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NATURAL RESOURCES PROGRAM

SPACE APPLICATIONS PROGRAMS

TECHNICAL LETTER NASA-64

U.S. Geological Survey
Department of the Interior

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

Technical Letter
NASA-64
November 1966

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

Dear Peter:

Transmitted herewith are 3 copies of:

TECHNICAL LETTER NASA-64

GEOLOGICAL EVALUATION OF NIMBUS VIDICON PHOTOGRAPHY

CHESAPEAKE BAY - BLUE RIDGE*

by

Charles R. Lewis and William E. Davies**

Sincerely yours,

William A. Fischer
Research Coordinator
Earth Orbiter Program

*Work performed under NASA Contract No. R-09-020-011
**U.S. Geological Survey, Washington, D. C.

UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

TECHNICAL LETTER NASA-64

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CHESAPEAKE BAY - BLUE RIDGE*

by

Charles R. Lewis and William E. Davies**

November 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-09-020-011
**U.S. Geological Survey, Menlo Park, California

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Geological Evaluation of Nimbus Vidicon Photography

Chesapeake Bay - Blue Ridge

by

Charles R. Lewis and William E. Davies

ABSTRACT

Vidicon photograph 36N284, at a scale of about 1:2,800,000, shows a "Mercator Effect" of scale distortion north and south of the center of the picture. No distinct cultural features can be discerned. Haze and vegetation patterns are dominant. Rocks reflected by vegetation changes can be identified. These include ridges of folded quartzites, the Blue Ridge Complex, and Triassic fault blocks. Deep soils in both the Piedmont and Coastal Plain make it impossible to distinguish the rocks of these areas (Fig. 1).

INTRODUCTION

Vidicon photograph, 36N284, covers the Middle Atlantic States from Delaware Bay south to Pamlico Sound, N. C. and extends west to Raleigh, N. C., and the Shenandoah Valley, Virginia. Two-thirds of the area covered is Coastal Plain and the remainder is mainly Piedmont with a small part of the Blue Ridge and the Valley and Ridge provinces included (Fig. 1).

Scale variations. The photo has a scale of about 1:2,800,000 at its center. The scale increases north and south from the central point to a scale of 1:2,400,000 along the southern and northern edges.

Image distortion. Images have very little distortion in an east-west direction. In the north-south direction distinct elongation occurs away from the center point of the photograph giving rise to a "Mercator Effect."

Resolution of cultural features. Cultural features, in general, are indistinct and large urban areas such as Richmond, Virginia, and Washington, D. C. are not discernible. A linear feature west of Washington to west of Richmond is possibly a high-tension powerline complex. Light cloud areas in the general vicinity of cities are probably smog zones subject to displacement by wind away from actual urban areas.

Resolution of topographic features. Tonal variations clearly distinguish bays, estuaries, and the ocean from the land. Major mountain ridges in the Blue Ridge and the Valley and Ridge Provinces show up as distinct tonal variations. Swamps in the coastal plain show up distinctly in darker tones.

Effect of vertical polarization. No unusual reflection effects from water, rock or other flat surfaces are visible. The photograph is so low in tonal contrast that polarization is not recognizable. This is probably due mostly to low sun angle since the photograph was taken in late afternoon (approximately 4:15 p.m.). Haze conditions, at the time, also probably reduced reflectivity.

Ninbus Imagery - Geological Application

Tonal rendition of rock units. The limestone areas of the Shenandoah Valley show up as a very light tone. This may be a true reflection of lithology or it may be related to haze or vegetation conditions prevalent in the valley at the time. September 6, 1964, when the photo was taken, was the 9th day of hot, humid, rainless weather with considerable haze.

There is no tonal differentiation between the Coastal Plain and the Piedmont. This is probably because both areas contain either deep residual soils or unconsolidated deposits (Fig. 1, overlay 1).

The Blue Ridge shows up as a very dark tone, probably a reflection of heavy vegetation.

The major ridges in the Valley and Ridge province formed of quartzite are distinguished by light-gray tones and typical zigzag patterns. This is also a reflection of vegetation cover.

An area of distinct lineations lies east of the Blue Ridge. This coincides closely with an area of Triassic block faults. The light lineations on the photo probably are bedrock edges of the tilted blocks. Similar lineations in a Triassic area are along the west-central part of the photograph. This may reflect actual differences in vegetation rather than a direct reflection of the faults.

Light-colored areas west of Richmond and north of Washington do not follow rock patterns and are probably heavy haze zones.

The linear feature extending west of Washington to west of Richmond transects numerous geologic features and is probably cultural in origin. Possibly it is the alignment of a high tension power system.

Beaches along the Atlantic coast show as continuous white tone somewhat exaggerated in size because of the great contrast with adjacent areas of dark tones.

CONCLUSION

The rock units that have distinct vegetation and horizontal patterns such as the folded quartzites in the Valley and Ridge province and the Blue Ridge Complex can be distinguished. This possibly applies also to the limestone areas of the Shenandoah Valley. It is not possible to distinguish differences between the rocks of the Coastal Plain and Piedmont. Triassic fault blocks, however, may be distinguished by light tones along the upper tilted edges of the blocks.

Factors overriding geologic patterns in this area appear to be persistent haze and heavy vegetation.

In general, distortion and lack of definition render the photograph useless except for major land-water boundaries. The photograph is of little value geologically since the scale is far less than reliable published maps, distortion is too great and texture and tone are too coarse for practical use.

Because of the poor tonal qualities and distortion this Nimbus photograph is of no value as a part of time-lapse sequences to show changes in features of geologic interest.

Selected Reference

Calver, J. L., and Hobbs, C. R. B., Jr., eds., 1963, Geologic map of Virginia, 1:500,000: Virginia Dept. Mineral Resources.

Characteristics of Features on Nimbus Vidicon Photography

Feature	Characteristic on Nimbus Vidicon Photography
Folded quartzite ridges.	Light-gray tone, zigzag pattern.
Metamorphic complex-mountains.	Dark-gray solid tone.
Block faults.	Light tone, linear intersecting pattern.
Limestone lowland.	White solid tone. This may be a belt of thick haze over the limestone, a condition characteristic of the area.
Deep residual soils and unconsolidated deposits.	Mottled gray tone.
Swamps.	Very dark gray tone.
Beaches.	Continuous white tone.

Fig. 1


SHENANDOAH MTS.
GREAT VALLEY
BLUE RIDGE
Washington
Cape May
Delaware Bay
Triassic Fault Blocks
Potomac River
NAS
Chesapeake Bay
Richmond
Norfolk
Cape Henry
Suffolk
Franklin, Va.
Dismal Swamp
Albemarle Sound
Pamlico Sound
Area of tonal distortion
Clouds or fog
Cape Hatteras

Fig. 2