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ERTS-1 APPLIED FOR STRUCTURAL AND MORPHOLOGICAL INVESTIGATIONS CASE STUDIES: (1) LOS ANGELES, CALIFORNIA AND (2) COASTAL PLAIN, NEW JERSEY

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This report addresses itself to a major earth's resources management problem; namely, the application of ERTS-1 imagery for geo-morpho-tectonics, and subsequently seismic-risk, earthquake, and mineral exploration applications.

Case Study No. 1 – Los Angeles, California

ERTS-1 image (MSS color composite of August 10, 1972, E-1018-501, centered at N 34.13/w 118-27), which covers the area from South Los Angeles to the Mojave Desert and from Eastern San Gabriel Mts. to Cuyama Valley and Central Santa Ynez Mts., of the Transverse Ranges, California, was analyzed (fig. 1). This image was studied in conjunction with the following conventional sources: (1) the Los Angeles Sheet of the geologic map of California (1); (2) the map of the Geology of the Central Santa Ynez Mountains, Santa Barbara County, California (2); (3) the geologic map of Transverse Ranges, Southern California (3).

A comparison of ERTS-1 image to the conventional sources indicated the usefulness of the image in studying structural geology.

The following are aspects of the comparisons:

(1) Each conventional source failed to show the Verdugo Mts. lineament, the Simi Hills lineament and the Santa Monica Mts. lineament, all of which bound the San Fernando Valley (fig. 2). These structural lineaments which are seen readily on the ERTS-1 image are apparently the major morphotectonic features in the structural framework of the San Fernando Valley. The image also indicates that Point Dume is the seaward extension of the Simi Hills lineament across the Santa Monica Mts., and that Point Dume represents a post-Cretaceous/early Paleocene geotectonic episode.

(2) Each conventional source fails to show the oval-shaped sedimentary basin between the Simi Hills lineament in the S.E. and the Oakridge fault in the N.W. This oval-shaped unit, which has no physiographic name, since it was not seen yet, is a lithological and structural unit separated from the adjacent region. It is inferred from ERTS-1 image that the Violin Canyon watershed, the upper part of the Santa Clara River system, is the major source of sedimentation in the oval basin.

(3) Neither conventional source showed the major structural element in the Transverse Ranges; namely, the Ventura-Soledad Trough. This structural trough, which is readily seen on the ERTS-1 image, cuts across the Transverse Ranges from Antelop Valley to Santa Barbara Channel. It is believed that Ventura-Soledad Trough is the most seismic part of greater Los Angeles. Newhall, California, the epicenter of the San Fernando Valley earthquake in February 1971, is located on the intersection of the San Gabriel Fault, the Verdugo Mts. Fault, the Simi Hills Fracture Belt and the Ventura-Soledad Trough. This conclusion was derived from ERTS-1 image analysis (fig. 3).

The conventional sources do not show the above mentioned information because they are either overgeneralized or undergeneralized. The geologic map of the Transverse Range Province has only fault lines and rock age distribution and lacks drainage patterns and contour lines. The Los Angeles sheet of the geologic map of California has too much information (road system, railroads, power line, etc.) and makes no distinction between major faults and local faults. ERTS-1 image was found to be a generalized, yet selective, source of information.

Case Study No. 2 – Coastal Plain, New Jersey

ERTS-1 image (MSS color composite of August 17, 1972, E-1024-15071-501 centered at N 40-21/w 073.26), which covers the area from the Palisades, New York-New Jersey to Burlington, New Jersey, and from New Brunswick, New Jersey to the great Pecomic Bay, New York, was analyzed (fig. 4). This image was compared with: (1) the geologic map of New Jersey 1:1,000,000 (4); (2) the geologic map of New Jersey 1:250,000 (5); and (3) selected maps as published in the geology of selected areas in New Jersey and Eastern Pennsylvania (6).

In this case study, too, ERTS-1 image indicated its usefulness in studying the structural geology of the test site region.

