NATURAL RESOURCES PROGRAM

SPACE APPLICATIONS PROGRAMS

TECHNICAL LETTER NASA-17

U.S. Geological Survey
Department of the Interior

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON, D.C. 20242

Technical Letter
NASA-17
August 1966

Dr. Peter C. Badgley
Chief, Natural Resources Program
Office of Space Science and Application
Code SAR, NASA Headquarters
Washington, D.C. 20546

Dear Peter:

Transmitted herewith are 2 copies of:

TECHNICAL LETTER NASA-17

EVALUATION OF EKTACHROME AND MULTIBAND PHOTOGRAPHY

IN CALIENTE RANGE, CALIFORNIA*

by

J. G. Vedder and E. W. Wolfe**

Sincerely yours,

William A. Fischer
Research Coordinator
Earth Orbiter Program

*Work performed under NASA Contract No. R-09-020-015
**U.S. Geological Survey, Menlo Park, California

UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

TECHNICAL LETTER NASA-17

EVALUATION OF EKTACHROME AND MULTIBAND PHOTOGRAPHY IN CALIENTE RANGE, CALIFORNIA*

by

J. G. Vedder and E. W. Wolfe**

August 1966

These data are preliminary and should not be quoted without permission

Prepared by the Geological Survey for the National Aeronautics and Space Administration (NASA)

*Work performed under NASA Contract No. R-09-020-015

**U.S. Geological Survey, Menlo Park, California

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EVALUATION OF EKTACHROME AND MULTIBAND PHOTOGRAPHY IN CALIENTE RANGE, CALIFORNIA

by

J. G. Vedder and E. W. Wolfe
U.S. Geological Survey, Menlo Park, California

An area in the Caliente Range of southern California, secs. 17, 18, 19, T11N, R21E, was selected for a trial of aerial Ektachrome and multiband photography. One test area which is approximately a mile square, is underlain by a northeast-dipping homoclinal sequence of Tertiary marine and nonmarine sedimentary rocks and basalt. Good exposure and detailed geologic mapping (Vedder and Repenning, 1965) make the area particularly well suited for study. [redacted]

Features particularly striking in the multiband image include the following:

(1) White to pale "salmon" arkosic sandstone beds in unit Tc_3 and resistant white sandstone beds in unit Tbc show up in the multiband composite as well defined red zones. The sandstone beds, especially those in the western part of the area, are much less obvious in the Ektachrome image.

(2) Similar red zones occur on the floors of some canyons southwest of the "Main" basalt (Tb_5). Probably they reflect the occurrence of alluvial white sand on the canyon floors. At best, this feature is barely discernible on the Ektachrome.

(3) Although striking on the Ektachrome image, the "Main" basalt (Tb_5) is one of the most obvious features of the multiband image, where it is represented by a purplish northwest-trending band sharply bounded to the southwest and northeast. The southwest contact, well defined on the Ektachrome, and even more vividly defined on the multiband image is the basal contact of the basalt. The northeast boundary of the purplish band lies stratigraphically below the top of the basalt; it defines the ridge crest and, perhaps only coincidentally, the contact between exposed basalt in place and basalt talus on the northeast-facing dip slope.

Features with equivalent definition in the two images include the following:

(1) Bedding in several of the sedimentary units such as Tm, Tcs, and Tc_3 is well defined.

(2) Talus from the "Main" basalt (Tb_5) is clearly displayed of the slope southwest of the basalt.

(3) Contacts of unit Tq are well defined on both images.

(4) Surficial expression of unit Qoa is equally good in the two images.

(5) Unit Tc_5 and the base of unit Tc_4 are obscure in both images.

