View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by NASA Technical Reports Server

Made available under NASA sponsorship
In the interest of early and wide dissemination of Earth Resources Survey Program information and without liability for any use made thereof."

E7.5 10.1.7.8.
CR-142306

Quarterly Progress Report, December 1973 - February 1974

SKYLAB EREP Investigation 475, Contract Number NAS 9-13406

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

Office for Remote Sensing of Earth Resources (ORSER)
Space Science and Engineering Laboratory (SSEL)
Room 219 Electrical Engineering West
The Pennsylvania State University
University Park, Pa. 16802

Principal Investigator: Dr. George J. McMurtry

NASA Technical Monitor: Mr. Martin Miller

March 1974

(E75-10178) INTERDISCIPLINARY APPLICATION AND INTERPRETATION OF EREP DATA WITHIN THE SUSQUEHANNA RIVER BASIN Quarterly Progress Report, Dec. 1973 - Feb. 1974 (Pennsylvania State Univ.) 8 p HC $3.25 CSCL 08H G3/43

N75-20781

Unclas 00178

Quarterly Progress Report

December 1973 - February 1974

SKYLAB EREP Investigation 475
Contract Number NAS 9-13406

Research Activities

A literature survey of base metal mineral occurrences in Pennsylvania continues, and the localities are being plotted according to size, habit, age, and commodity type. The lack of a snow cover has permitted "ground truth" data to be collected along the Bald Eagle ridge west of State College, in the Tyrone area, and in the Huntingdon - Mount Union area.

An area north of Philadelphia has been selected for a detailed study of possible relationships between ore deposits and lineaments. Not only are base metal mineral localities more abundant in this area than elsewhere in the State, but the contrasting tectonic and physiographic provinces, the variety of rock types, and the range in age of "ore deposits," make this a unique testing ground. ERTS-1 imagery and aircraft photography have been used to plot lineaments and other tectonic elements in conjunction with the available geologic maps of the area.

A similar study for "ground truthing" a lineament has been continued along the Bald Eagle ridge, west of State College. The ridge is being sampled at 1/4 mile intervals for "fracture" parameters (breccia, sulfide mineralization, gossan, etc.) and their distribution with respect to the lineaments mapped on ERTS-1, SKYLAB, and aircraft imagery will be studied.

In a related study, a graduate student in Geology has used SKYLAB and ERTS imagery for his research on the distribution and nature of sulfide mineralization in the Mount Union - Huntingdon area. For this purpose, the following scenes are being studied:

U2 flight 73-009, Sensor 12, Frames 0067-0081

SKYLAB 3, Orbit 14, Sensor S190A, Roll 20, Frame 192

ERTS-1 scenes 1045-15243-7, 6 September 1972
1243-15253-7, 23 March 1973

In addition to the mineral deposits correlation studies now taking place, ORSER is involved in ongoing studies of the application of lineaments, observed on SKYLAB and ERTS images, to groundwater exploration and problems in geologic engineering. It has been recognized that prolonged investigations would be required to demonstrate the significance of lineaments to groundwater and foundation engineering investigations because:

1. The width of subsurface structural features causing lineaments to be visible is not known.

2. Direct observation of these structures in heavily forested regions of the humid eastern United States, where soil overburden typically mantles the bedrock, is limited.

3. It is difficult to locate with precision on the ground the lineaments seen on satellite images. Thus a comparison of the performance of known water wells, foundations, mine roofs, etc., on and off lineaments becomes difficult.

Most of the water well records available for study in Pennsylvania that are on file with the Pennsylvania Geological Survey include "hear say" data reported by the well owner or water well contractor. Frequently wells are not located where they are reported to be located, formations penetrated and lithology encountered are not reported or are incorrectly reported, and yield tests are run in such a manner that the decline in water levels required to produce a given yield are not reported.

An alternate source of data may be obtained using well inventory procedures involving a door-to-door survey of well owners. Rarely do the well owners have records or knowledge on their well depth, casing lengths, pump setting, water levels, etc. Still worse, even if they grant permission to conduct pumping tests on their wells, provisions may be lacking to allow drawdown determinations to be made. Many fear that they will run out of water during such tests, hence, the length of the tests is restricted. Other wells lack pumps and require the setting and pulling of test pumps. Contracts for these services, including pump rental with water well contractors, may run between $25.00 to $75.00 per hour, depending upon the pump size used. These costs are prohibitive in view of research budget limitations.

A final data source may be obtained by providing assistance to landowners, towns and industries, either as an extension service or through consulting activities where well sites may be selected, test and production wells designed, and drilling and yield testing services conducted under controlled and supervised conditions. This procedure yields data of high quality but is time consuming, because there is no assurance that a recommended well site will be drilled out. Further, there is no way to assure that well yields will be clustered adequately within any hydrogeological setting to allow statical analysis.