The following are aspects of this case study:

(1) The coastal plain is underlain almost entirely by unconsolidated marine and fluviatile clay, silt, sand and gravel of Late Cretaceous and Tertiary Age. Much of this province is covered by Quarternary deposits, particularly in the inner and outer lowlands and the southern one-third of the central upland of the Coastal Plain. The difficulty of mapping the quarternary deposits was recognized a long time ago (Salisbury 1917, 7). He subdivided the Pleistocene deposits into three formations: (from the oldest to the youngest) (a) the Bridgeton; (b) Pensauken; and (c) Cape

May. The major portion of the Pensauken is confined to a 20-mile wide belt whose axis extends from Staten Island, N. Y., south westward to Salem, N. Y. This belt was first seen and traced on the ERTS-1 image. It was suggested that this belt is trough shaped. This trough was only roughly mapped (Campbell and Bascom 1933, 8). It was also concluded that the Pensauken was an alluvial deposit formed by the combined ancestral drainage system of the Hudson River (9), (fig. 5).

(2) The Coastal Plain has potential economic ilmenite sands type ore bodies and other heavy mineral deposits (10). Today several companies mine these and other minerals in the Coastal Plain. Some of the mines can be seen and identified on the ERTS-1 image, such as the mines at Lakehurst, N. J. In order to determine the location of these mineral deposits, the ancient drainage patterns have to be determined. ERTS-1 imagery can be used for the hypothetical reconstruction of ancient drainage patterns (see (1)a on previous page), (fig. 6).

Conventional sources, including field investigation, have been found to be inadequate to supply all the required structural and paleohydrographic information needed.

It is, therefore, concluded that ERTS-1 was found to be an essential supplementary source of information for geologic explorations, much like and even better than space photography from manned spacecraft, and SLR imagery (11).

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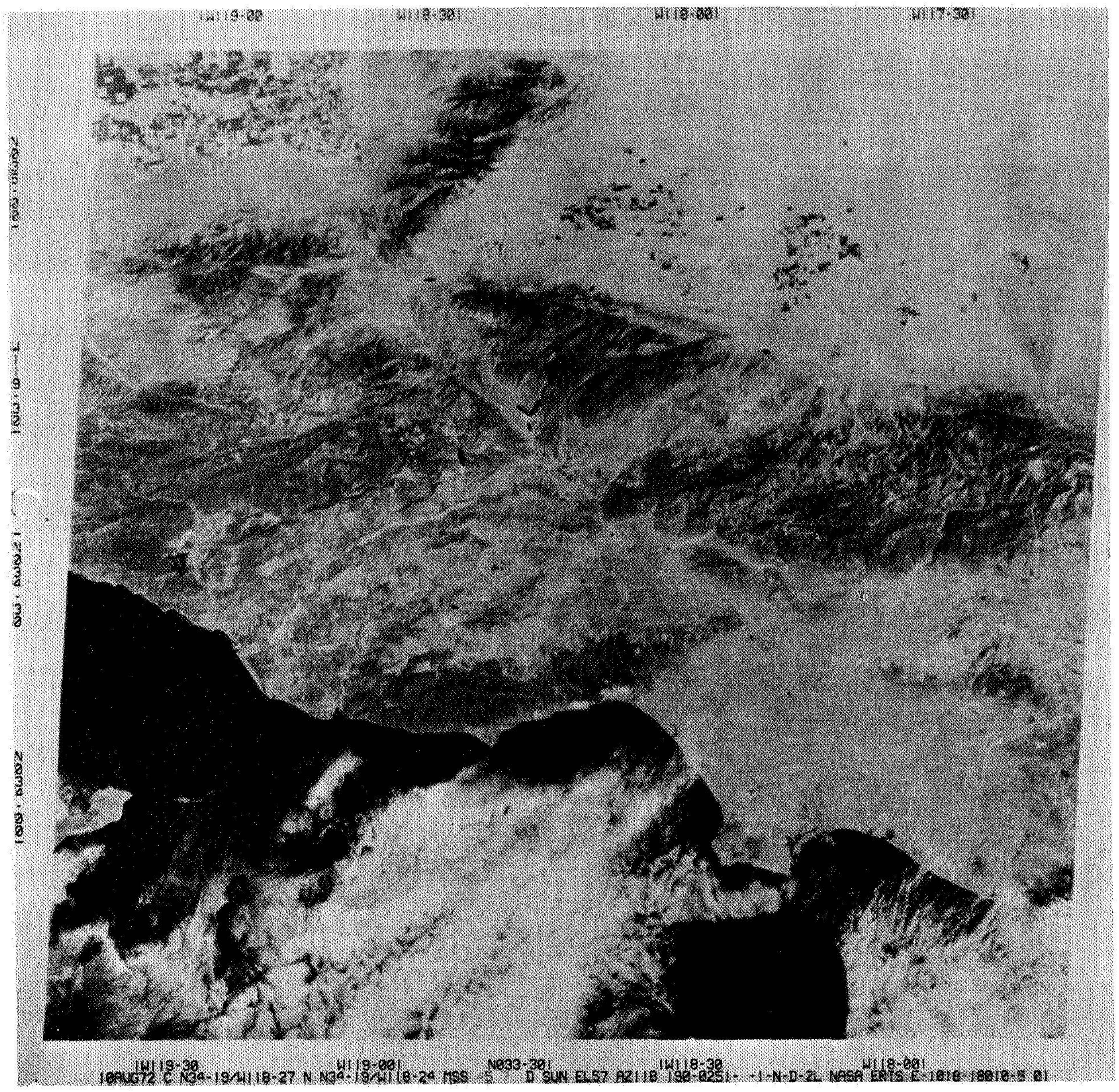