Features less well defined in multiband image than in aerial Ektachrome include the following:

(1) Distribution of Qya and Ql. Some of the landslide deposits near the southeast edge of the area, though well defined on the Ektachrome,

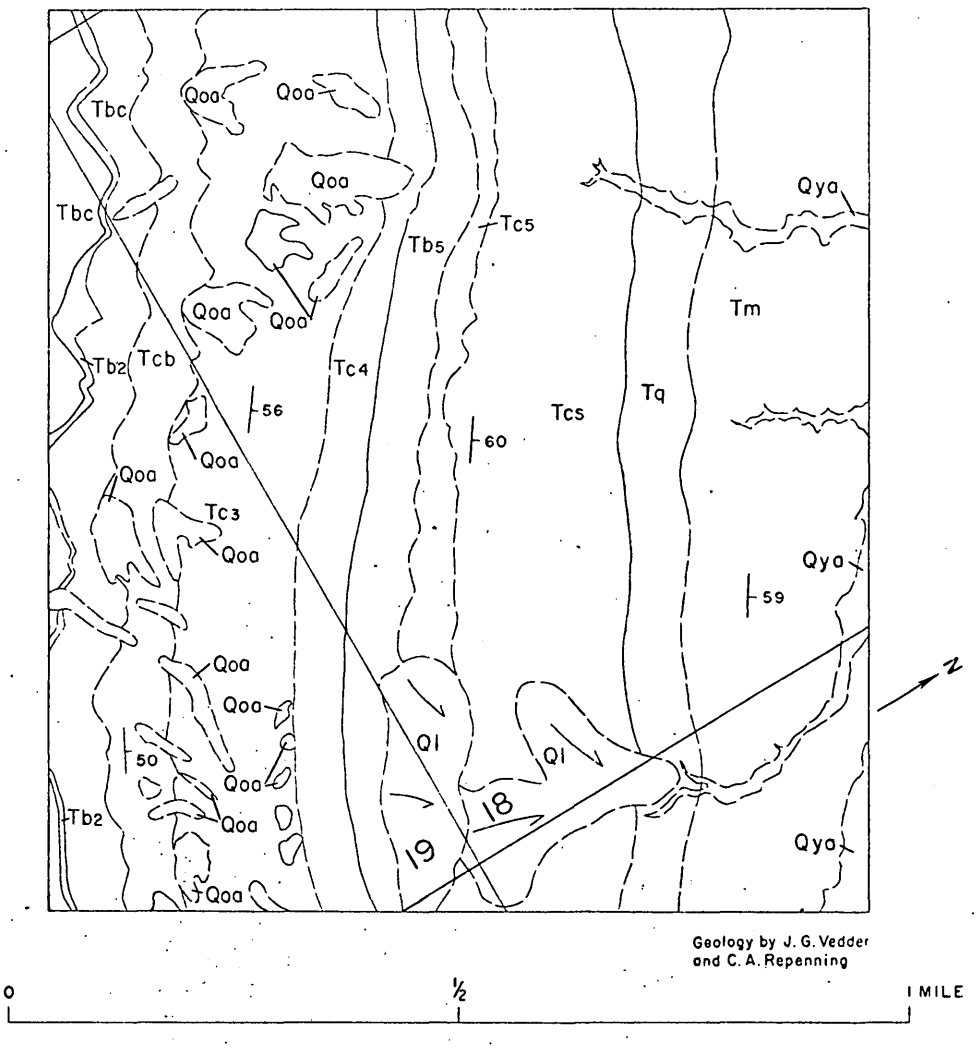
are virtually invisible on the multiband image.

(2) Definition of the drainage pattern is excellent on the Ektachrome and poor in the multiband image, probably because of poor registry in preparation of the multiband composite.

Conclusions:

Aerial Ektachrome photography would be extremely valuable in mapping unknown terrane with color contrast of rock units. However, few rock types could be interpreted without on-site inspection, and for detailed geologic study such photography would greatly aid but not replace on-the-ground geologic mapping.