Many factors combine to influence well yields at a particular location (well radius, well depth and diameter, casing length, method of drilling, degree of well development, depth of water table, presence of various changes of rock, dip of beds, topographic setting, rock type, type of fold structure, presence and type of joints, faults, number and type of zones of fracture concentration, etc.). Comparison of yields of but a few wells on or off a lineament will not suffice to establish significant relationships or to determine the magnitude of yield increases. Similar variables influence the depth and extent of weathering, of importance in engineering foundation studies, mine and tunnel roof stability, etc.

The difficulties encountered in establishing ground truth correlation for the lineaments seen on ERTS and SKYLAB scenes are many, and even more problems are associated with determining the usefulness of these features for groundwater and mineral exploration. However, SKYLAB and ERTS have revealed the universality of lineaments as structural features of the earth's crust, and investigations to date indicate their potential significance in resource exploration.

Negotiations have been started with the Pennsylvania Department of Environmental Resources, The Pennsylvania State University, and the Consulting Engineering firm of Skelly and Loy of Harrisburg, to demonstrate the application of lineaments to coal mine pollution abatement. The study is designed to demonstrate that the connector well method of abating pollution is feasible when the selection of well locations is determined by the intersection of a number of lineaments within the mined-out region. Connector wells are gravity drainage wells used to dewater source beds above deep mines located in regional ground-water recharge areas. Lineament intersections mapped on aircraft, SKYLAB, and ERTS-1 scenes will be used to locate the sites of the connector wells in this study.

Land use mapping from ERTS-1 MSS digital data is being accomplished with major verification of the information provided by SKYLAB EREP S190B photography. The photos are being used to provide assurance of training area homogeneity.

SKYLAB photography is proving useful as an important intermediate link between ERTS and aircraft coverage, in determining geologic features such as faults, lineaments, and folds, as well as specific rock types exposed at the surface.

A thermal hot spot seen on SKYLAB photography is being investigated. The hot spot is on the periphery of a large circular feature that appears to coincide with a major magnetic anomaly, and is the location of a hot spring near Shermansdale, Pennsylvania.

Related Activities

A literature survey and investigation has been initiated in an effort to establish the feasibility of installing a color display system in the ORSER laboratory. This system would be capable of displaying the results of standard software developed by ORSER for use on the general purpose computer at Penn State. It is anticipated that this system will be installed with a view toward expansion, with particular emphasis on speed-up procedures for more effective man-machine interaction and direct digitization, display, and enhancement of imagery and photography. All of the design, installation, and evaluation steps will take into account the flexibility, utility, speed, and cost of the display system. If purchased and installed, this system should be a significant tool in the analysis of SKYLAB and other satellite and aircraft data.

We have ordered a Bausch and Lomb Zoom 95 stereoscope unit to facilitate stereoscopic study of SKYLAB photography enlarged to 9 x 9 inches.

ORSER/SSEL personnel were invited in February to give a presentation in Harrisburg concerning the relevance or remote sensing data and analysis to projects of concern to the Commonwealth of Pennsylvania. ORSER considers the field of remote sensing to be in an applied research stage, i.e.,

1. the concept has been proven;
2. some research remains to be done;

3. applications are being sought;
4. remote sensing will not only be an important, but an essential tool in future land use and environmental management.

ORSER/SSEL is thus seeking increased interaction with local, state, and federal agencies for the following purposes:

1. to identify real world problems which may be solved wholly or in part by the use of remote sensing techniques;
2. to acquaint and train agency personnel with remote sensing and its potential applications;
3. to help agencies develop working systems using remote sensing techniques for natural resource, environmental, and land use management purposes.

The presentation was attended by representatives from a host of State agencies. A list of these is appended.

Demonstrations of ORSER facilities and data were conducted at various times during this reporting period for the assistant director of the Pennsylvania Geologic Survey and for representatives of the Pennsylvania Department of Transportation, the Northeastern Economic and Development Council (Avoca), and the Lackawana County Regional Planning Commission. These demonstrations included a first look at the SKYLAB photography just received. The Lackawana County Regional Planning Commission desires to use remote sensing data and analysis in a comprehensive land use planning process.

A paper on "Application of Remote Sensing to Natural Resource and Environmental Problems in Pennsylvania" is being prepared to help acquaint legislators and other potential users of the utility and limitations of remote sensing techniques and systems. Scaling phenomena and digital analysis for land use monitoring are discussed.

ORSER-SSEL Technical Report 9-74, "The Penn State ORSER System for Processing and Analyzing ERTS and other MSS Data," by G. J. McMurtry, F. Y. Borden, H. A. Weeden, and G. W. Petersen, was published in Vol. 3, pp. 697-720, of REMOTE SENSING OF EARTH RESOURCES, University of Tennessee Space Institute, Tullahoma, Tennessee, 1974.

