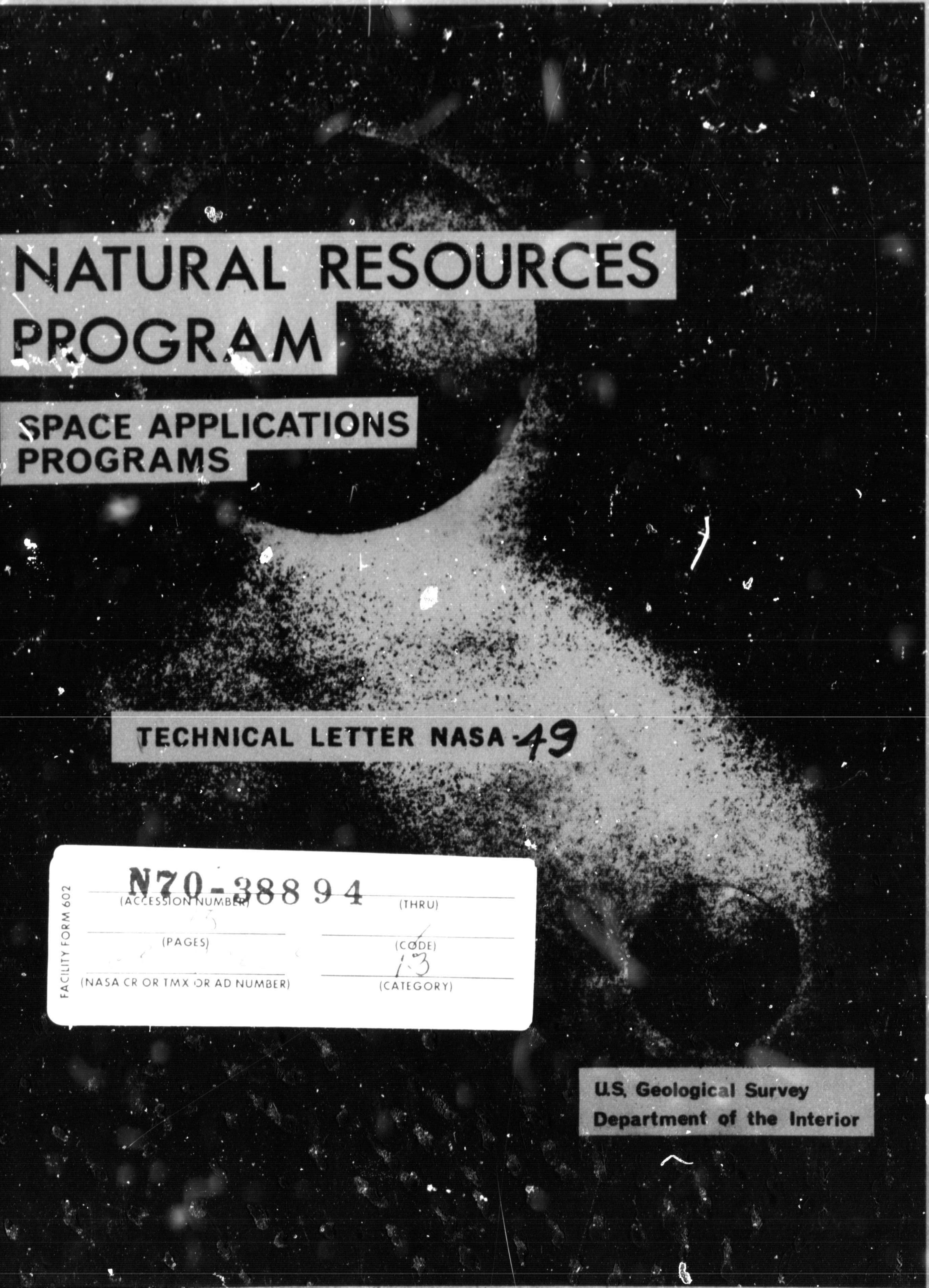

NATURAL RESOURCES PROGRAM

SPACE APPLICATIONS PROGRAMS

TECHNICAL LETTER NASA-49

U.S. Geological Survey
Department of the Interior

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

Technical Letter
NASA-49
August 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 2 copies of:

TECHNICAL LETTER NASA-49

GEOLOGICAL EVALUATION OF K-BAND RADAR IMAGERY,

NORTH-CENTRAL NEVADA*

by

Ralph J. Roberts**

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-49

GEOLOGICAL EVALUATION OF K-BAND RADAR IMAGERY, NORTH-CENTRAL NEVADA*

by

Ralph J. Roberts**

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

Photo copies of illustrations are available for viewing at the following places:

Author(s); Discipline Coordinators; NASA Data Bank (Houston); Remote Sensing Evaluation and Coordination Staff (RESECS) and the U.S. Geological Survey Libraries (Denver, Menlo, Washington).

