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February 10, 1976

Contract NAS 2-7698
MONTHLY PROGRESS REPORT NO. 32
January 1976
Fault Tectonics and Earthquake Hazards in the Peninsular Ranges, Southern California, EREP Investigation 463

NASA-Lyndon B. Johnson Space Center
Technical Support Procurement Branch
Houston, Texas 77058

Attention: Mrs. Ruth Elder, Mail Stop BB631 (B9)

Dear Mrs. Elder:

California Earth Science Corporation (CalESCO) is pleased to submit its 32nd Monthly Progress Report on the application of Skylab imagery to analysis of fault tectonics and earthquake hazards in the Peninsular Ranges, Southern California, under NASA Contract No. NAS 2-7698. The contract has expired. This final monthly report presents a summary of work accomplished under the subject contract and plans for additional publication of the results.

All of the proposed research has been accomplished and advance copies of all parts of the final report have been submitted to the technical monitor. Copies of the final report will be printed and distributed when advance copies are approved by the technical monitor.

MAJOR ACCOMPLISHMENTS

Application of Skylab and Landsat Imagery to Analysis of Fault Tectonics and Earthquake Hazards in the Peninsular Ranges, Southern California

The following reports summarize the results of this phase of the investigation:

Lineaments in basement terrane of the Peninsular Ranges, southern California; Technical Report 74-1, August 1974.

Investigation of lineaments on Skylab and ERTS images of Peninsular Ranges, southwestern California; Technical Report 74-5, December 1974.

Application of Skylab and ERTS imagery to fault tectonics and earthquake hazards of Peninsular Ranges, southwestern California; Technical Report 75-2, July 1975.

Faults and Linears on Skylab and Landsat images of Peninsular Ranges, southwestern California; Part II of Final Report, Skylab EREP 463 Results, January 1976.

The results have also been presented in the following papers and presentations:

Lineaments in basement terrane of the Peninsular Ranges, southern California: presented at First International Conference on New Basement Tectonics, Salt Lake City, 1974, in press in Proceedings Volume.

Faulting in basement terrane, San Diego County, California; in: San Diego Association of Geologists, field trip guidebook, 1975, pgs. 51-55.

Several previously unmapped faults in the Peninsular Ranges were discovered during the investigation. The study demonstrates the usefulness of Skylab imagery in regional fault investigations and contributes to a better understanding of the structure and tectonic history of southwestern California. It is planned to publish the results as a Special Report by the California Division of Mines and Geology.

Study of Indicators of Active Faults in the Salton Trough and Along Garlock Fault, California

The following reports and presentations have summarized the results of this investigation:

Faults on Skylab imagery of the Salton Trough area, southern California; Technical Report 75-1, June 1975; also: Part IV of Final Report, Skylab EREP 463 Results, January 1976.

Active and inactive faults in southern California viewed from Skylab; presented at the NASA Earth Resources Survey Symposium, June 8-13, 1975, Houston, Texas, in Proceedings Volume, NASA TM X-58168, JSC-09930, p. 779-797.

The Garlock fault; an example of the ability of EREP imagery to resolve indicators of active faults; Part III of Final Report, Skylab EREP 463 Results, January 1976.

Based on regional alignment of probable fault-controlled features visible on Skylab images, the following previously unrecognized fault segments are postulated: (1) An extension of a previously known fault in the San Andreas fault set located southeast of the Salton Sea. (2) An extension of the active San

Jacinto fault zone along a tonal change in cultivated fields across Mexicali Valley; the tonal change may represent different soil conditions along opposite sides of a fault. Long segments of previously mapped major high-angle faults are readily identifiable on Skylab images. Along active faults, distinctive topographic features such as scarps, offset drainage, shutter ridges, linear valleys, and linear ridges are visible. The following surface manifestations of ground water blockage in alluvium are also visible along branches of the San Andreas fault: spring alignments, oases, and linear differences in vegetation or land use along or on opposite sides of faults. A large proportion of indicators of recent faulting falls into the range of meters to tens of meters and is therefore resolved by the 190B camera. The 190A camera resolved a large percentage of these features but is less suitable for this purpose.

Study of Enhancement Characteristics of Pseudocolor Images

The results of this phase of the study are summarized in the following report:

> Enhancement characteristics of pseudocolor transformations of Skylab and Landsat images and test charts; Part V of Final Report, Skylab EREP 463 Results, January 1976.

The research indicated that, for the Skylab and Landsat images studied, pseudocolor transformations do not provide sufficient enhancement to justify their preparation. These results were unexpected because the eye can discriminate significantly more colors than shades of gray. Thus, it has been suggested that much smaller density differences and more information could be obtained from a complex black and white image if the grays in the image were transformed to colors in a pseudocolor image. Because of the discouraging results in our analysis of Skylab and Landsat images, the research was redirected toward a study of the ability to recognize simple symbols on charts. The charts were generated by computer graphics with variations in the intensity of symbols and background so that some of the symbols could not be distinguished. High and low contrast black and white transparencies and pseudocolor transformations of the charts were prepared and tests were given to compare the ability to recognize symbols on the original and the pseudocolor images. We were unable

to detect any significant difference in the ability to recognize symbols on either the high-contrast black and white or on the pseudocolor transformations as compared to the original black and white images. In some cases, significantly fewer symbols could be identified on the low-contrast pseudocolor transformations.

It is planned to prepare a summary of the research on pseudocolor transformations for submission to an appropriate scientific journal.

Analysis of Spectral Band Ratio Images of Mojave Mining District

The following reports and presentations have summarized the results of this phase of the investigation:

> Digital enhancement of ERTS and Skylab S-192 multispectral scanner images of the Mojave Desert, California; presented at annual meeting of American Geophysical Union, EOS Trans. AGU, Vol. 56, p. 347, 1975.
>
> Analysis of S-192 imagery of the western Mojave Desert, California; Part VI of Final Report, Skylab EREP 463 Results, January 1976.

The research shows that S-192 spectral band ratio images have promise for the following practical applications: (1) Detection of hydrous iron oxide gossans as indicators of economic mineral deposits, as previously reported for Landsat images by Larry Rowen of the U.S. Geological Survey. (2) distinguishing soils of different age, based on percentage of hydrous iron oxide, (3) distinguishing calcarous, alkaline infertile soils from fertile soils, (4) detection of limestone and marble.

It has been a pleasure to accomplish this research for NASA.

Very truly yours,

CALIFORNIA EARTH SCIENCE CORPORATION

Paul M. Merifield

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