Fig. 1 ERTS MSS Color Composite of August 10, 1972
Centered at N 34.13/W 118.27.

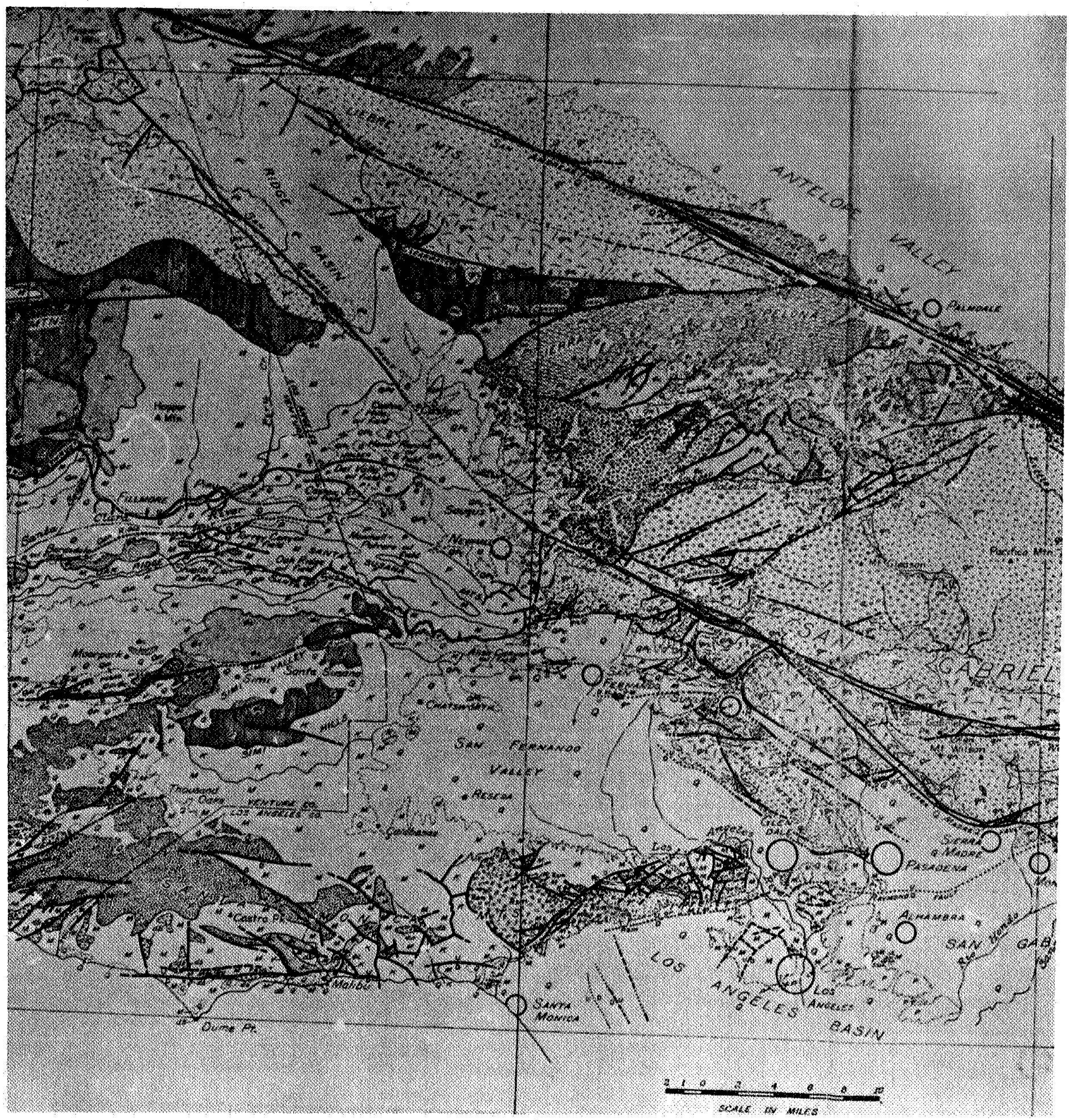

Fig. 2 Geologic Map, Transverse Range Province.

