surveyors.

Also in September, Dr. Pennypacker attended the First International Congress of Ecology, The Hague, where he participated in the symposium on Ecological Interpretation of Remote Sensing Data. During this time he visited with Dr. Herman Frinking, of the Laboratory of Phytopathology and Dr. J. C. Zadoks, Dean of the Agricultural University of Wageningen, The Netherlands. Dr. Pennypacker also met with Dr. R. D. Curnow, USDI, Fish and Wildlife Service, Virginia. Dr. Curnow is interested in the applications of remote sensing techniques to wet land game management, and was exploring the possibility of cooperation with ORSER on a project.

Dr. Charles Schnetzler, Head of the Earth Resources Branch of the Earth Survey Applications Division, NASA, Goddard, visited ORSER. Dr. Schnetzler was here to familiarize himself with our office and capabilities, and to explore the possibility of using our data processing system by long distance telephone connection.

#### DATA FLIGHTS AND RECEIPTS

The following SKYLAB related data were received by ORSER during this reporting period:

23 Sept	SL3	S190B	5 inch photography
		S192	5 inch imagery
	SL4	S190A	70 mm photography
		S190B	5 inch photography
4 Oct	SL3	S190A	70 mm photography