## General Disclaimer

## One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.

- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.

- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.

- This document is paginated as submitted by the original source.

- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

Produced by the NASA Center for Aerospace Information (CASI)

"Made available under NASA sponsorship
In the interest of early and wide dissemination of Earth Resources Survey
Program information and without liability
for any use made thereof."

E7-10176
CR-153274

# REMOTE SENSING OF GEOLOGIC MINERAL OCCURRENCES FOR THE COLORADO MINERAL BELT USING LANDSAT DATA

(E77-10176) REMOTE SENSING OF GEOLOGIC MINERAL OCCURRENCES FOR THE COLORADO MINERAL BELT USING LANDSAT DATA Final Report, 1 Jul. 1975 - 30 Sep. 1976 (Colorado School of Mines, Golden.) 161 p A08/MF A01 CSCL 08G G3/43

N77-27466

Unclas
00176

NASA Contract NAS5-20955

INVESTIGATORS:

Robert H. Carpenter
David W. Trexler

Type III Report for Period 1 July 1975 - 30 September 1976

Prepared for

NASA/GODDARD SPACE FLIGHT CENTER

Greenbelt, Maryland 20771

REMOTE SENSING PROJECTS

DEPARTMENT OF GEOLOGY

COLORADO SCHOOL OF MINES • GOLDEN, COLORADO

Technical Report Documentation Page

| | | |
|---|---|---|
| 1. Report No. | 2. Government Accession No. | 3. Recipient's Catalog No. |
| 4. Title and Subtitle<br>Remote Sensing of Geologic Mineral Occurrences for the Colorado Mineral Belt using LANDSAT Data | | 5. Report Date |
| | | 6. Performing Organization Code |
| 7. Author(s) Robert H Carpenter and David W. Trexler | | 8. Performing Organization Report No. |
| 9. Performing Organization Name and Address<br>Colorado School of Mines<br>Golden, Colorado 80401 | | 10. Work Unit No. (TRAIS) |
| | | 11. Contract or Grant No.<br>NAS 5 - 20955 |
| 12. Sponsoring Agency Name and Address<br>James C. Broderick<br>Landsat Technical Monitor<br>NASA/Goddard Space Flight Center<br>Greenbelt, Maryland 20771 | | 13. Type of Report and Period Covered<br>Type III<br>7/1/75 to 9/30/76 |
| | | 14. Sponsoring Agency Code |
| 15. Supplementary Notes | | |

16. Abstract The object of this program was to determine the value of LANDSAT imagery as a practical and productive tool for mineral exploration along the Colorado Mineral Belt. An attempt was made to identify all large, active and/or abandoned mining districts on the imagery which initially were discovered by surface manifestations. A number of strong photolinements, circular features and color anomalies were identified. Some of these form a part of the structural and igneous-volcanic framework in which mineral deposits occur. No specific mineral deposits such as veins or porphyries were identified. Promising linear and concentric features were field checked at several locations. Some proved to be fault zones and calderas; others were strictly topographic features related to stream or glacial entrenchment. The Silverton Caldera region and the Idaho Springs-Central City district were chosen and studied as "case histories" to evaluate the application of LANDSAT imagery to mineral exploration. Evidence of specific mineralization related to ore deposits in these two areas were observed only on low level photography.

| | | | |
|---|---|---|---|
| 17. Key Words<br>mineral deposits<br>surface manifestations<br>geomorphic expression<br>photolinements | | 18. Distribution Statement | |
| 19. Security Classif. (of this report) | 20. Security Classif. (of this page) | 21. No. of Pages | 22. Price |

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized



U. S. GOVERNMENT PRINTING OFFICE : 1973 725-504/329

# TABLE OF CONTENTS

Page

INTRODUCTION ..... 2

DESCRIPTION OF THE COLORADO MINERAL BELT ..... 4

LINEAR STUDY ..... 8

THE SILVERTON CALDERA - A CASE HISTORY ..... 21

THE IDAHO SPRINGS-CENTRAL CITY AREA - A CASE HISTORY .... 25

CONCLUSIONS ..... 28

APPENDIX A (Tables I, II, III)

APPENDIX B

## LIST OF ILLUSTRATIONS


| Plate | | Page |
|---|---|---|
| 1 | Topolinears | 29 |
| 2 | Topolinears and mineral occurrences and mining districts | 30 |
| 3 | Structure of the Silverton Caldera and adjacent areas (Burbank, Plate 1, pp. 535) | 31 |
| 4 | Geologic sketch map of Central Colorado (Tweto & Sims, GSA Bull., Aug. 1964) | 32 |
| **Figure** | | |
| 1 | Index map of the Colorado Mineral Belt (Tweto & Sims, GSA Bull., Aug. 1964) | 3 |
| 2 | Location of principal mountain ranges and the mineral belt (Tweto & Sims, GSA Bull., Aug. 1964) | 5 |
| 3 | Explanation of symbols used on Plates 1 & 2 and Figures 4 through 11 | 9 |
| 4 | Mining districts: (1) Jamestown-Gold Hill, (2) Fig. 4 to 11 | 10 |
| 5 | Mining districts: (4) Montezuma-Breckenridge, (5) Kokomo-Climax-Leadville | 11 |
| 6 | Mining districts: (6) Battle Mountain (Red Cliff-Gilman), (7) Homestake, (8) Independence | 12 |
| 7 | Mining districts: (9) Aspen-Ashcroft-Snowmass, (10) Marble, (11) Taylor River | 13 |
| 8 | Mining districts: (12) Winfield, (13) Cottonwood, (14) Tincup, (15) Pitkin-Ohio City, (16) St. Elmo-Chalk Creek, (17) Garfield-Monarch | 14 |
| 9 | Area south of Gunnison | 15 |
| 10 | Mining district: Creede | 16 |
| 11 | Mining districts: (19) Lake City-Ouray-Silverton-Telluride, (20) Rico | 17 |
| 12 | Calderas of the San Juan Volcanic Field (Stevens, pp. 938) | 22 |
| 13 | Vein systems of the Central City-Idaho Springs area (Lovering, pp. 223) | 26 |

# INTRODUCTION

A contract was signed between the National Aeronautical and Space Administration and the University of Utah on March 31, 1975, under which the University agreed to evaluate the application of LANDSAT imagery to mineral exploration in the Nevada-Utah Mineral Belt and the Colorado Mineral Belt. The Colorado School of Mines subsequently was granted a sub-contract to assume the responsibility of the Colorado Mineral Belt investigations. These studies were started July 1, 1975.

The specific objective of this study was to establish methods and criteria for using LANDSAT multi-spectral scanner imagery as a practical and productive tool for mineral exploration along the Colorado Mineral Belt.

The Colorado Mineral Belt includes a northeast-southwest zone of major Precambrian and Tertiary shearing and intrusive activity. It extends from the Jamestown mineral district on the northeast to the Rico district on the southwest, a distance of approximately 300 miles. It ranges from 20 to 50 miles in width and includes most of the mining districts of the State (see fig. 1).

The first step in the program was a detailed literature search to establish a comprehensive bibliography of the Mineral Belt. References by mineral districts and by counties are given in Appendix A. This was accompanied by a study of LANDSAT multi-spectral scanner imagery, the scale of which is 1/1,000,000. No U-2 photography was available. Low level black and white photos of the Silverton Caldera area and the Idaho Springs-Central City district also were evaluated in conjunction with "case history" studies of these two areas.

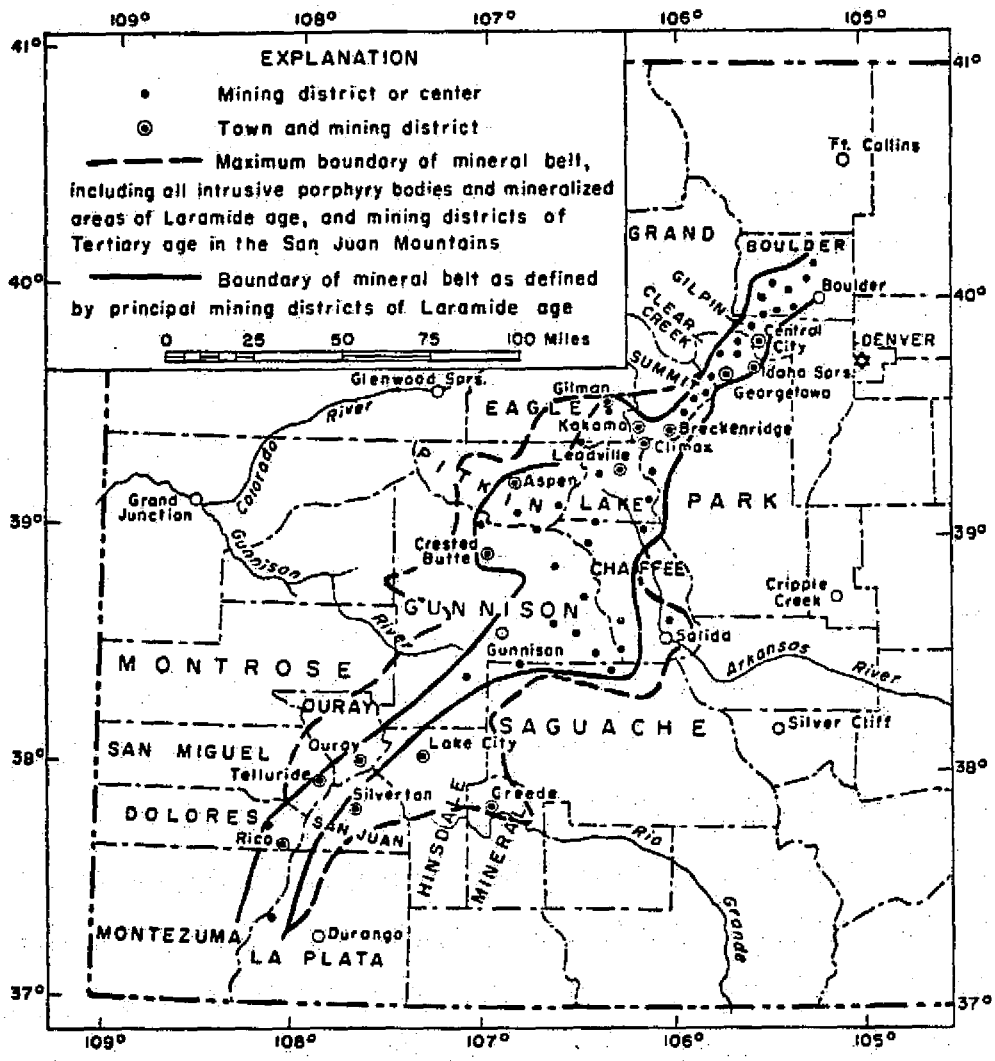



Figure 2. Shape and extent of the Colorado mineral belt

# DESCRIPTION OF THE COLORADO MINERAL BELT

## Introduction

The Colorado Mineral Belt is a tectonic zone which formed initially in Precambrian time and which was rejuvenated during the Laramide orogeny. Most all of the major metallic mineral deposits of Colorado occur within this zone. It extends diagonally across the State from Jamestown on the northeast to Rico on the southwest, a distance of over 300 miles. The width of the Belt varies from 20 to 50 miles (figs. 1 and 2).

## Geologic Backdrop

Precambrian metamorphic rocks and granites constitute the country rocks in the northeast, central and locally in the southwest where the belt crosses the deeply eroded portion of the Front Range, the Sawatch Range and the San Juan uplift. Mesozoic sedimentary rocks occur in the Middle Park region between the Front and Sawatch Ranges, whereas Paleozoic and Mesozoic sediments with a thick cover of Tertiary volcanics predominate in the San Juan uplift (fig. 2).

Laramide and mid-Tertiary igneous activity consisting of dikes, sills, stocks and batholiths of intermediate to acidic composition occur along the Colorado Mineral Belt, reflecting mobilization of deeply buried crustal rocks in the root zone of the Belt.

In the central and northern part of the Mineral Belt tectonism is reflected by (a) a strong northeast arcuate trend in the Precambrian metamorphics and granites which probably formed when the crust was thin and somewhat mobile, by (b) northwest-trending faults including breccia reefs; they are parallel to the northwest-trending portions of the individual mountain arcs,