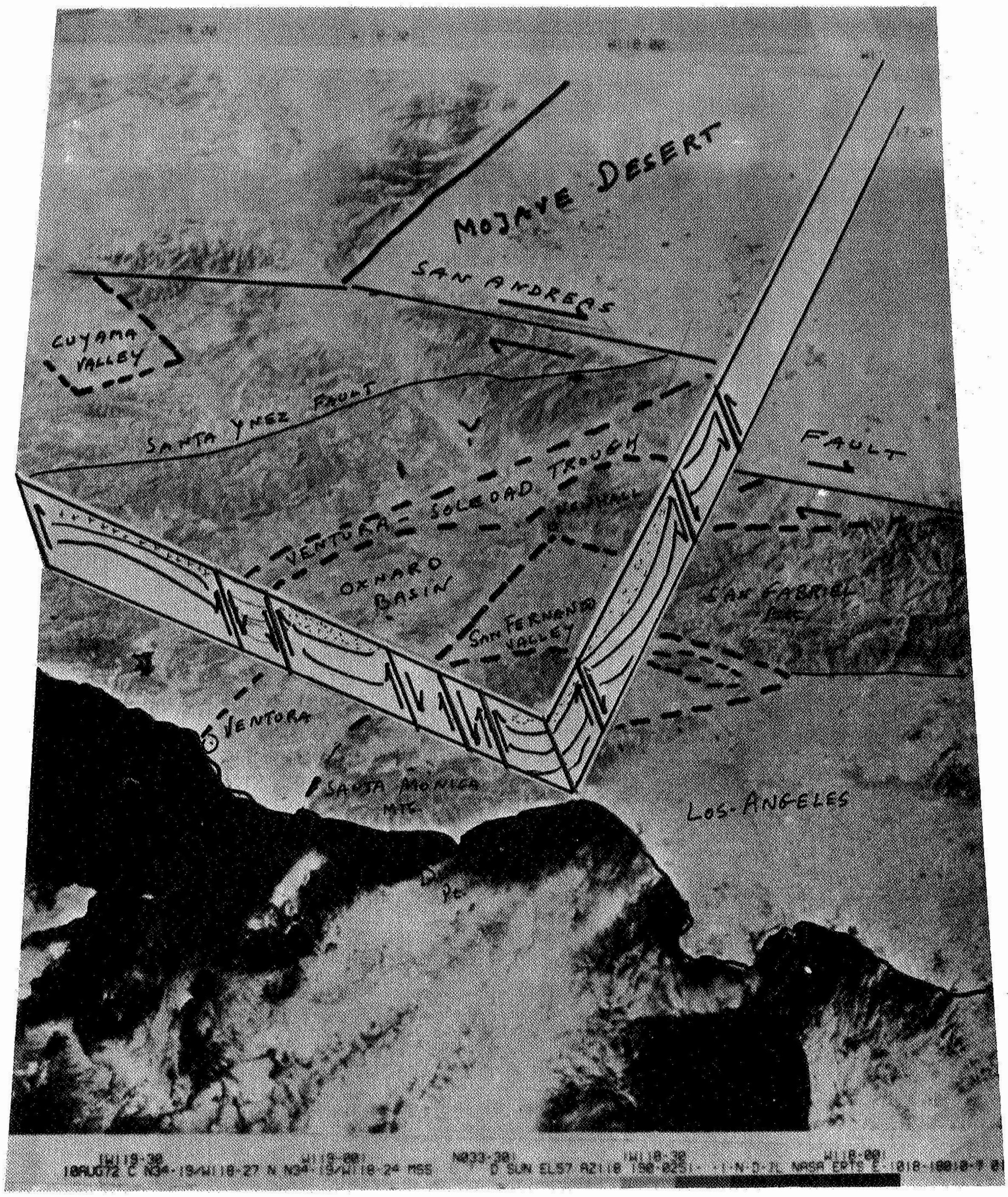

Fig. 3 ERTS-1 MSS Color Composite of August 10, 1972, Structural Analysis (See fig. 1).