Geological evaluation of K-band radar imagery,

north-central Nevada

By

Ralph J. Roberts

INTRODUCTION

Radar imagery of strip 96 through north-central Nevada covers part of Test Site 73 (Lynn District). This strip was not flown primarily for evaluation of radar imagery of this area, but as the Carlin mine of the Newmont Mining Company lies in the strip, some comments on the geology of the area may be pertinent.

Geology

The area lies mostly east of 116°30'-41° and includes part of the Tuscarora Mountains between Rodeo Creek on the west and Maggie Creek on the east (Fig. 1). The Tuscarora Mountains are composed of rocks ranging from Paleozoic to Quaternary age. The Paleozoic rocks include typical representatives of both the siliceous and volcanic facies and carbonate assemblages. Tertiary volcanic rocks flank the range on the west and Tertiary and Quaternary alluvium fill the valleys.

Paleozoic rocks.--Paleozoic rocks include both the siliceous and volcanic and carbonate assemblages (Roberts and others, 1958). The siliceous and volcanic assemblage has been thrust into the area from the west and is, therefore, allochthonous and the carbonate assemblage was deposited in this area and is authochthonous.

Siliceous and volcanic assemblage.--The siliceous and volcanic assemblage, which will herein be called siliceous assemblage, is mostly dark chert and shale, and a little limestone. It underlies the northern two-thirds of the Tuscarora Range north of the Carlin Mine, and the low hills north of Rodeo Creek (fig. 1). It includes three units designated on the map by Vinini Formation (Ov), undivided Silurian and Devonian units (DSwu), and Devonian rocks (DWu). Soil on these units is commonly dark and contains abundant fragments of chert and slate; dissection is generally medium to fine.

Carbonate assemblage.--The carbonate assemblage in north-central Nevada is mostly limestone and silty limestone, but contains one quartzite, the Eureka. The oldest unit recognized (fig. 1) is the Hamburg Dolomite (Eh); it is successively overlain by the Pogonip Formation (Op), mostly silty and shaly limestone, the Eureka Quartzite (Oe), the Hansen Creek Dolomite (Oh), the Roberts Mountains Formation (Srm), and undivided Devonian sandy and silty limestone (Deu). The carbonate facies is characterized by fine dissection in most areas.

Tertiary volcanics.--Tertiary volcanic rocks underlie the low hills west and southeast of the words "Rodeo Cr." on figure 2. These rocks are mostly andesitic flows (Tvu); west of Rodeo Creek they form steep bluffs that rise 500-1,000 ft above the valley and grade into a lava plateau sloping westward; southeast of Rodeo Creek the flows form a gently rolling upland. The volcanics are characterized by medium to coarse dissection.

Tertiary and Quaternary sediments.--Tertiary and Quaternary unconsolidated sediments underly terraces on both sides of Maggie Creek and Quaternary alluvium fills valleys to Maggie Creek and Rodeo Creek. Sediments underlying the terraces in Maggie Creek valley include silts, sands, and gravels (QTsu) assigned to the Humboldt Formation. These units have been minutely dissected by streams.

Quaternary alluvium.--Alluvium in the map area has been subdivided into two units, older alluvium (Qoa) and younger alluvium (Qal). The older alluvium covers the broad valley floors and has been locally dissected and regraded; younger alluvium (Qal) is incised in the valley floors.

Radar Imagery

Scale.--The block studied is about 20 miles long and 12 miles wide. The scale of imagery is about 1:200,000 (fig. 2).

Cultural features.--Only a few cultural features can be recognized in the area studied. Unimproved, dirt roads, mostly less than 30 ft wide, are recognizable only in a few places. A road was being surfaced with asphalt at the time the imagery was being flown but cannot be detected.