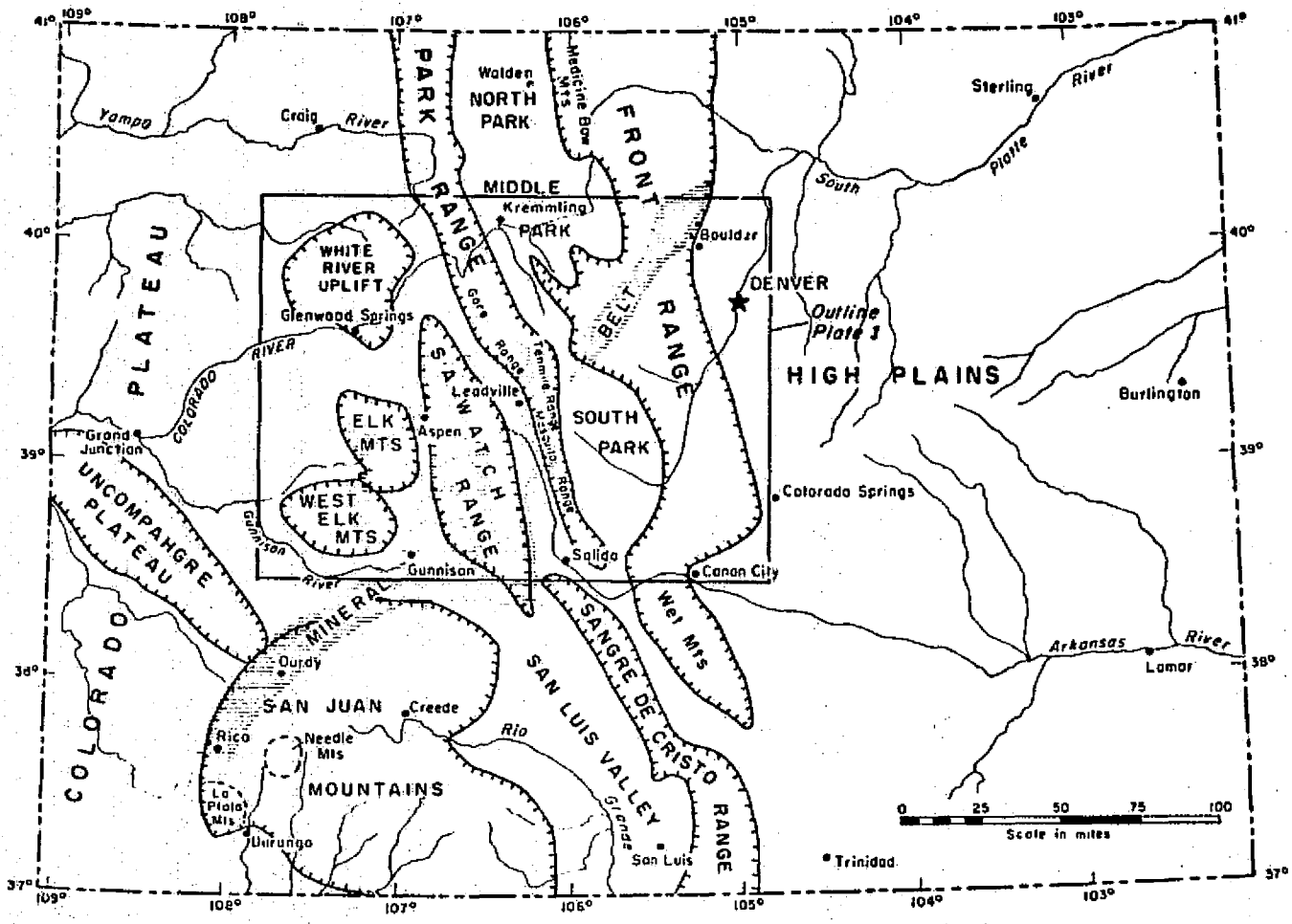



Figure 1. Location of principal mountain ranges and mineral belt in Colorado

by (c) north-northeast trending faults; these faults are essentially parallel to the Precambrian foliation trends, and by (d) east-northeast faults; they developed in the arcuate junctions where major foliation direction reversed trend very rapidly (Plate 4). These fault systems are believed to have developed as thrusts or high angle reverse faults in the Precambrian and were reactivated during the Laramide and Tertiary in part as strike slip faults resulting from east-west directed stresses (Plate 4). Low angle, northerly-trending thrust faults were active along the flanks of the Front Range and Sawatch Range as these arches developed during the early Tertiary.

In the southwestern part of the Mineral Belt deep-seated shearing related to failure within and along the flanks of the northwest-southeast trending Uncompahgre positive structural block appears to have been responsible for the mobilization of the crust and the subsequent expulsion of large volumes of intermediate to acidic volcanics and the emplacement of numerous underlying batholiths and stocks in the volcanic field. Failure over the crest of a number of the intrusives has resulted in the caldera features of this extensive volcanic pile which occupies approximately 25,000 $km^2$. There is a strong relationship in space and time during the Laramide and Tertiary between tectonic fabric along the Mineral Belt and igneous activity and mineralization. Deep rooted channelways are believed to have developed at the corners of wedge-shaped blocks in the northern part of the Mineral Belt (Plate 4). Molybdenum porphyry intrusions such as the Urad-Henderson are located at sharp changes in trend in the foliation of the Precambrian rocks and with associated faulting (Plate 4). Mineralization in the San Juan volcanic field is clearly associated with late stage failure within and between the caldera centers (Plate 3).

Two periods of mineralization are evident along the Colorado Mineral Belt: (a) precious and base metal vein and replacement deposits of Laramide age occur in the central and northeastern part of the Belt, (b) mid-Tertiary molybdenum porphyry deposits occur in the mid-portion of the Belt. The precious and base metal vein and breccia pipe mineralization in the San Juans also is mid-Tertiary in age.

# LINEAR STUDY

Because the location of mineral occurrences along the entire length of the Colorado Mineral Belt is well documented an attempt was made by Dr. Trexler to relate visible linears to mineral deposits.

## Procedure

Topolinears were plotted on LANDSAT transparencies using a Bausch & Lomb zoom stereoscope. Both LANDSAT 1 and 2 images of each scene which contained any part of the area of interest were annotated. Table I lists the frames used in this study. The photolinears were transferred from all images to photographic enlargements (1:500,000 approximate) with a transfer scope and from the enlargements to AMS $2^{0}$ topographic maps. A composite overlay was made at 1:250,000 scale. This is shown in reduced form on Plate 1 (scale 1:500,000 approximate). The locations of mineral occurrences were then plotted on the overlay (Plate 2). These locations were taken from USGS Prof. Paper 138, Plate I.

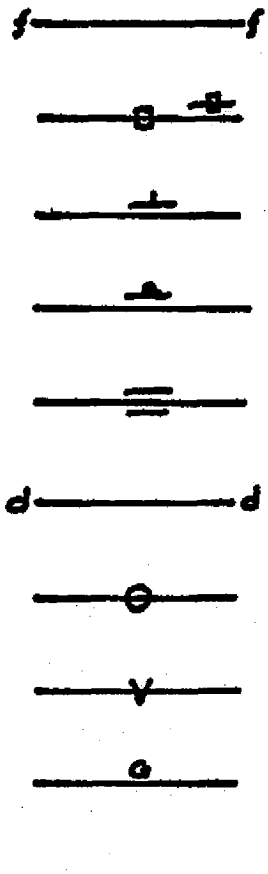
## Interpretation of Linears

With the exception of ring structures associated with the caldera of the San Juan Mountains, no apparent relation could be seen between the topolinears and mineral deposits.

The geologic significance of photolinears was studied using all available geologic maps in order to detect any relation between linears and mineral occurrences. Figure 3 is an explanation of symbols used on maps for identified topolinears.

Only 48, or about 0.05%, of the linears were identified from the Geologic Map of Colorado (scale 1:500,000). As would be expected, a much

Fig. 3. Expanation of symbols used on Plates 1 & 2, Fig. 4 - 11




Faults and shear zones

Joint control

Dip control

Foliation control

Lithologic contact

Dike or vein system

Ring fracture of cauldera

Edge of volcanic flow

Glaciated valley

Unidentified topolinear

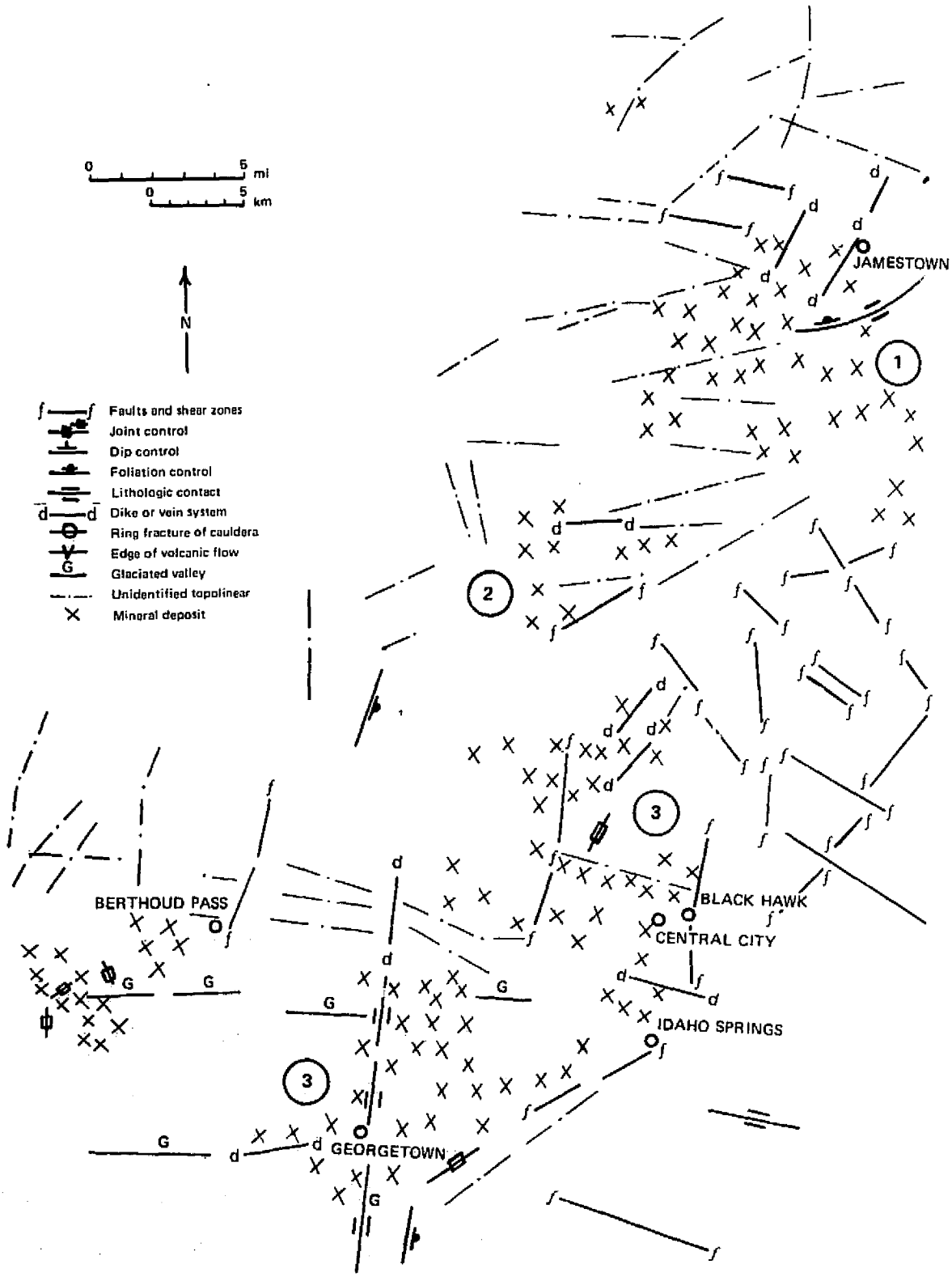



Figure 4. — Mining districts: (1) Jamestown-Gold Hill, (2) Caribou-Nederland, (3) Black Hawk-Central City-Idaho Springs — Georgetown.

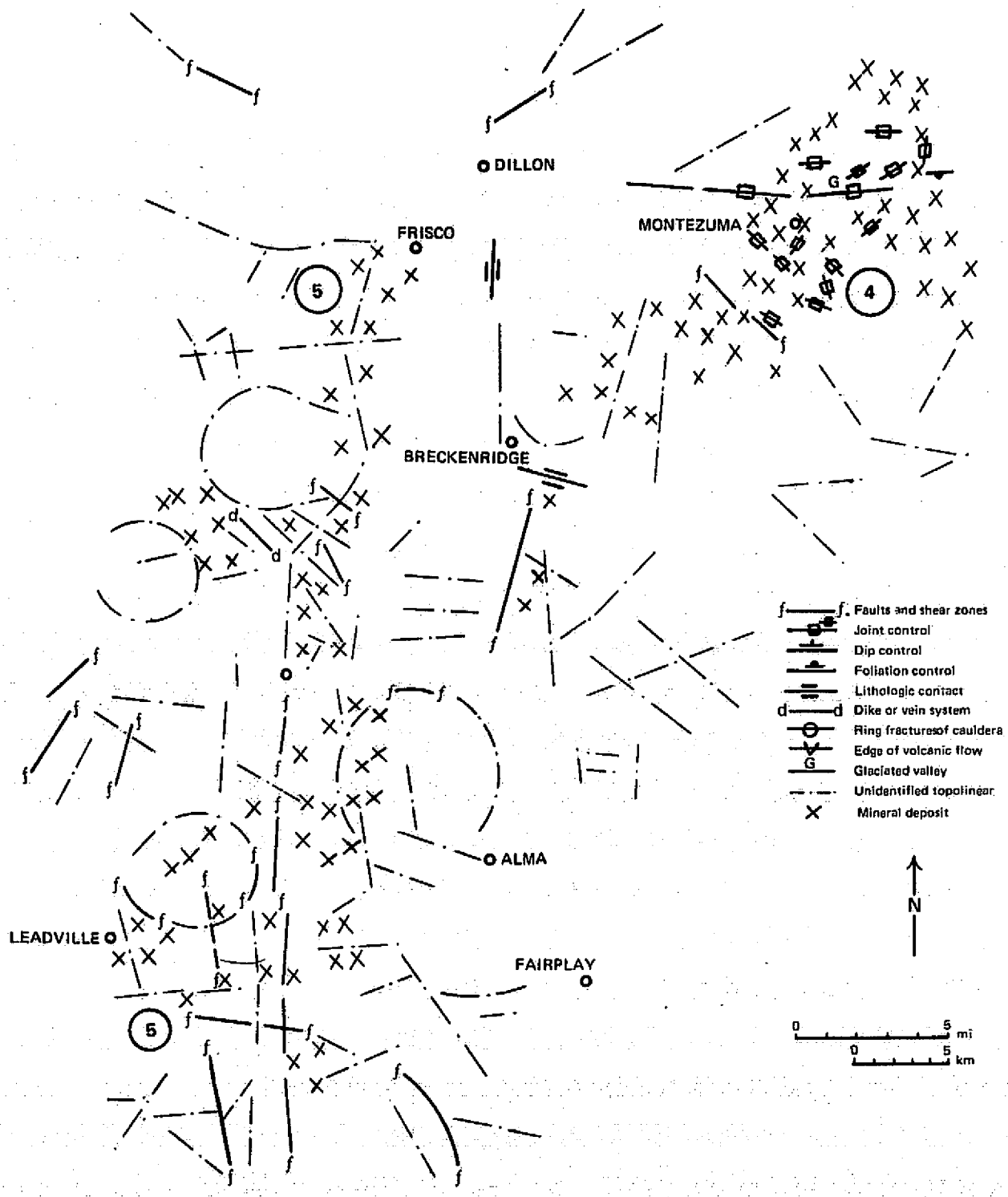



Figure 5. — Mining districts: (4) Montezuma-Breckenridge, (5) Kokomo-Climax-Leadville.