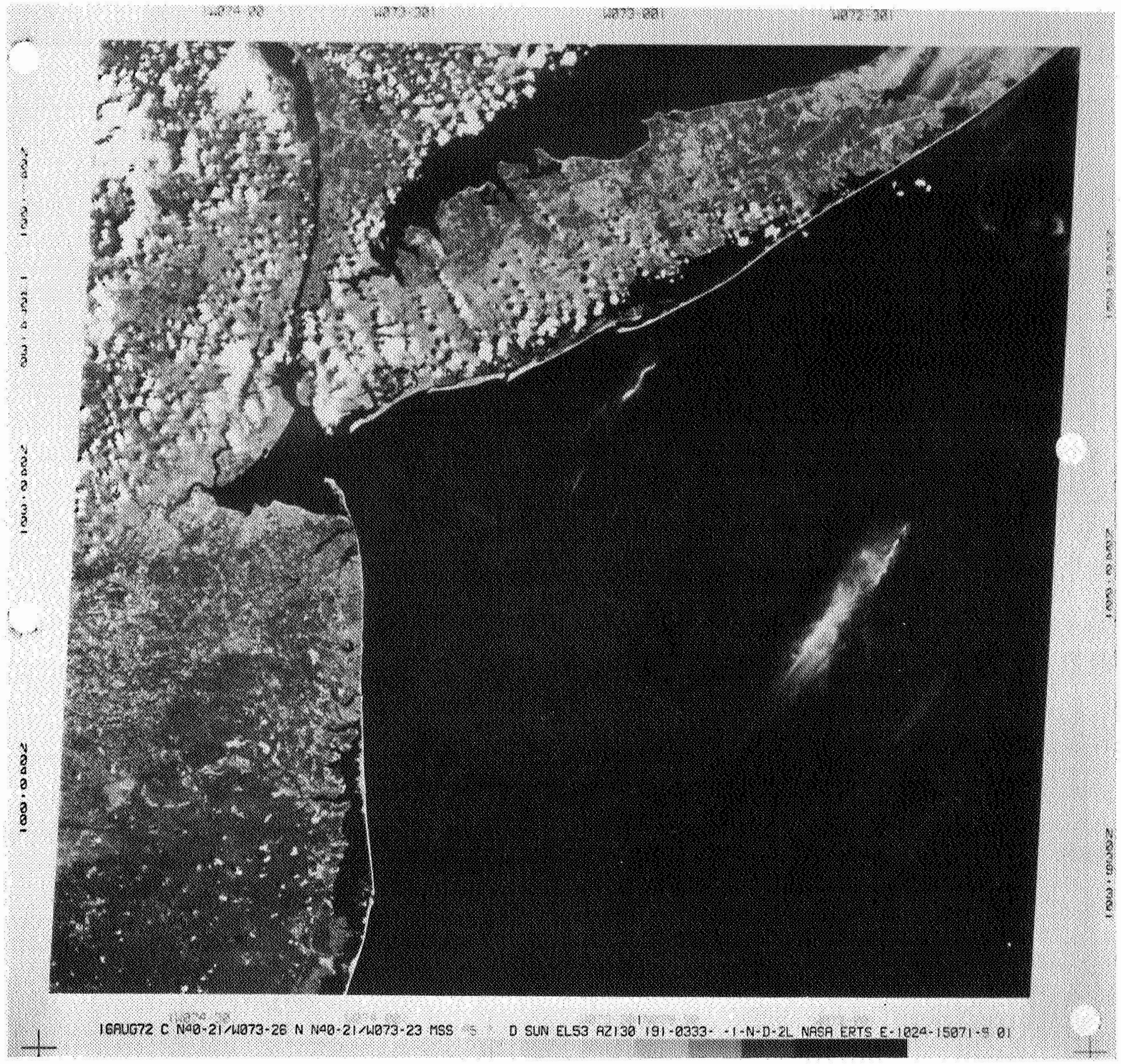

Fig. 4 ERTS-1 MSS Color Composite of August 16, 1972, Centered at N 40.21/W 073.26.