One other feature, a cultivated and irrigated field in Maggie Creek Valley, shows as a distinctly darker tone, both in polarized and unpolarized images; this field contrasts with bottom lands of similar composition which gives lighter gray tones.

Geologic features.--Variations among specific lithologic types are not well shown on the radar imagery, but structural features were noted that were not recognized when the area was mapped during the mid-1950's, at a field scale of 1:62,500 (fig. 3). Because of the small scale of radar imagery (1:200,000) contrasts in rock units are not striking. Except for gross differences in appearance of alluvial, volcanic, and sedimentary units, the radar imagery would not be useful in geologic mapping. However, the imagery is very useful in structural analysis in this area. Major faults show clearly and many minor faults can be recognized.

Conclusions.--Radar imagery at a scale of 1:200,000 offers little help to the geologist in differentiating small geologic units, but major rock units can be distinguished. The tonal contrasts noted are probably due largely to differences in vegetation which may reflect differences in soils and in the moisture content of soils. It may be worthwhile to compare radar imagery at larger scale, such as 1:62,500, with conventional photography at the same scale. This would afford a more realistic comparison of radar imagery and conventional photographs.

Geologic structures such as faults are apparently accentuated on radar imagery in north-central Nevada. This is largely due to the fact that faults control drainage lines. Radar imagery at a scale of 1:200,000 permits coverage of a large area on a single pass and will be useful in preparing regional tectonic maps. For detailed structural studies, larger-scale coverage would be desirable.

As cultural features are mostly small in the map area, they do not show strongly in the radar imagery. Unimproved dirt roads less than 30 ft wide can be recognized only in places; bodies of water and cultivated and irrigated land show plainly. This suggests that radar imagery at 1:200,000 scale may be used for land classification and other kinds of terrain studies.

References cited

Lehner, R. E., Tagg, K. M., Bell, M. M., and Roberts, R. J., 1961, Preliminary geologic map of Eureka County, Nevada: U. S. Geol. Survey Mineral Inv. Field Studies Map MF-178.

Roberts, R. J., and others, 1958, Paleozoic rocks of north-central Nevada: Am. Assoc. Petroleum Geologists Bull., v. 42, no. 12, p. 2813-2857.

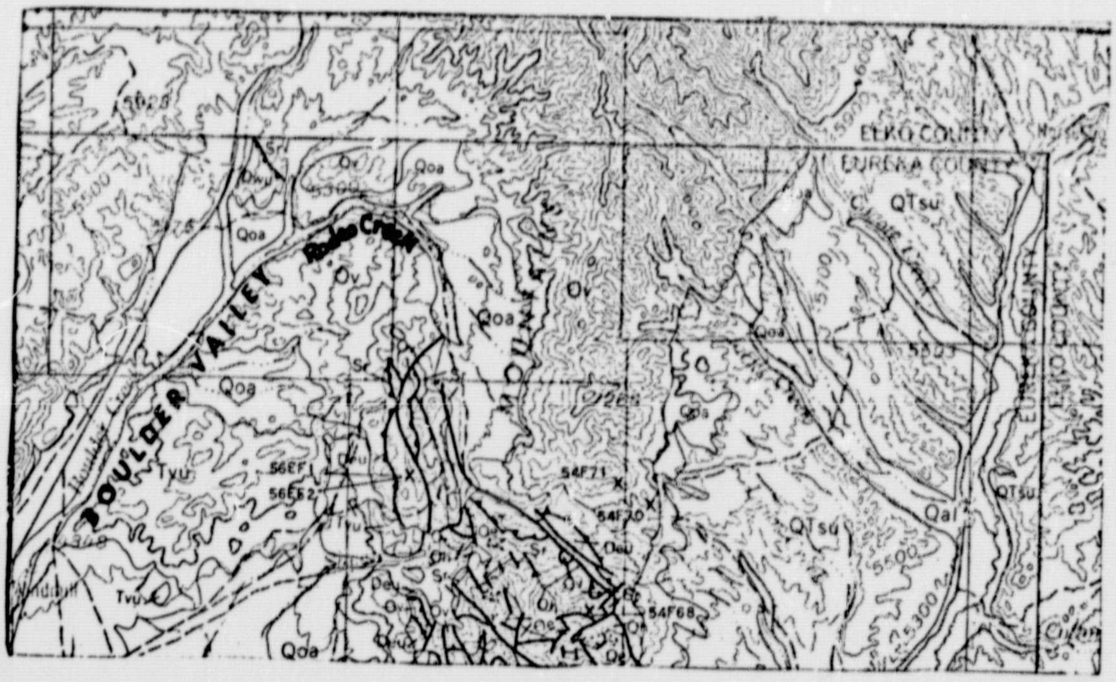

Figure 1. Geologic map of northern Eureka County, Nevada. After Lehner, Tagg, and Bell, 1961.