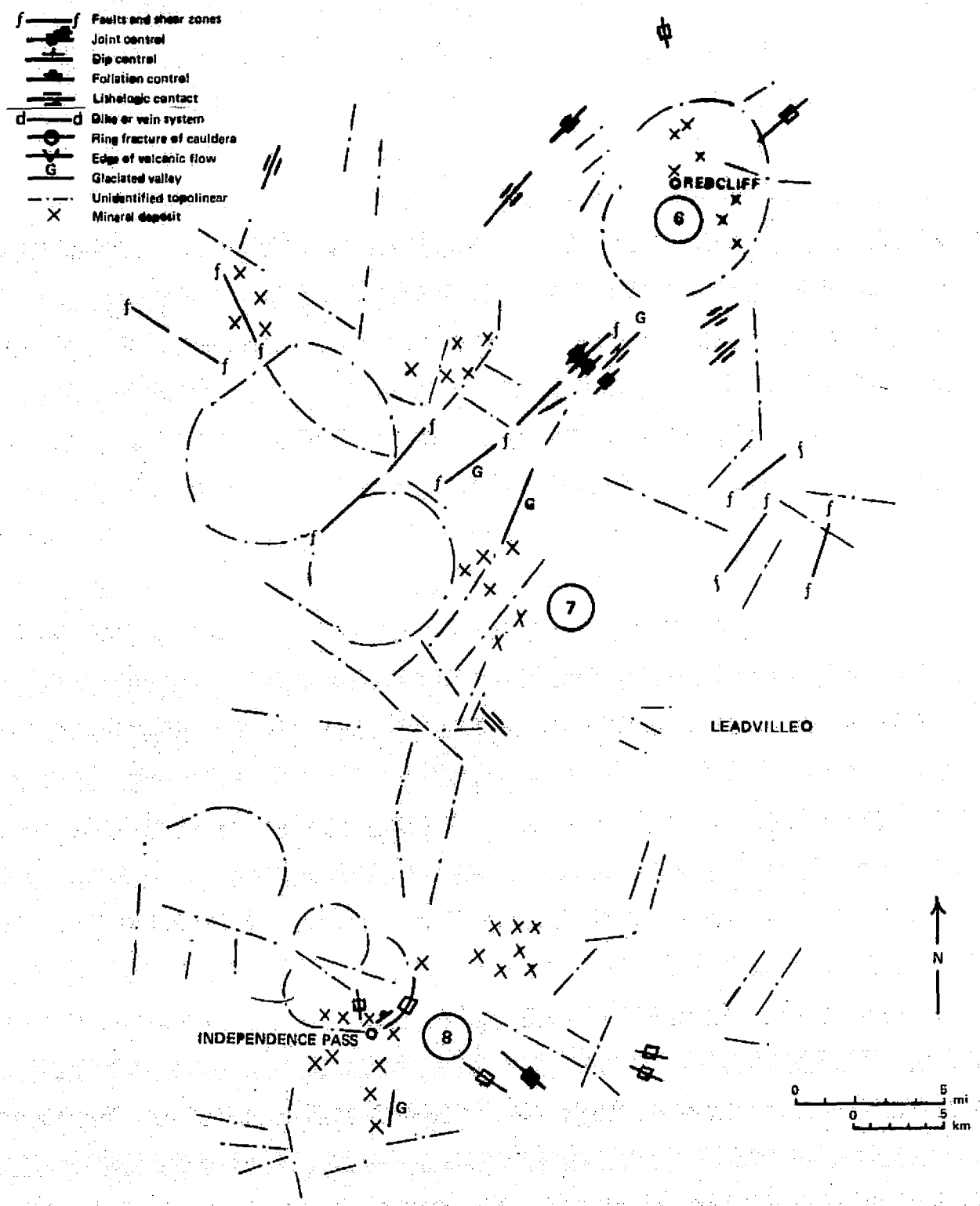



Figure 6. – Mining districts: (6) Battle Mountain (Red Cliff-Gilman), (7) Homestake, (8) Independence.

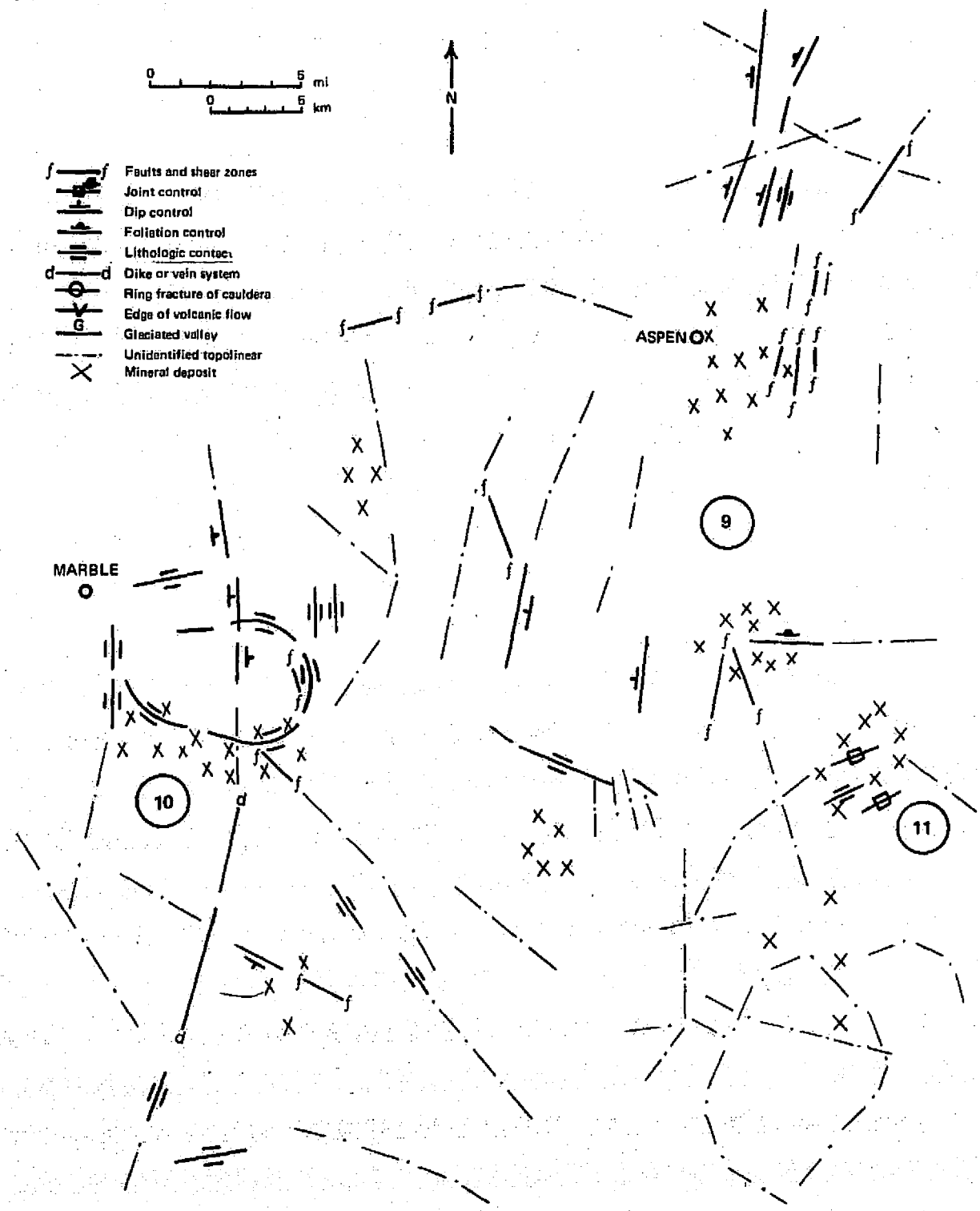



Figure 7. — Mining districts: (9) Aspen-Ashcroft-Snowmass, (10) Marble, (11) Taylor River.

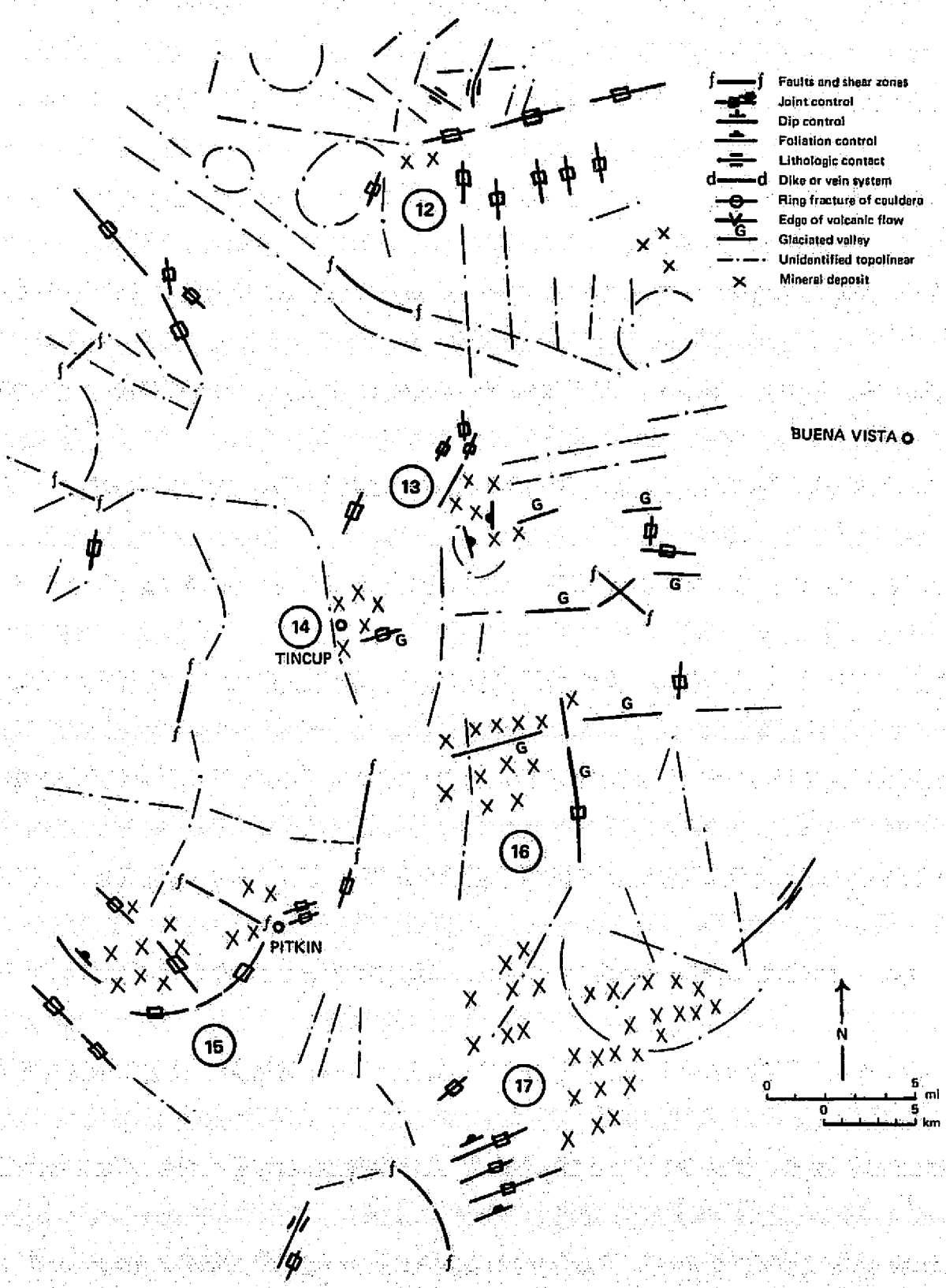



Figure 8. – Mining districts: (12) Winfield, (13) Cottonwood, (14) Tincup, (15) Pitkin-Ohio City, (16) St. Elmo-Chalk Creek, (17) Garfield-Monarch.

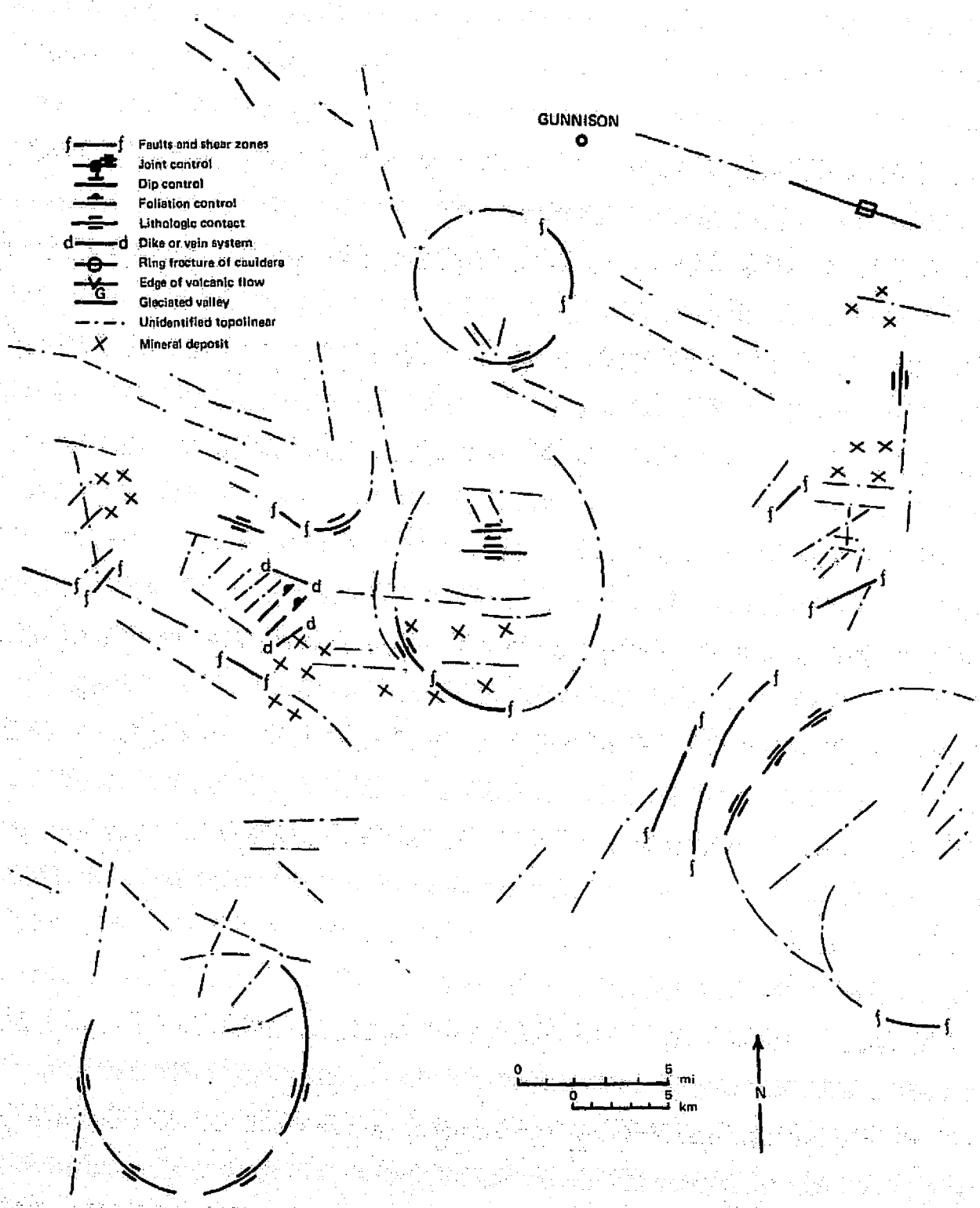



Figure 9. — Area south of Gunnison.