This trial indicates that multiband methods can be used to discern specific geologic features such as the white sandstone beds of units Tc_3 and Tbc. The implications are that the multiband technique has promise as a remote-sensing analytical tool and that it could be of great value in rapid quantitative analysis of such features as sedimentary facies. Obviously further development of the technique and of our interpretative capability is essential to optimum use of the too.


Tbc
Qoa
Qoa
Qoa
Tbc
Tb5
Tc5
Qya
Tm
Qoa
Qoa
Tb2
Tcb
Tc4
56
Tcs
Tq
60
Qoa
Qoa
Tc3
Qoa
Qya
59
Qoa
Qoa
Q1
Q1
50
Qoa
18
Tb2
Qoa
19
Qya
Qoa
N
Geology by J. G. Vedder
and C. A. Repenning
0
½
1 MILE

EXPLANATION

Qya

Younger alluvium

Clay, silt, sand, and gravel, unconsolidated, poorly stratified to well stratified; includes alluvial fan, flood-plain, and streambed deposits

Qoa

Older alluvium

Clay, silt, sand, and gravel, unconsolidated to semi-consolidated, poorly stratified to well stratified; includes remnants of streambed deposits, alluvial fans, and flood-plain deposits; dissected and locally deformed

Qls

Landslide deposits

Strata disrupted by slumping or block gliding, fragmented or highly deformed to relatively unbroken; arrows show direction of movement

Tm

Morales Formation of Hill and others (1958)

Sandstone and conglomerate, yellowish-gray to greenish-gray, thick-bedded; claystone, greenish-gray, thin-bedded

Tq

Quatal Formation of Hill and others (1958)

Claystone and siltstone, tuffaceous, greenish-gray to yellowish-gray, thin-bedded; gypsiferous; silty very fine grained sandstone in lower part; probably lacustrine

Tcs
Tc_5
Tb_3
Tc_4
Tc_3

Caliente Formation of Hill and others (1958), "Main" basalt of Eaton (1939)

Tcs, claystone, mudstone, siltstone, and fine-grained sandstone, greenish-gray to yellowish-gray and grayish-red, thin-bedded to cross-laminated, ripple-marked; includes biotitic tuff bed; chiefly lacustrine

Tc_5, sandstone, conglomeratic, arkosic, clayey, coarse-grained, red to reddish-brown and grayish-red; mudstone and conglomerate interbedded; poorly stratified; nonmarine

Tb_3, "Main" basalt of Eaton (1939), multiple flows; alkalic olivine basalt, highly vesicular in part, includes breccias on some flow tops; subaerial

Tc_4, mudstone, claystone, and sandstone, grayish-red to pale-pink, thin-bedded, nonmarine

Tc_3, sandstone and conglomerate, arkosic, pink to light-red and white, thick-bedded; mudstone, red, thin-bedded; nonmarine; unconformity at base

Teb

Caliente Formation and Branch Canyon Formation of Hill and others (1958) undifferentiated

Lithologies of both units intertongued and intricately interbedded; includes very thin tongues of red and greenish-gray to olive-gray mudstone; nonmarine and marine

Tbc
Tb_2
Tbc

Branch Canyon Formation of Hill and others (1958) and "Triple" basalt of Eaton (1939)

Tbc, Branch Canyon Formation; medium- to coarse-grained sandstone and pebble-boulder conglomerate, light-gray to yellowish-gray, thick-bedded, locally cross-stratified, concretionary at places; siltstone and fine-grained sandstone, greenish-gray, thin-bedded; claystone, grayish-olive and red, very thin beds locally; dominantly marine; contains shallow-water mollusks

Tb_2, "Triple" basalt of Eaton (1939), middle flow; alkalic olivine basalt, vesicular in part, hydrothermally altered, subaerial

(Stratigraphy from Vedder and Repenning, 1965)

Contact

Dashed where approximately located

60

Strike and dip of beds

Pleistocene and Recent — QUATERNARY

Miocene — TERTIARY

Miocene and Pliocene — TERTIARY

Miocene — TERTIARY

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