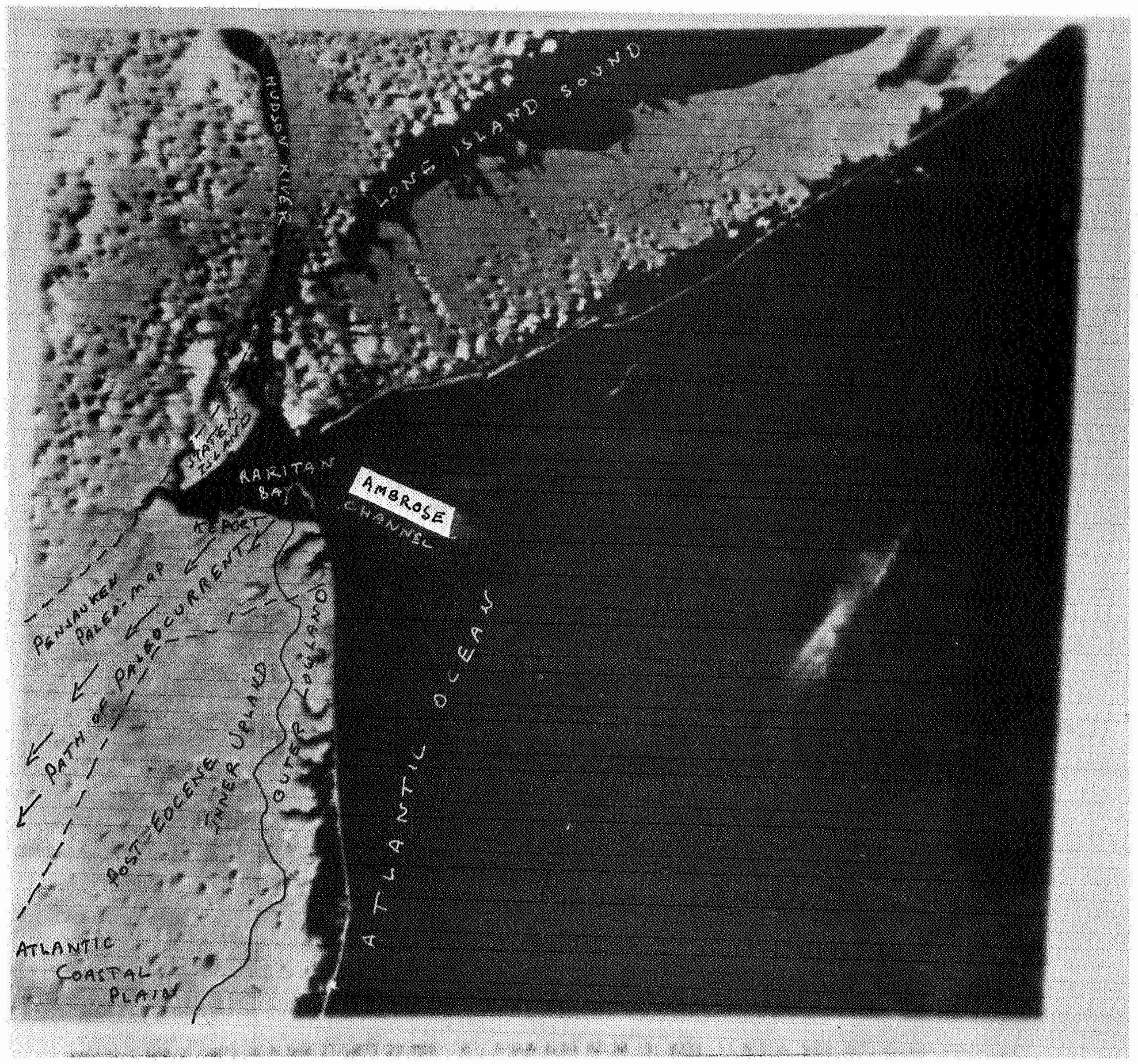

Fig. 5 ERTS-1 MSS of Eastern New Jersey Paleo-Hydrology.