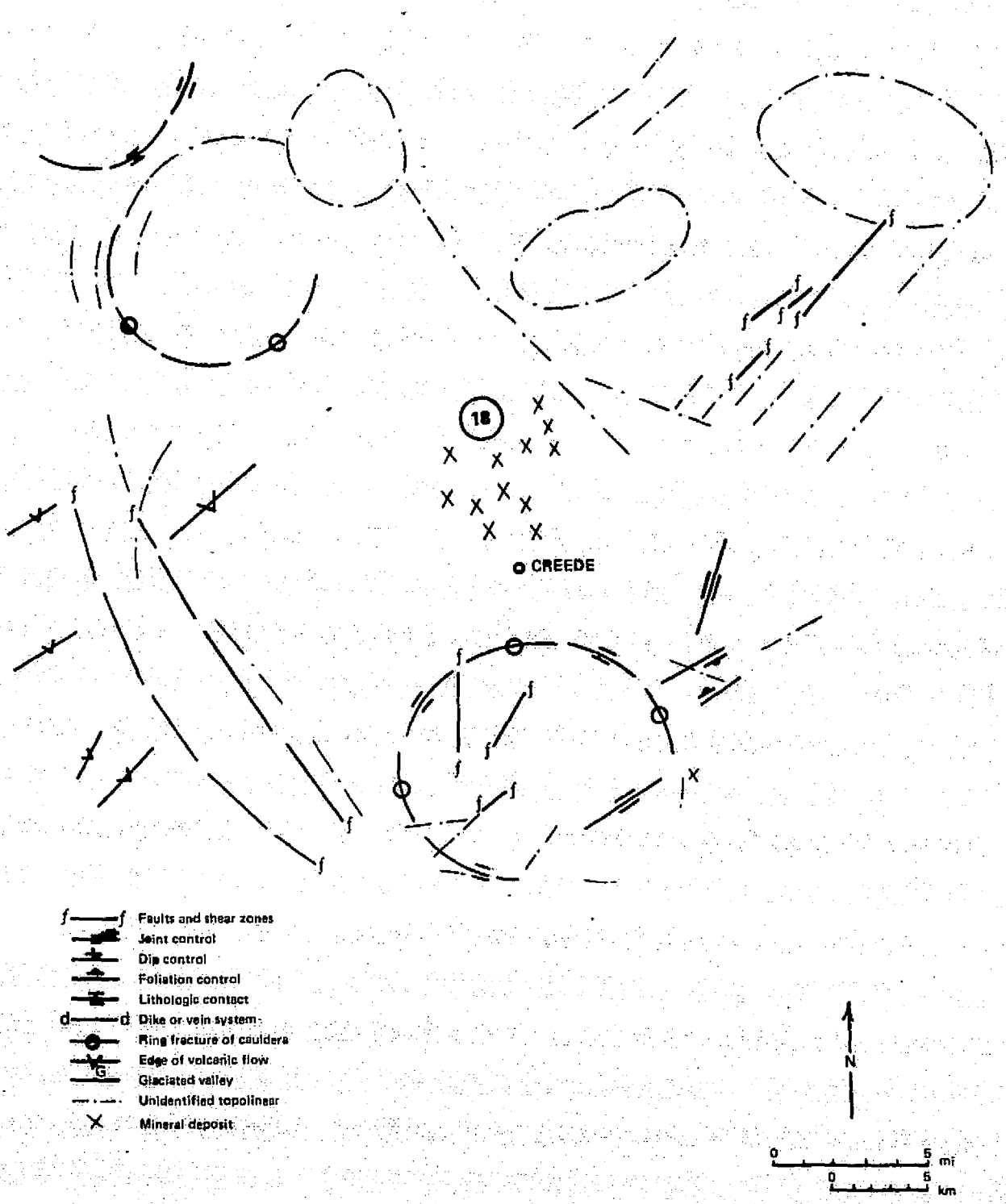



Figure 10. — Mining district: (18) Creede.

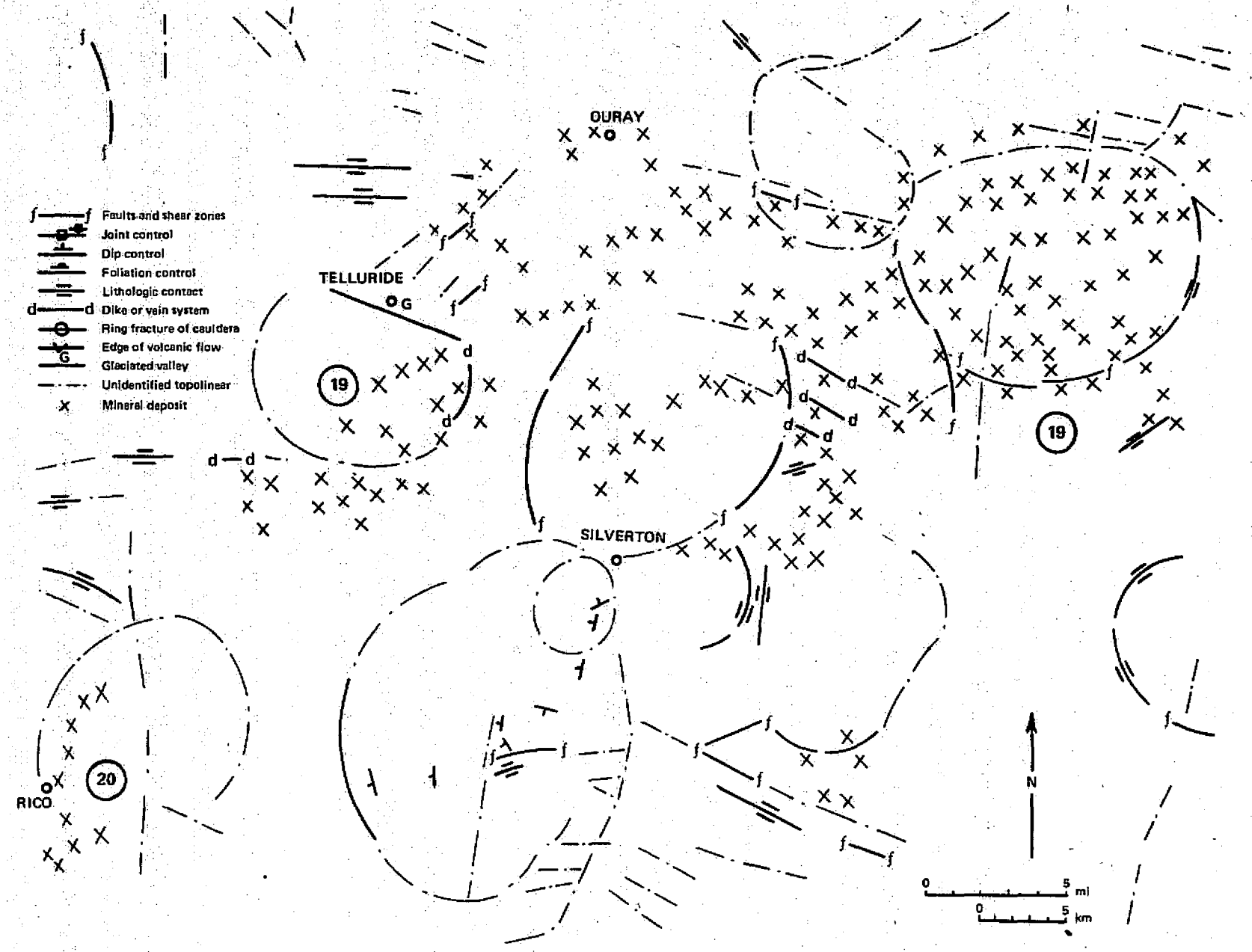



Figure 11. – Mining districts: (19) Lake City-Ouray-Silverton-Telluride, (20) Rico.

higher percentage of linears were identified from larger scaled maps. As for example about 50% of the linears within the coverage of USGS 1:24,000 quadrangle geologic maps could be identified (Table III).

Because large-scale geologic map coverage is limited, field checking was conducted in a number of areas of mineral occurrence in order to identify as many linears as possible and to see if these linears had any direct relation to mineral deposits. Figures 4 to 11 are large scale maps (1:250,000) of the mineral districts with both identified and unidentified linears shown. A brief discussion follows.

Figure 4 of the northern end of the mineral belt shows a high percentage of identified linears. Most of these are north-northeast and northwest Precambrian fractures. Northeast to east early Tertiary fractures were also identified. The northeast and east vein system at Central City and Idaho Springs (Fig. 14) were not detected, nor were the early Tertiary igneous stocks. Also the vein system could not be detected on 1:60,000 airphotos.

Figure 5; the mineralization at the Montezuma district (4) is associated with an early Tertiary stock which could not be detected. The east-west linear coincides with a known fault and parallels a strong set of east-west joints. The Kokomo, Climax, and Leadville districts (5) are along the trend of the Mosquito fault. The numerous sills, dikes, and stocks, which could not be detected, control the localization of ore minerals in Upper Paleozoic sediments.

Figure 6; the mineralization at Red Cliff and Gilman (6) is associated with sills and dikes in Paleozoic sediments (Fig. 13). A northeast joint trend was identified. Mineralization in the Homestake area (7) is associated with a northeast trending set of strong shear zones and parallel joints

(Fig. 13). These were also identified. A shear zone associated with mineralization at Independence Pass (8) was not identified.

Figure 7; a few north trending faults were the only linears annotated in the vicinity of Aspen and Ashcroft (9). The Treasure Mountain uplift (Early Tertiary) near Marble (10) was annotated as a conspicuous curvilinear. Mineralization along the upper Taylor River (11) seems to be related to a conspicuous northeast trending set of joints.

Figure 8; mineralization at Winfield (12), Cottonwood Pass (13), and St. Elmo (16) is associated with conspicuous north to north-northeast sets of joints. At Pitkin and Ohio City (15) joint sets and a fault were identified with northwest and northeast trends. On the southwest side of the Garfield and Monarch districts (17) the dominant trend of foliation and jointing is northeast.

Figure 9; the northern part of this area is an old erosional surface cut in Precambrian rocks on which can be detected numerous joint sets except on some stream divides where low dipping Mesozoic sediments and Tertiary volcanics cap the older rocks. The curvilinear in the southeast corner is the Cochetopa caldera. The other curvilinears may also represent older ring structures associated with cauldera.

Figure 10; the curvilinear south of the town of Creede is the Creede cauldera. Mineralization, however, is to the north at (18) where no topolinears were noted.

Figure 11; two of the annotated curvilinears are known cauldera structures. These are the Silverton cauldera (central) and the Lake City cauldera (northeast corner). Mineralization is dominantly along northeast and northwest veins with some east-west veins south of Telluride (Fig. 12). These vein systems were not detected.

## Conclusions

The only detectable linears that can have a bearing on ore deposits and can be detected on LANDSAT imagery are those structural features which are capable of geomorphic expression such as faults, joints, and some contacts. Surficial features produced by volcanism and glacial erosion and deposition were also visible. Vein systems in general are not reflected in the topography because of their relative strong resistance.

# THE SILVERTON CALDERA - A CASE HISTORY

## Introduction

The San Juan Mountains which include the Silverton caldera, are located in the southwestern part of the Colorado Mineral Belt. They constitute a great, composite volcanic field covering an area 100 miles by 150 miles in which 18 calderas are known or are postulated (fig. 12). The volcanic rocks of this field consist of early stratovolcanos overlain by ash flow eruptions and pyroclastics. Calderas were superimposed as individual magmas moved upward toward the surface from an underlying regional batholith. This intrusive is identified by a sharp gravity low. The formation of the San Juan volcanic field extended in time from 35 m.y. to 20 m.y., but most of the volcanism occurred prior to 26 m.y.