Students in Dr. F. Yates Borden's graduate course in Remote Sensing of Earth Resources have begun using SKYLAB photography as ground truth for their ERTS-1 data processing projects. The potentialities of SKYLAB data analysis were discussed in a laboratory demonstration of ORSER facilities presented for a group of graduate students in geology and related fields. Dr. D. P. Gold gave a talk at the Corl Street Elementary School in State College, on "The Use of Satellites for Looking at the Earth."

A color film entitled "To Water By Air" has been completed in cooperation with the office of Public Information of The Pennsylvania State University and Hornbein-Wood Film Studio of Lemont, Pennsylvania. The film includes references to ongoing studies using recent ERTS-1, SKYLAB and underflight data. The film is designed for public information purposes to stress that

often groundwater is available in large quantities in rocks where previously it was costly or difficult to obtain water on a low risk basis, that new methods using SKYLAB and ERTS data are available to allow for the prospecting and efficient development of these water supplies, and that these avenues of high permeability development may be used in environmental monitoring, groundwater exploration and foundation engineering studies. Scenes within ORSER laboratories are included.

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

C130, Mission 238 (SKYLAB ground truth) - film and thermal IR tapes

C130, Mission 247 (SKYLAB ground truth) - film

SL3, S190A and S190B - 70 mm and 5 inch film, respectively

The 5 inch film is of use in stereoscopic viewing only when each frame is cut out and reversed with respect to the other. Apparently the progression of the film in the camera was opposite to that of the direction of the spacecraft, resulting in reverse orientation of the film frames with respect to one another. Thus, the overlap area needed for stereo viewing occurs on the far side of the neighboring frame, furthest from the scene where the area to be studied is located, instead of adjacent to it, making stereo viewing impossible.

List of Attendees

ORSER Presentation in Harrisburg

February 28, 1974

Harry Simms	DER-Office Legislation & Boards
George E. Fogg	DER-Div. of Outdoor Recreation
William Kutternik	DCA-Flood Recovery Team
W. Roy Newsome, Jr.	DCA Executive Office
Linford Harley	DER Bur. of Operations, Ofc. Res. Man.
Leo D. Sandvig	PennDot Bur. of Mat'ls, Testing Res.
Afton Schadel	DER Bureau of Soils and Water
Joseph J. Ellam	DER Div. Dams and Encroachments
Alan R. Geyer	DER Geologic Survey
William A. Gast	DER Bur. of Resources Programming
Eugene Eisenbise	DER Bur. of Master Planning
Louis Kirkaldie	U.S. Soil Conservation Service
Bruce A. Whyte	N.W.S. N.O.A.A. River Forecast Ctr.-Hrbg.
Donald Meagher	University of Pennsylvania
Sie Ling Chiang	DER, Bur. of Res. Programming
William G. McGlade	DER, Bur. Environmental Master Planning
Gary L. Merritt	DER, Div. of Water Quality
James W. Miller	DER, Mine Drainage Control
Raj N. Chadha	Ofc. of State Planning & Development
Stanley F. Gierlach	Fiscal Management
Dwight D. Worley	DER Div. of Solid Waste Management
Caren Glotfetty	DER Ofc. of Enforcement
Dallas A. Dollase	Dept. of Community Affairs
George Cook	Bureau of Plg. D.C.A.
Spencer C. Ryland	PennDot Dist. 2-0(Clearfield)
W. C. Collins	Bureau of State Parks-Maintenance
Herb Gervin	Financial Mgmt.
J.W. Skovron	Financial Mgmt.
D. M. Lohman	Bureau of Air Quality & Noise
J. E. Barclay	U. S. Geological Survey
C. F. Merk	U. S. Geological Survey

Robert D. Laughlin	Pa. Dept. of Commerce
Michael J. Lokert	Dept. of Earth Sci., Edinboro State College representing NW Regional Planning
Millard L. Haskin, P.E.	Dept. of Environmental Resources Bureau of State Parks
Bruno J. Chiega	DER Comptroller
Jose R. del Rio	DER, Bureau of Water Quality Management
Robert F. Mills	Dept. of Landscape Arch. & Regional Plan. University of Pennsylvania
Fred Wertz	Pa. Dept. of Agriculture
David M. Soulen	Pa. Dept. of Agriculture
John L. Longenecker	Pa. Dept. of Agriculture
Seong H. Kim	Pa. Dept. of Agriculture
Terry Krammes	Bur. Comm. Environmental Control DER
John Fedko	DER, Bureau of Systems Management
G. Kasmarch	OSPD
J. Richard Rombach	Susquehanna River Basin Commission
Charles S. Takita	Susquehanna River Basin Commission