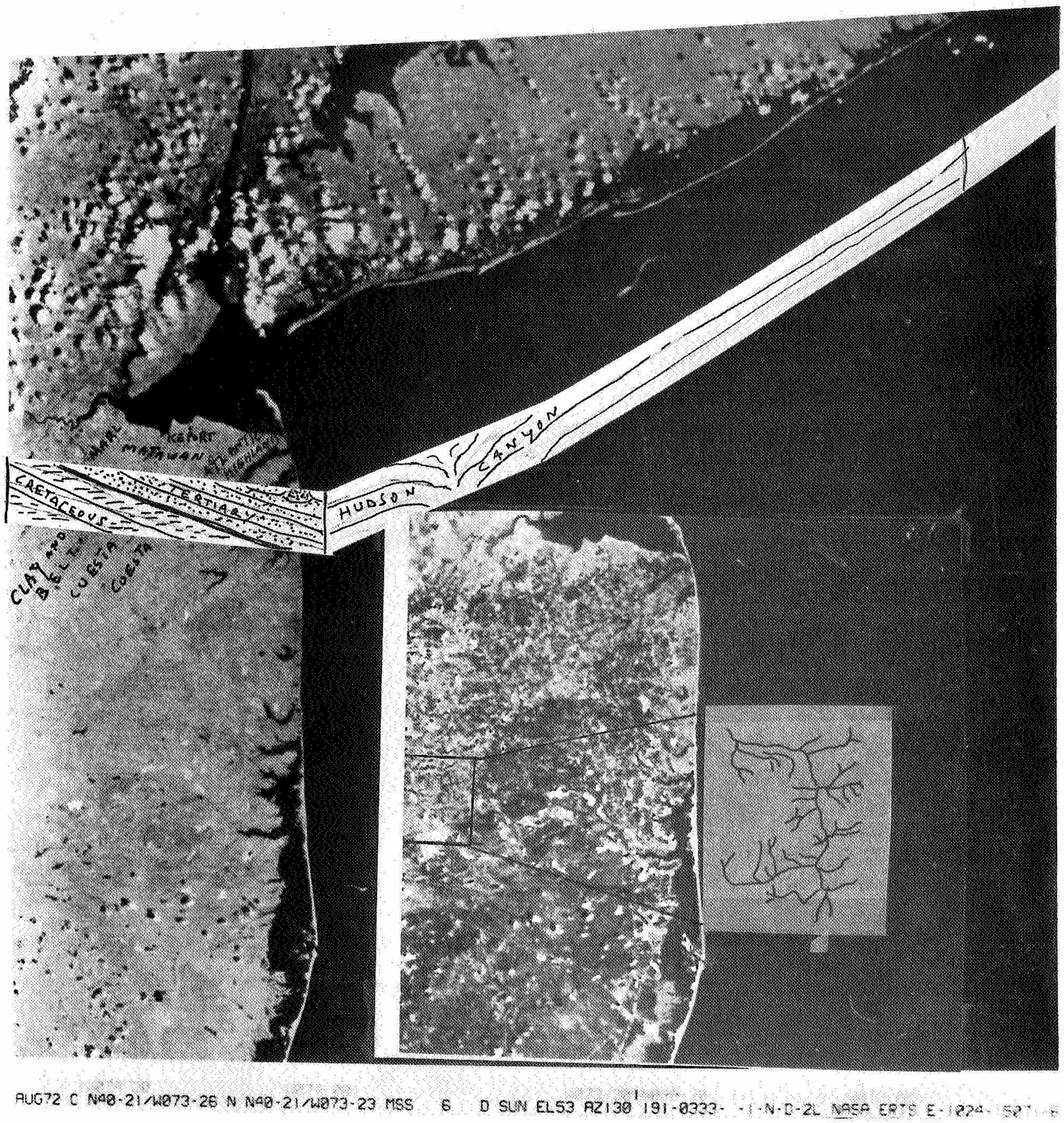

Fig. 6 ERTS-1 MSS Structural and Hydrographic Interpretations.