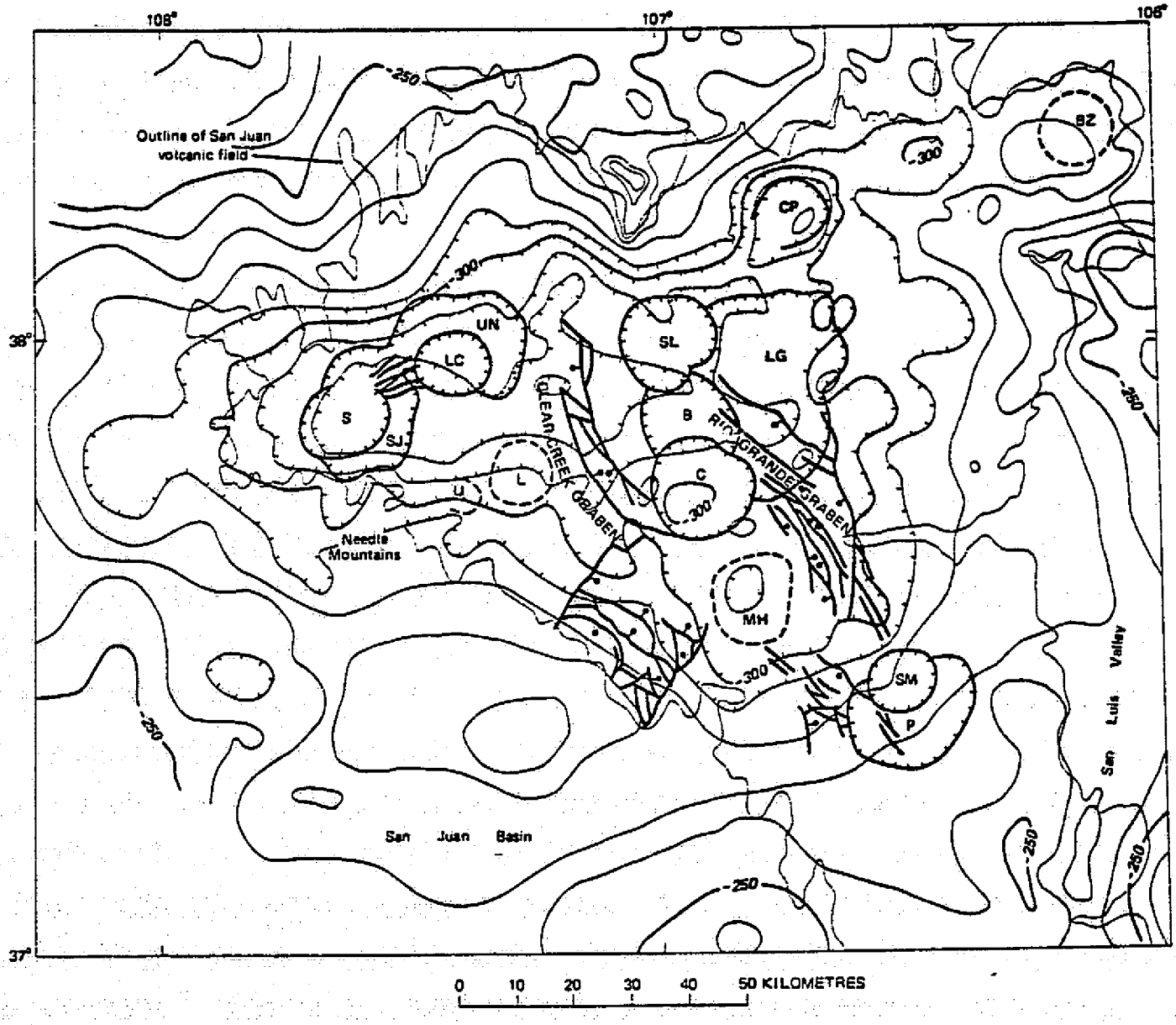
## Volcanic Sequence

A thickness of more than a mile of volcanic rocks rest on a basement of Precambrian, Paleozoic and Mesozoic rocks. These volcanics consist of lava flows, breccias, tuff-breccias, tuffs and welded ash-flow tuffs which average rhyo-dacite - quartz latite in composition, but range from andesitic basalt to rhyolite. There are many feeder dikes and sills and irregularly shaped porphyry intrusives within the volcanic pile.

## Structural Fabric of the Region

The dominant structural pattern of the San Juan Mountains includes circular caldera centers and inter-connecting graben. These are indicated on intermediate level photography of 1/80,000 scale. In addition, both radial and concentric faulting form a strong structural fabric within and outward from each caldera center.

Fig. 12




**EXPLANATION**

Fault—Bar and ball on downthrown side

Caldera

Buried or inferred caldera

-300- Bouguer gravity contours—Hachures point toward closed gravity lows. Contour interval 10 milligals. Gravity data from Plouff and Pakiser (1972, fig. 3)

CALDERAS (In order of increasing age)

| | |
|---|---|
| LC | Lake City |
| C | Creede |
| CP | Cochetopa Park |
| SL | San Luis |
| B | Bachelor |
| LG | La Garita |
| MH | Mount Hope |
| S | Silverton |
| SJ | San Juan |
| UN | Uncompahgre |
| L | Lost Lake |
| U | Ute Creek |
| SM | Summitville |
| P | Platoro |
| Bz | Bonanza |

LOCATION OF SAN JUAN VOLCANIC FIELD

FIGURE 1.—Calderas in the San Juan volcanic field (patterned) in relation to Bouguer gravity field.

## Silverton Caldera

The Silverton caldera, located on the western side of the San Juan volcanic field, serves as one of two case histories for this study. It is about 10 miles in diameter and is situated within the western half of the San Juan volcanic depression which is about 15 miles wide and 30 miles long (Plate 3). The volcanic and basement rocks of this caldera are broken by systems of radial and concentric fractures, and the rocks within and adjacent to the caldera are broken, tilted and irregularly faulted. This widespread rock failure developed access for hydrothermal solutions which permeated the fault systems to cause profound rock alteration and selective mineralization in the area.

Widespread propylitic rock alteration occurred throughout the Silverton caldera region during the late stages of volcanism as a result of fluids and gases moving outward from the underlying magma chamber and mixing with meteoric waters. The near surface rocks were altered to chlorite, calcite and clays, whereas deeper epidote, albite, and chlorite are the predominant alteration minerals. As a consequence, the rocks of the Silverton caldera region have been well bleached to white, tan and light gray with superimposed iron oxide staining in specific mineralized centers to brown, yellow, orange and red. The latter are readily identifiable on low level color photography.

Strong, late alteration by sulfur enriched fluids also developed around the periphery of the Silverton caldera, along local faulted blocks and related pipe-like bodies of breccia and intrusive rocks. This type of alteration also has been effective near some of the channelways through which these sulfur-enriched fluids passed. The adjacent rocks have been strongly leached or silicified and kaolinized and permeated with both sulphates and sulfides. They are well bleached and subsequently stained by surface oxida-

tion of pyrite. This sulfotaric alteration usually is restricted in nature and can be identified, in some instances, on low level photography.

Mineralization in the Silverton caldera area is of two types: (a) vein systems and (b) chimney or breccia pipe deposits. The former occur in extensive systems of open fissures and along major faults and splits. The latter are found in solfateric centers along the margins of the Silverton caldera. The ore occurs as shoots within the veins and as a matrix of the breccias within the chimneys. Some of the major veins can be identified on low and intermediate photographs.

## Application of Imagery

The overall features of the Silverton caldera are identifiable on LANDSAT imagery. Semi-detailed caldera features and associated fault systems are evident on intermediate level photography. Individual faults are apparent on low level photography, some of which are known to be mineralized, but mineralization itself and hydrothermal alteration halos related to mineralization are not recognizable.

# IDAHO SPRINGS - CENTRAL CITY AREA

## Introduction

The Idaho Springs-Central City area in the northern part of the Colorado Mineral Belt is the second case history selected for this project. This area lies about 30 miles west of Denver along the southern edge of the Mineral Belt on the east slope of the Front Range. It has yielded an estimated 170 million dollars worth of gold, silver, base metals, and uranium since 1859.

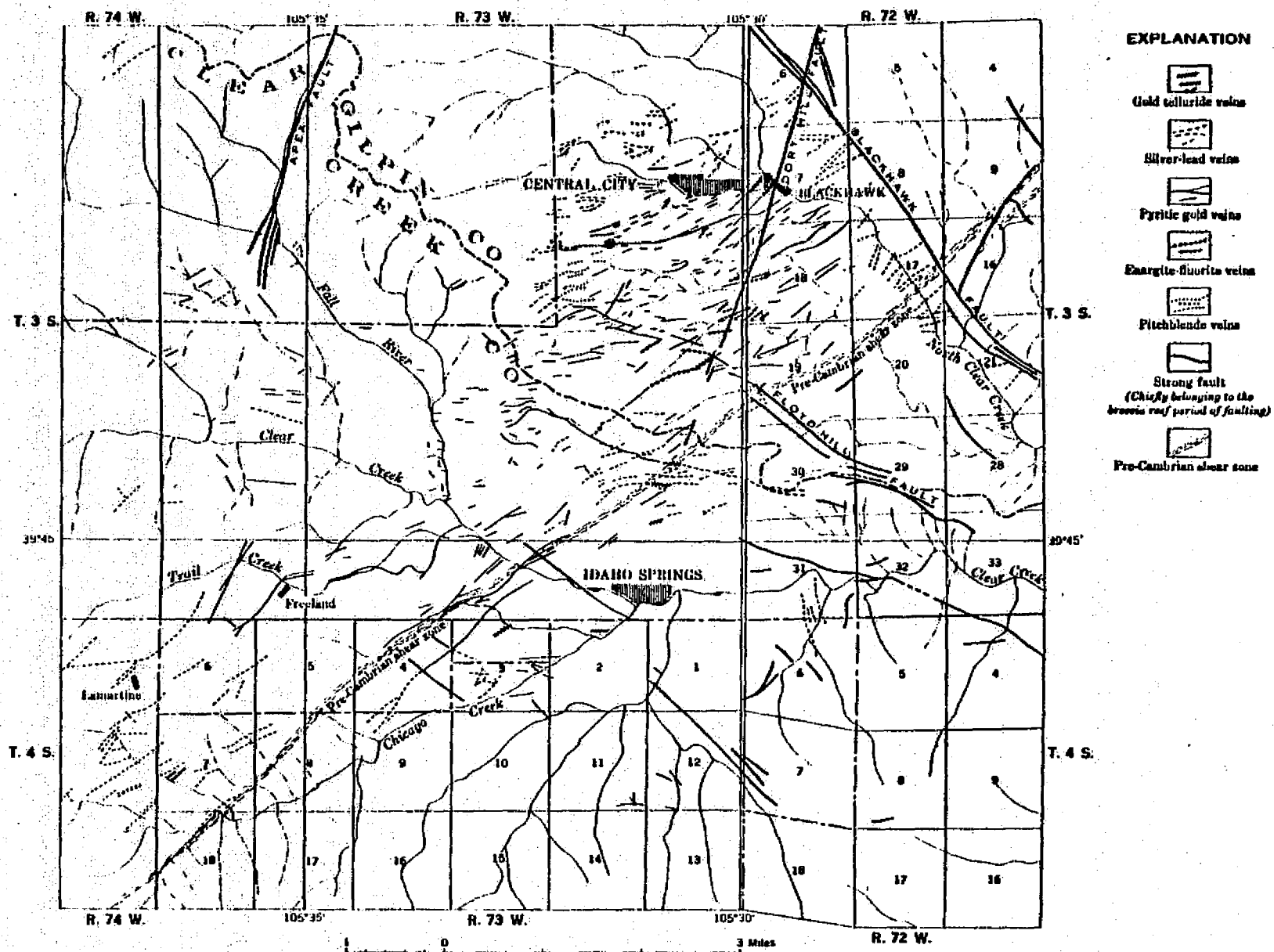
## Geologic Summary

Precambrian crystalline rocks, constituting the core of the Front Range are the host rocks of the Idaho Springs-Central City area. They consist of an interlayered and generally conformable succession of gneissic, granitic and pegmatitic suites derived initially from a sedimentary sequence. Nine different types of porphyritic intrusive rocks of Early Tertiary age cut across the Precambrian rocks including leucocratic granodiorite porphyry, quartz monzonite porphyry, and bostonite porphyries.

The gneissic rocks were folded during Precambrian time to develop broad north-northeast trending major folds which form the fundamental fabric of the area. They plunge gently to the northeast and southwest. Some contain siliceous breccias. A late Precambrian deformation formed northwest and north-northeast faults. Locally they form a closely spaced network particularly in the Central City district. Near the end of the Early Eocene igneous activity a third system of faults developed. Three main trends predominate: northeast, east-northeast, and east (fig. 13).

The ore base metal deposits of the area consist of veins and stockworks resulting from filling of open spaces along faults and highly fractured zones.

Fig. 13




MAP, SHOWING THE ZONAL ARRANGEMENT OF THE ORES OF THE CENTRAL CITY—IDAHO SPRINGS MINING DISTRICT

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

The veins range from 1 to 3 feet in width and vary from well defined, single fissures to complex, mineralized fractured zones. An extensively shattered, pipe-like body in the Central City district consisting of closely spaced, mineralized fractures, has been mined for its high gold content. This stockwork appears to have been formed by explosive activity.

Hydrothermal alteration adjacent to the veins is strong, but restricted to approximately the width of the vein on either side of the structure. Sericitization lies in an inner zone whereas propylitization has developed in an outer zone and grades outward into fresh rock. The hydrothermal fluids responsible for both the alteration of the wall rocks and the mineralization of the veins are believed to have been generated from an underlying magma body. Shallow intrusives, faulting, alteration and mineralization appear to be hood zone phenomena above the proposed magma body.

Application of Photography (Remote Sensing Technology)

Neither intermediate nor low level photography are effective in locating new veins or stockworks in the Idaho Springs-Central City area because of lack of surface expression and heavy vegetation and overburden.

## CONCLUSIONS

1. LANDSAT imagery can cover large areas quickly and inexpensively, and there are some surface features in any given region that are general indicators of possible mineralization.

2. Lineament analysis of the less known geologic portions of the Colorado Mineral Belt on LANDSAT, intermediate and low level photography in conjunction with remote sensing techniques and ground geologic mapping may point to additional mineral target areas.

3. Orbital photography by itself is not considered adequate to fulfill exploration needs. It is useful in reducing the size of an exploration area, but like other remote sensing techniques, it is an applicable tool only when used in conjunction with detailed field work.

4. Linear structures are extractable from LANDSAT imagery.

5. Areas where orbital photography would be most useful in the search for mineral deposits include desert mountains or snow-free alpine mountains.

6. Areas extensively covered by soil, vegetation, clouds, or snow, no matter how favorable, are incapable of being evaluated.