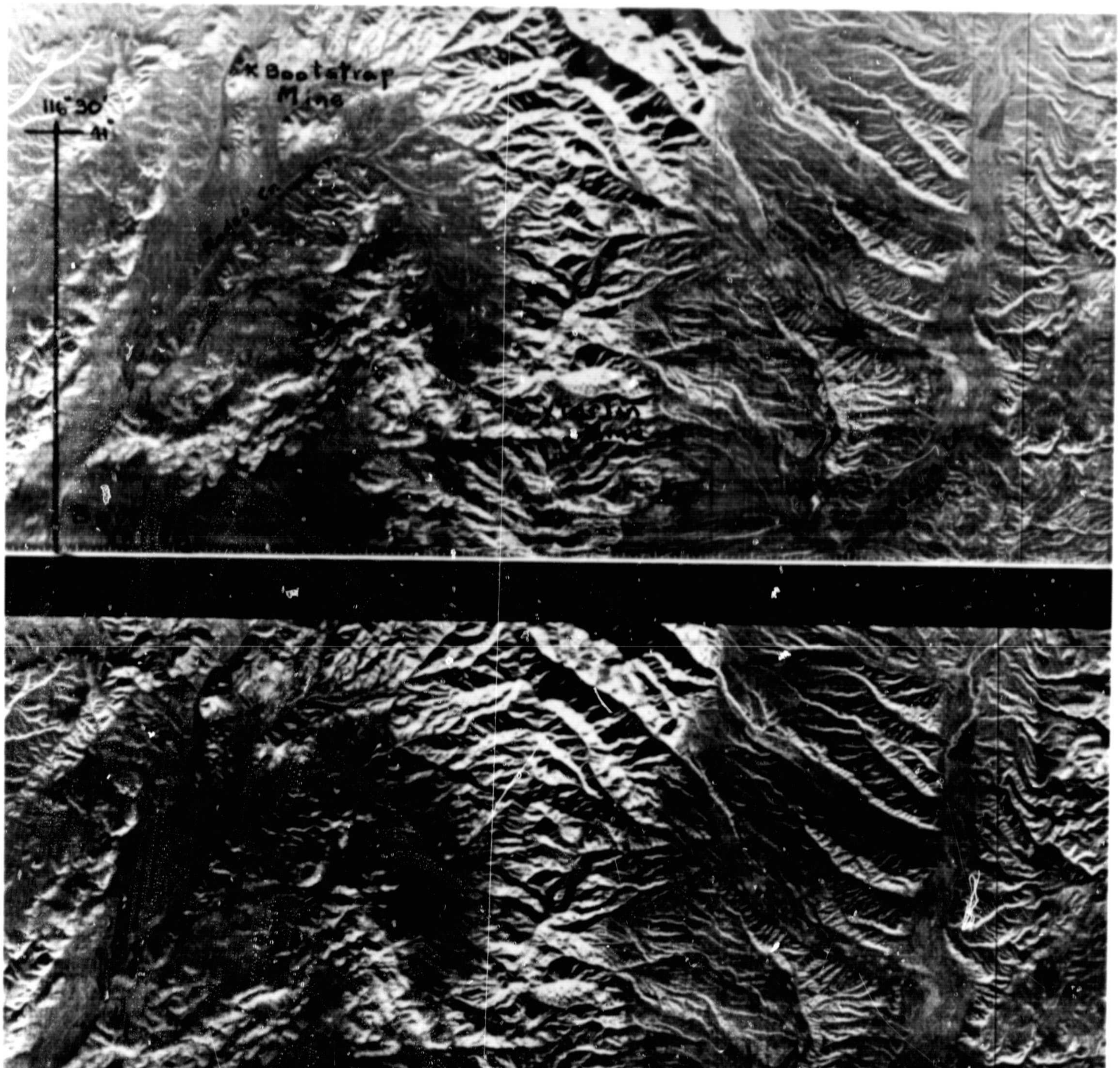

Figure 2.--Photograph of radar imagery, northern Eureka County
Nevada, scale 1:200,000.

