

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

CR-136491

RECOGNITION OF THE GEOLOGIC FRAMEWORK OF PORPHYRY DEPOSITS ON ERTS-1 IMAGERY

John C. Wilson
Kennecott Exploration, Inc.
Exploration Services Department
2300 West 1700 South
Salt Lake City, Utah 84104

January 18, 1974
Type II Progress Report for Period July-December 1973

Prepared for

Goddard Space Flight Center
Greenbelt, Maryland 20771

(E74-10228) RECOGNITION OF THE GEOLOGIC
FRAMEWORK OF PORPHYRY DEPOSITS ON ERTS-1
IMAGERY Progress Report, Jul. - Dec.
1973 (Kennecott Exploration, Inc., Salt
Lake City) 5 p HC \$3.00

CSCL 08G

N74-15033

Unclas

G3/13 00228

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Recognition of the Geologic Framework of Porphyry Deposits on ERTS-1 Imagery		5. Report Date January 18, 1974	
		6. Performing Organization Code	
7. Author(s) John C. Wilson		8. Performing Organization Report No.	
9. Performing Organization Name and Address Kennecott Exploration, Inc. 2300 West 1700 South Salt Lake City, Utah 84104		10. Work Unit No.	
		11. Contract or Grant No. NAS5-21769	
12. Sponsoring Agency Name and Address Goddard Space Flight Center Greenbelt, Maryland 20771		13. Type of Report and Period Covered Type II July-December 1973	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract Three major tectonic provinces have been mapped by geologic photointerpretation of ERTS imagery over the Ok Tedi test site. These areas can be characterized as follows: 1. A broad area of low relief and mature topography suggesting a history of relative tectonic stability. 2. A narrow belt of moderate to high relief, broad open folds and prominent linear features. The Mount Fubilan-type porphyry copper deposits and recent volcanic effusive centers occur in this province. 3. A heterogeneous zone of high relief and high drainage density suggestive of relative structural complexity.			
17. Key Words (Selected by Author(s))		18. Distribution Statement	
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*

*For sale by the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

PREFACE

- a) **Objective:** The investigation is examining the general hypothesis that mineral deposits of the copper/molybdenum porphyry type occur in a characteristic geologic setting which is recognizable in the surface data presented on a space-acquired imagery.
- b) **Scope of Work:** ERTS-1 imagery obtained over six test sites selected to represent a variety of physical environments and ages, as well as a range of "levels of knowledge," are being studied by conventional aerial photo interpretive methods and by the use of optical image enhancement techniques. The compilation of available public and "in-house" information on each site to construct a readiness file has been completed. A "naive" conventional interpretation of imagery over each test site (i. e., without reference to the readiness file) has been accomplished by an outside contractor, Earth Satellite Corporation, the purpose being to compare the information which can be obtained from the imagery with that already known, one method of obtaining a relatively unbiased evaluation. Comprehensive interpretations of the imagery over each test site using all information available, including aeromagnetics and the use of image enhancement techniques to produce a map folio treating magnetic characteristics, metallogenics, lithology, tectonics and hydrothermal alteration have been initiated.
- c) **Conclusions:** Supplementary map information obtained by conventional aerial photo interpretive methods is available from ERTS-1 imagery, chiefly in less vegetated areas. Low sun angle and synoptic coverage are particularly valuable in disclosing previously unrecognized linear features expressed in the topography. A light snow cover enhances subtle linear features.
- d) **Recommendations:** None.

MAIN TEXT

This report covers the progress of the investigation for the period July 1 to December 31, 1973. This period was devoted primarily to documenting the interpretive work done on the six test sites by Earth Satellite Corporation. Their Silverton, Colorado and Ray, Arizona test site reports were completed. A preliminary report on the "naive" interpretation of the Ok Tedi test site was completed by a co-investigator.

Results obtained in the naive geologic interpretation (i. e., interpretation without reference to previous work) of the imagery over the Ok Tedi test site fall into three principal categories: (1) definition of contrasting geologic terrains or tectonic zones (based on differences in structural and/or lithologic character

evidenced by differences in relief, landforms, and/or drainage texture); (2) designation of specific geologic features with unambiguously recognizable geomorphic character (e.g., volcanic features, anticlines and synclines, and major linear "fault zones"); and (3) delineation of a variety of tonal and geometric patterns of unknown character.

Three principal geologic terrains or tectonic zones were distinguished. The southernmost terrain makes up the southern two-thirds of New Guinea between 140 and 144 east longitude (an area in excess of 300 km EW by 200 km NS) and is characterized by extremely low relief, low elevations, and broadly meandering streams. These characteristics suggest terrain I has experienced comparative tectonic stability for a significant period of geologic time, probably tens of millions of years.

The second terrain distinguished lies immediately to the north and is a narrow, west-northwest-trending zone characterized by moderate to high relief, broad open fold and prominent linear structures with mostly west-northwest trends, and a low drainage density. The Mount Fubilan porphyry copper deposit and other porphyry-type prospects occur in this zone.

The third terrain occupies the area north from zone II to the north coast of New Guinea. This is more heterogeneous in character, but is distinguishable from the terrain II on the south primarily by a much higher drainage density, suggestive of a much greater structural complexity. Relief is quite similar to that of terrain II, throughout, except in broad river valleys which are flat and possibly contain abundant alluvial fill. West- to west-northwest-trending structural linears (probable fault zones) are prominently developed near, and closely parallel the boundary with terrain II.

Several volcanic effusive centers of recent age occur in the eastern half of terrain II and appear to be mostly confined to that terrain. However, since these features occur in part on or near presently defined boundaries with terrains I and III, and in part disrupt and conceal the characteristics by which these terrains are distinguished, their designation as a unique feature of terrain II is somewhat tenuous.

A report on the evaluation and calibration of this naive interpretation with existing geologic knowledge is in progress and will be included in a subsequent periodic report.

PRACTICAL APPLICATIONS

It is evident that sufficient geologic information can be developed by naive interpretation of ERTS imagery over relatively unknown areas to outline

permissive areas for subsequent geologic reconnaissance and/or geophysical surveys. This can result in a significant savings in time and money.

PROGRAM FOR THE NEXT REPORTING PERIOD

As with this reporting period, the next period will be devoted primarily to documentation of the interpretive work accomplished. The rough draft of the final report is due mid-April.