FOLDOUT FRAME 1

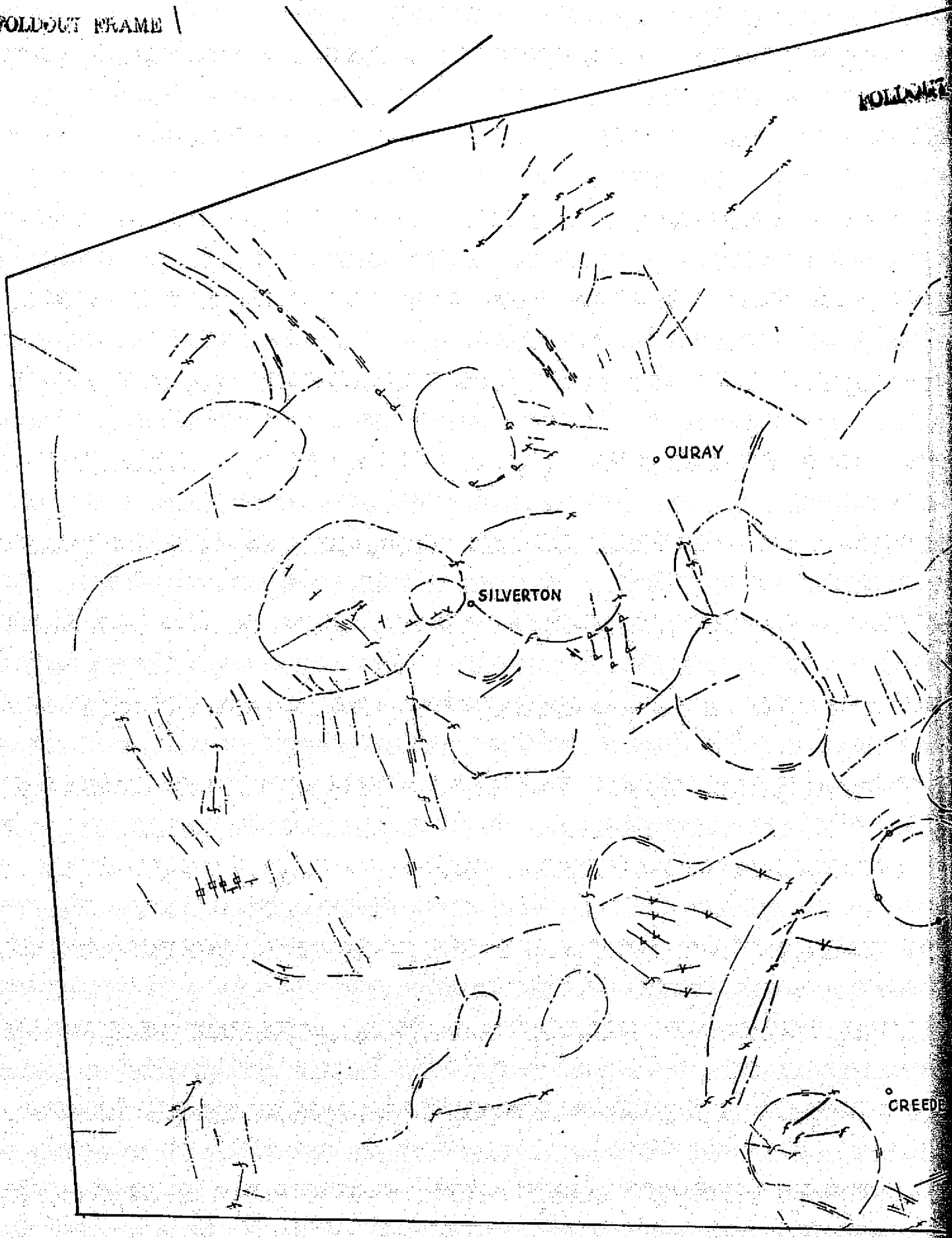



PLATE 1

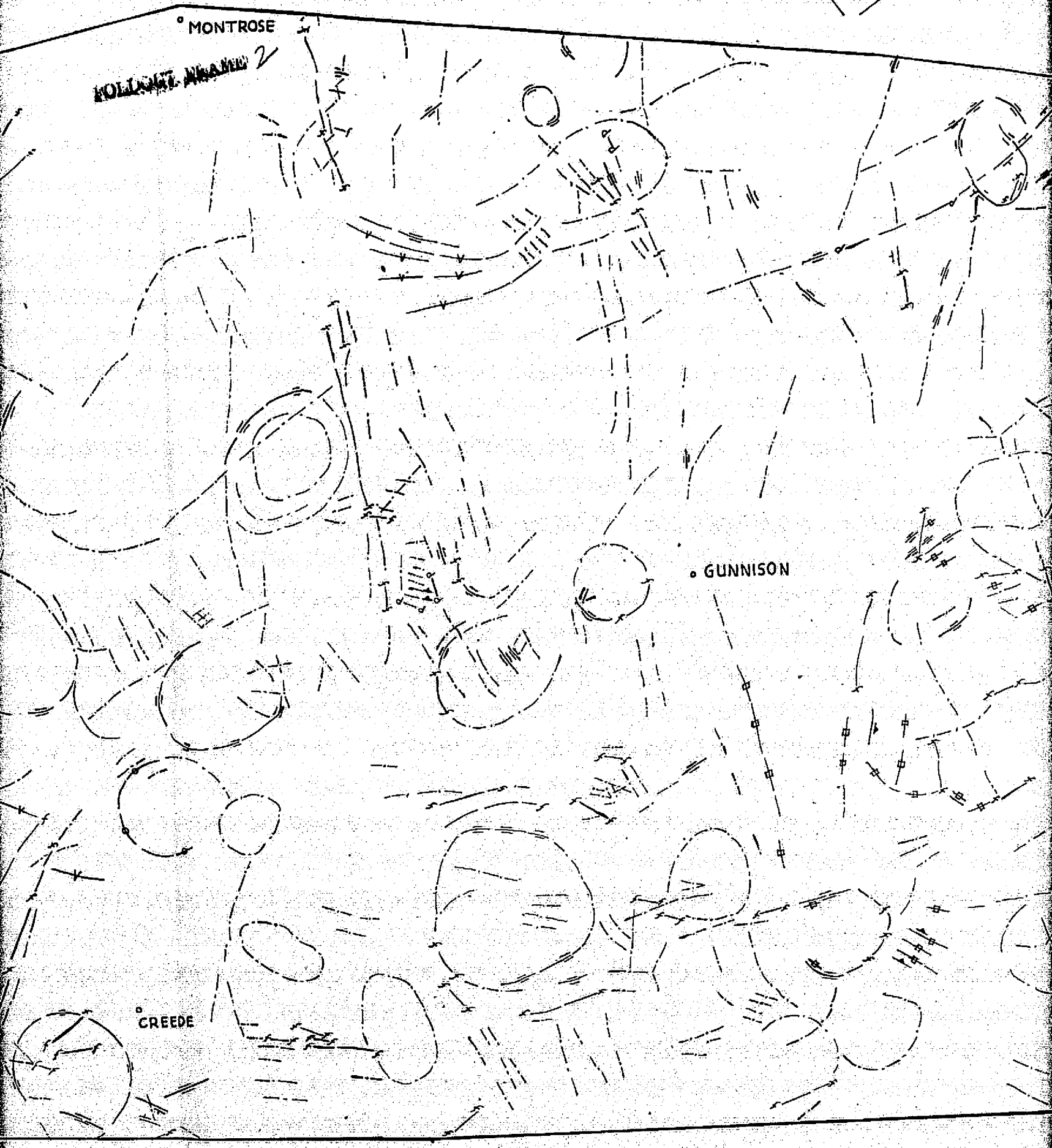
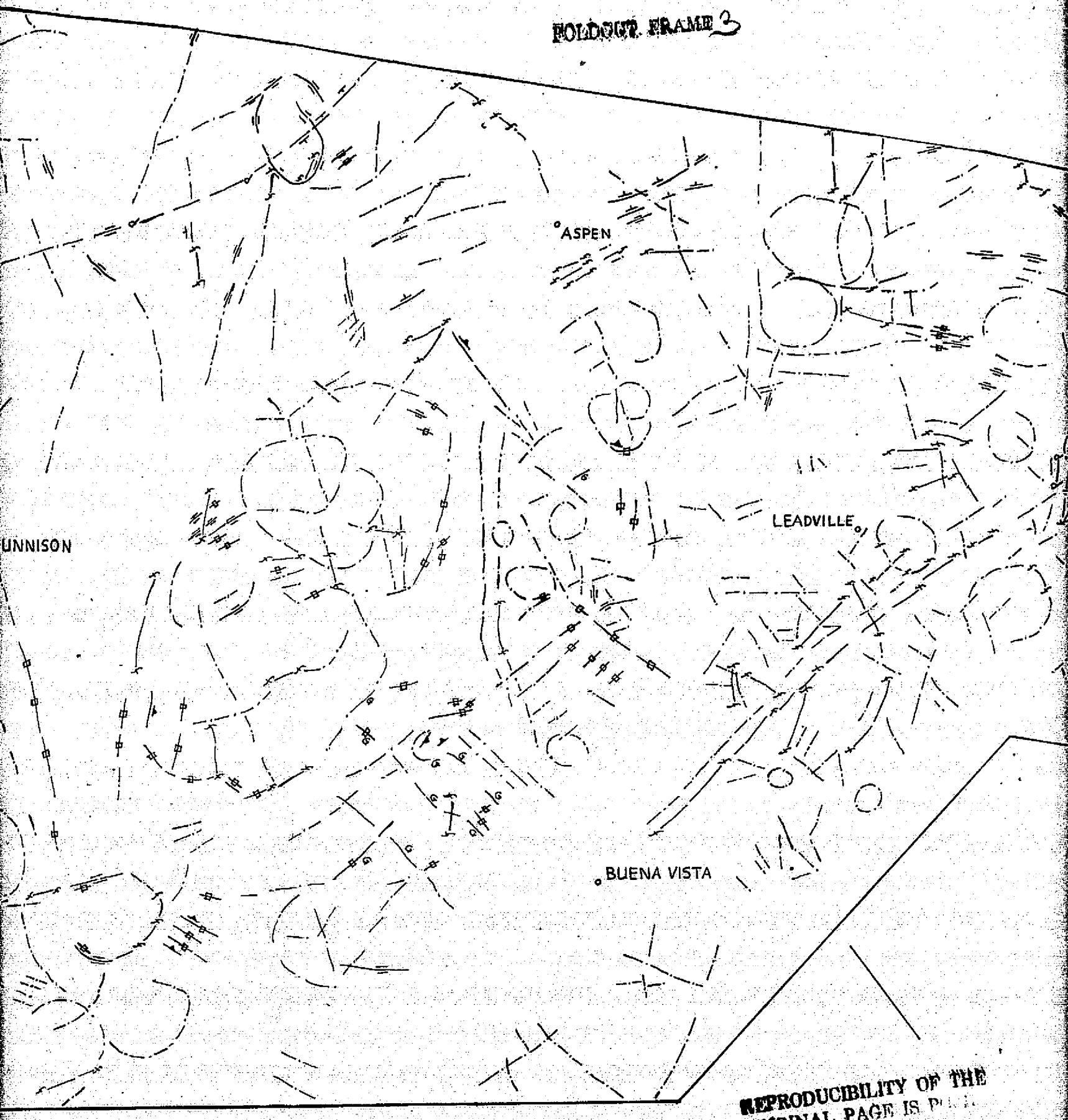