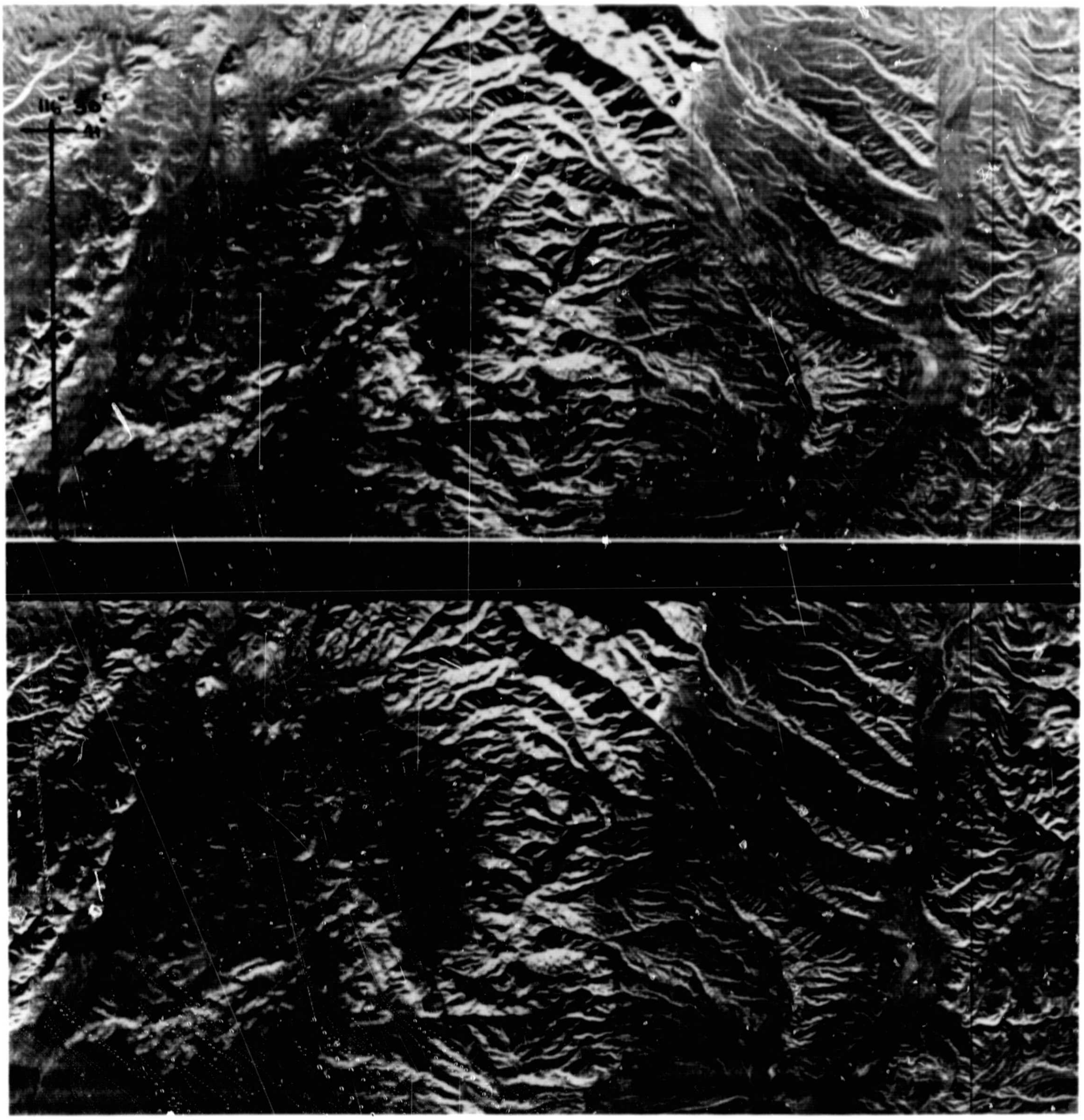

Figure 3. Radar imagery, northern Eureka County, showing structural features that were not noted in original field mapping.