PLATE 1 A

FOLDOUT FRAME 3




REPRODUCIBILITY OF THE
ORIGINAL PAGE IS P

PLATE 1B

FOLDOUT FRAME 4

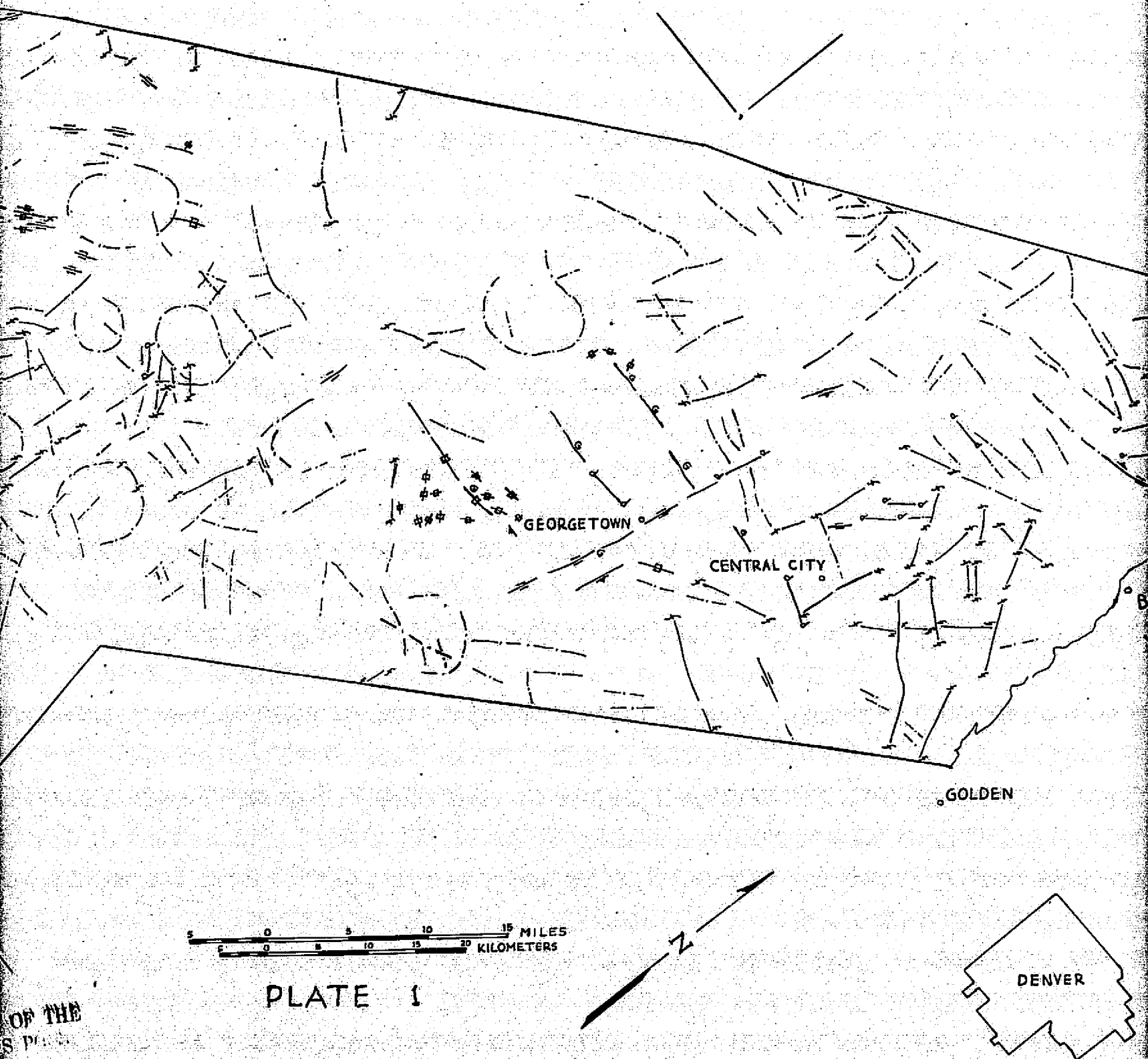



PLATE 1

OF THE
S Pl

PLATE 1C

FOLDOUT FRAME 4

FOLDOUT FRAME 5

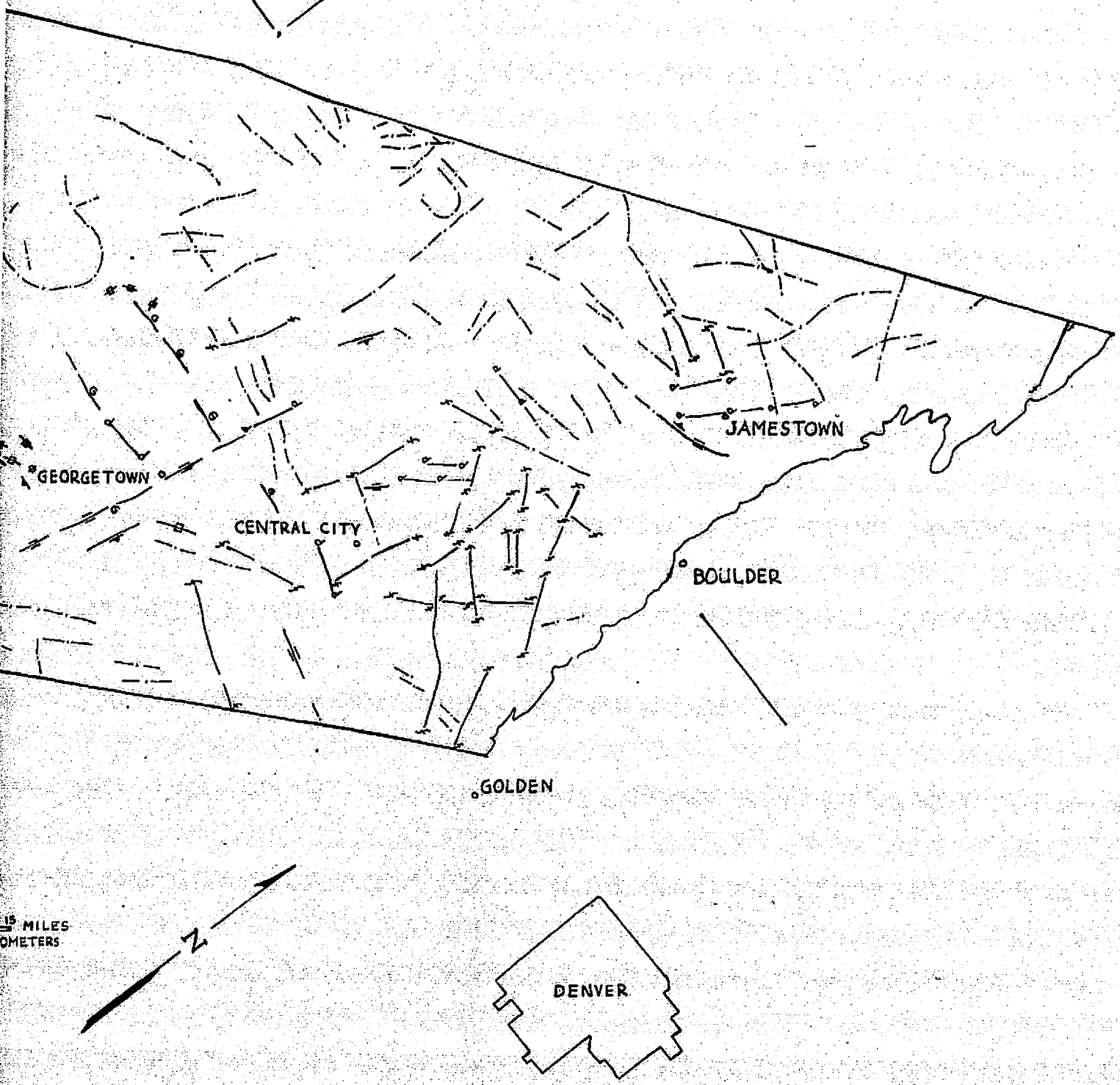
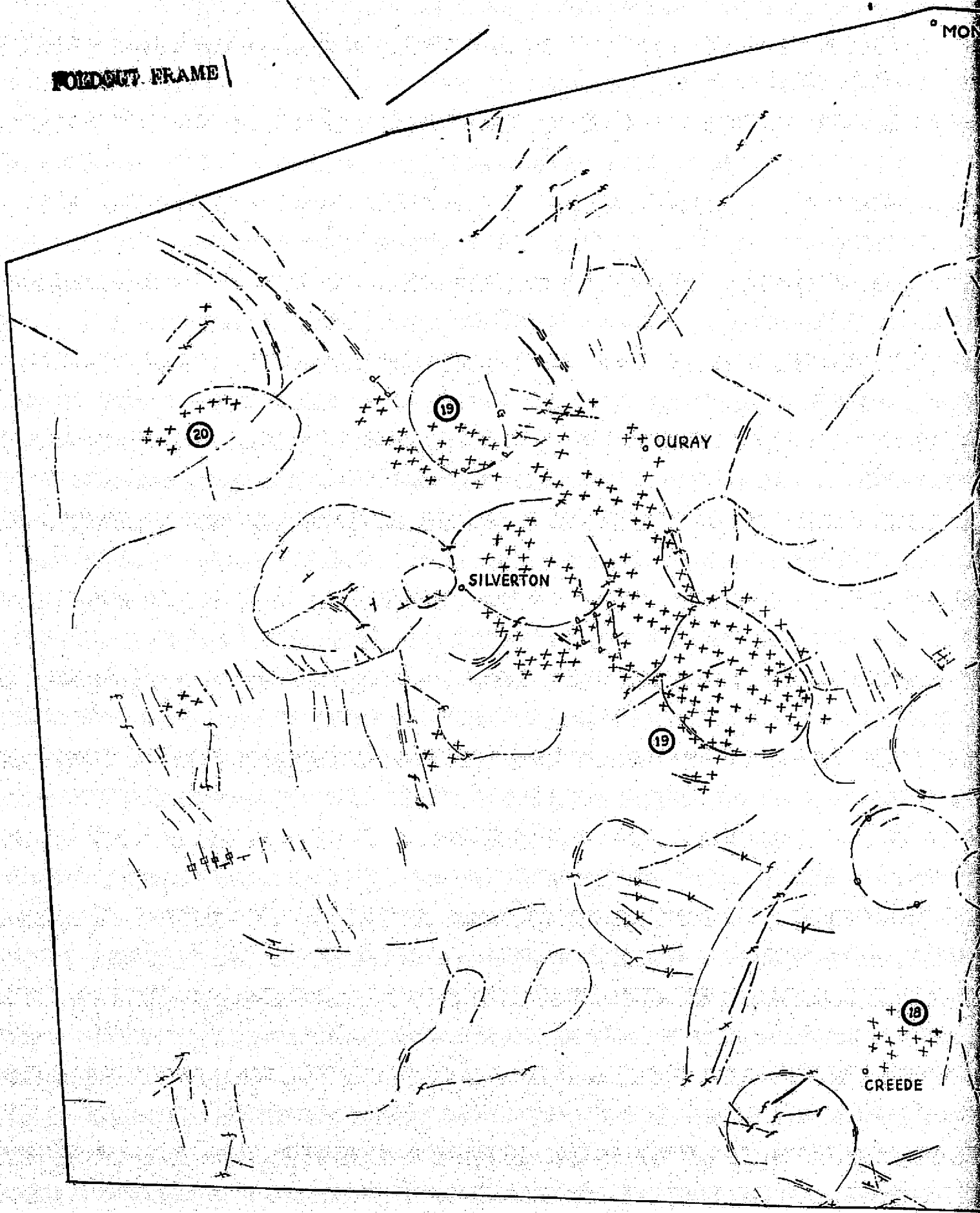



PLATE 1C

FOLDOUT FRAME




REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

PLATE 2

ONTROSE

FOLDOUT FRAME 2

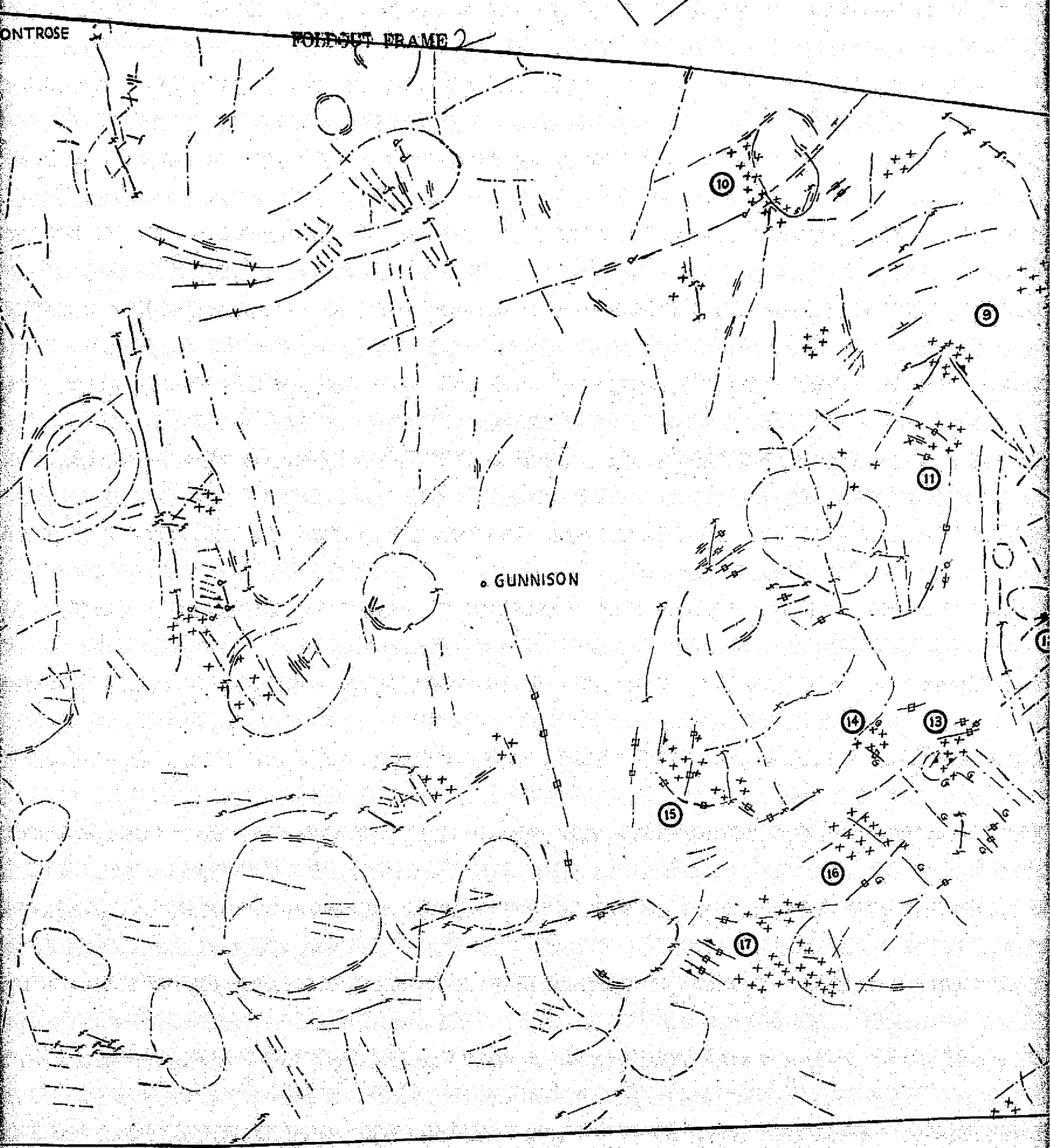



PLATE 2A

FOLDOUT FRAME 3

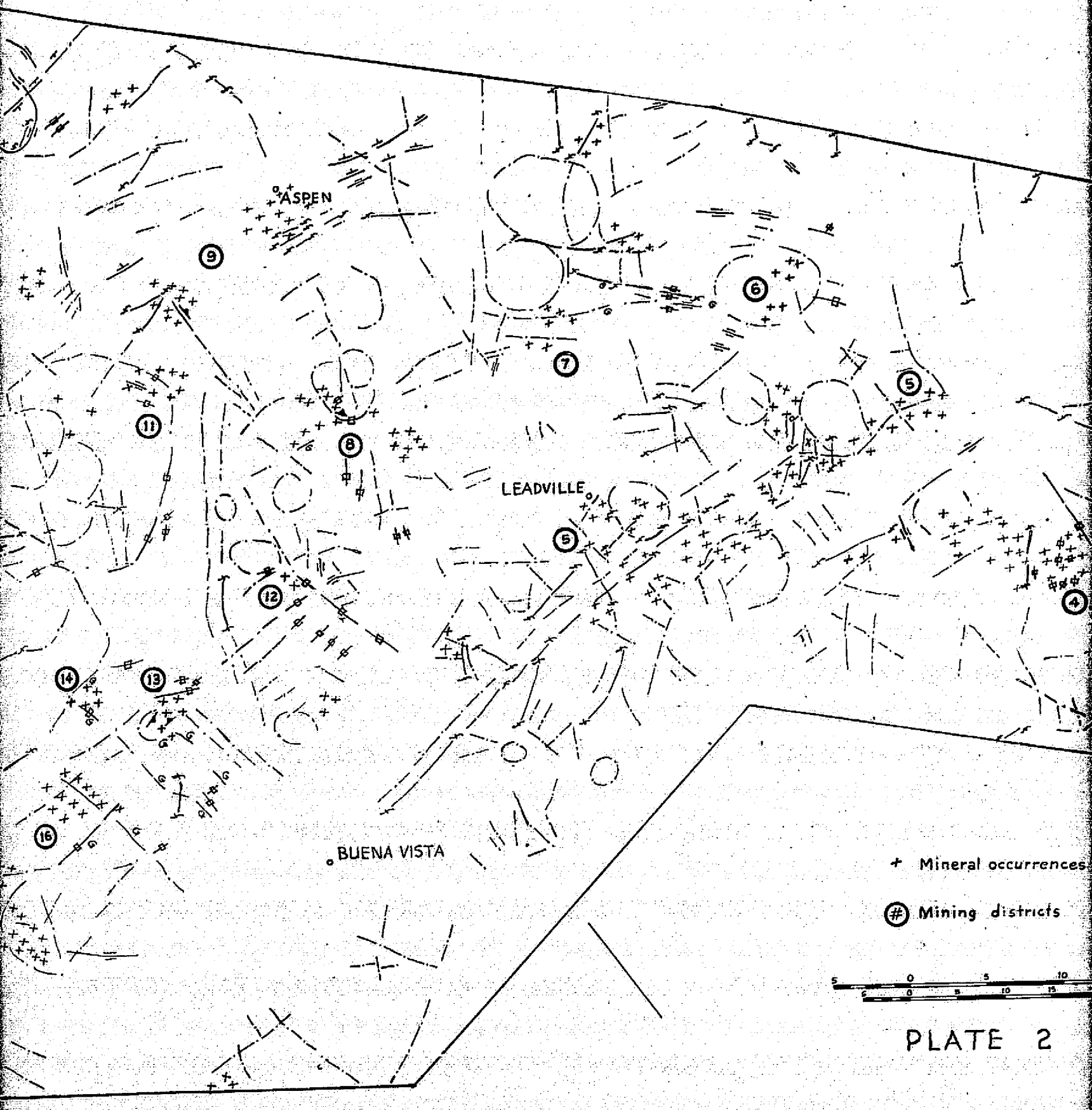



PLATE 2

PLATE 2B

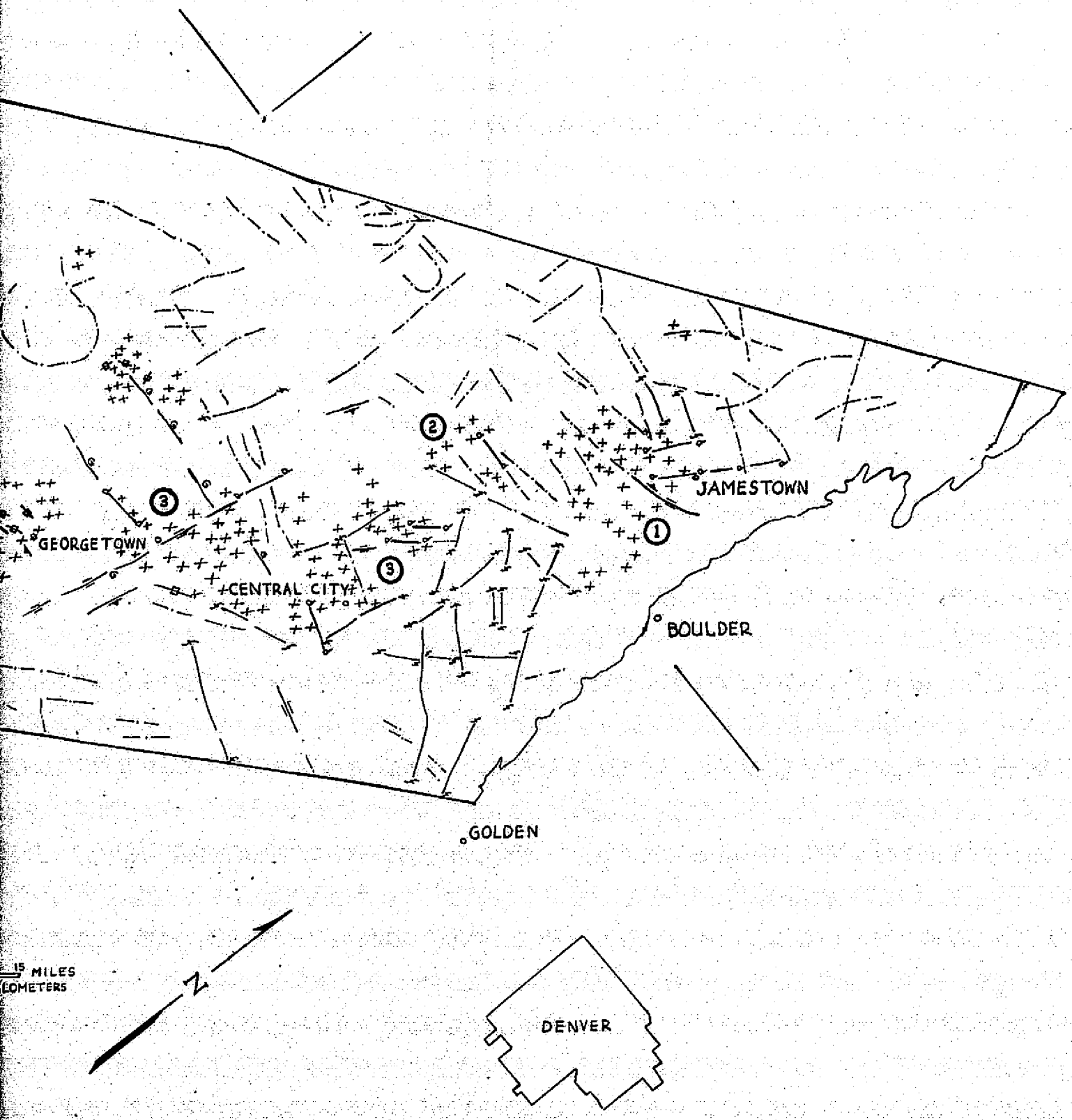
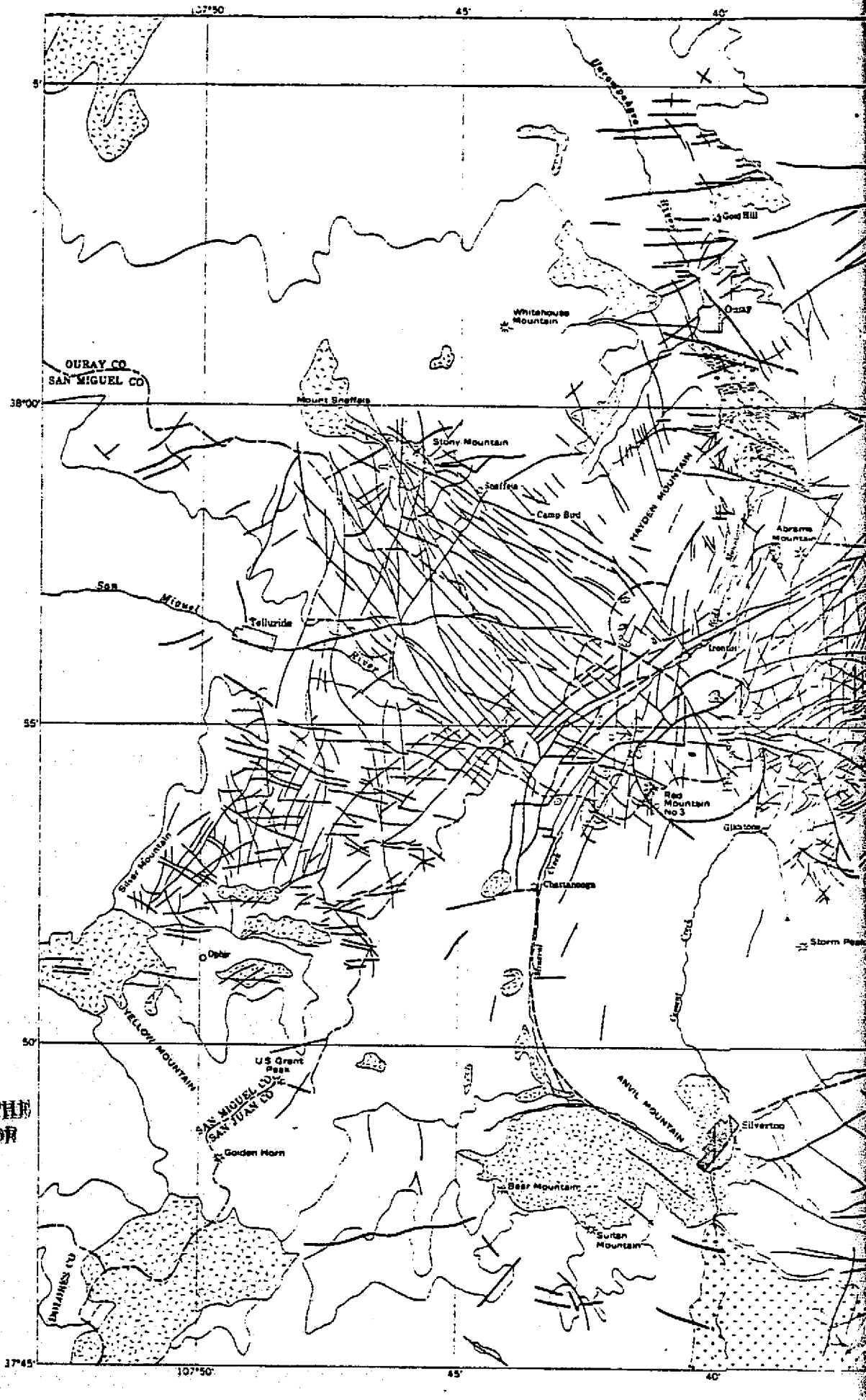

JAMESTOWN
GEORGETOWN
CENTRAL CITY
BOULDER
GOLDEN
DENVER
15 MILES
LOMETERS
N
1
2
3
3

PLATE 2C

FOLDOUT FRAME

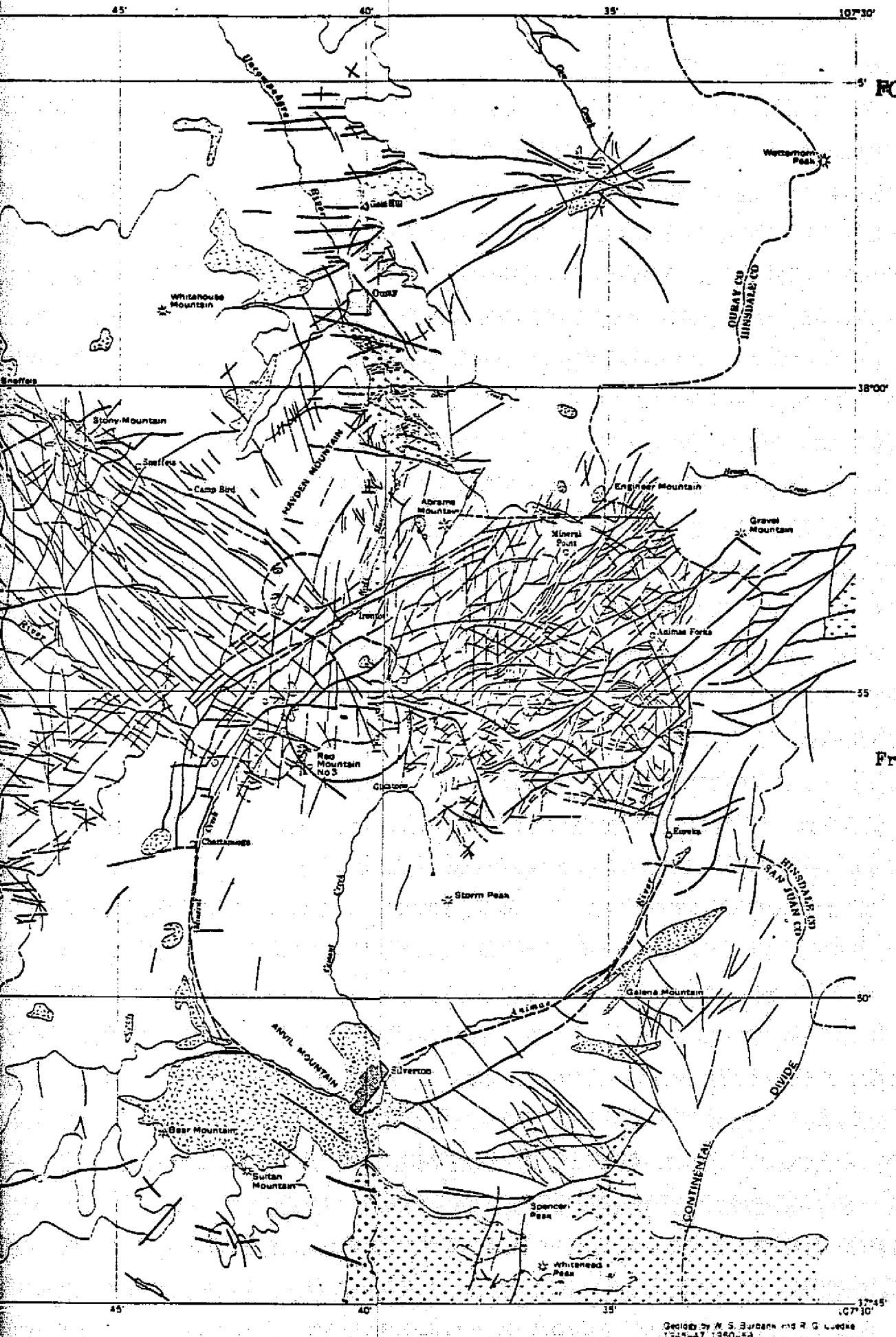



REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

PLATE 3

GEOLOGIC MAP SHOWING STRUCTURE OF PART OF THE SILVERTON C
IN OURAY, SAN JUAN, SAN MIGUEL, AND HINSDALE COUN

FOLDOUT FRAME 2



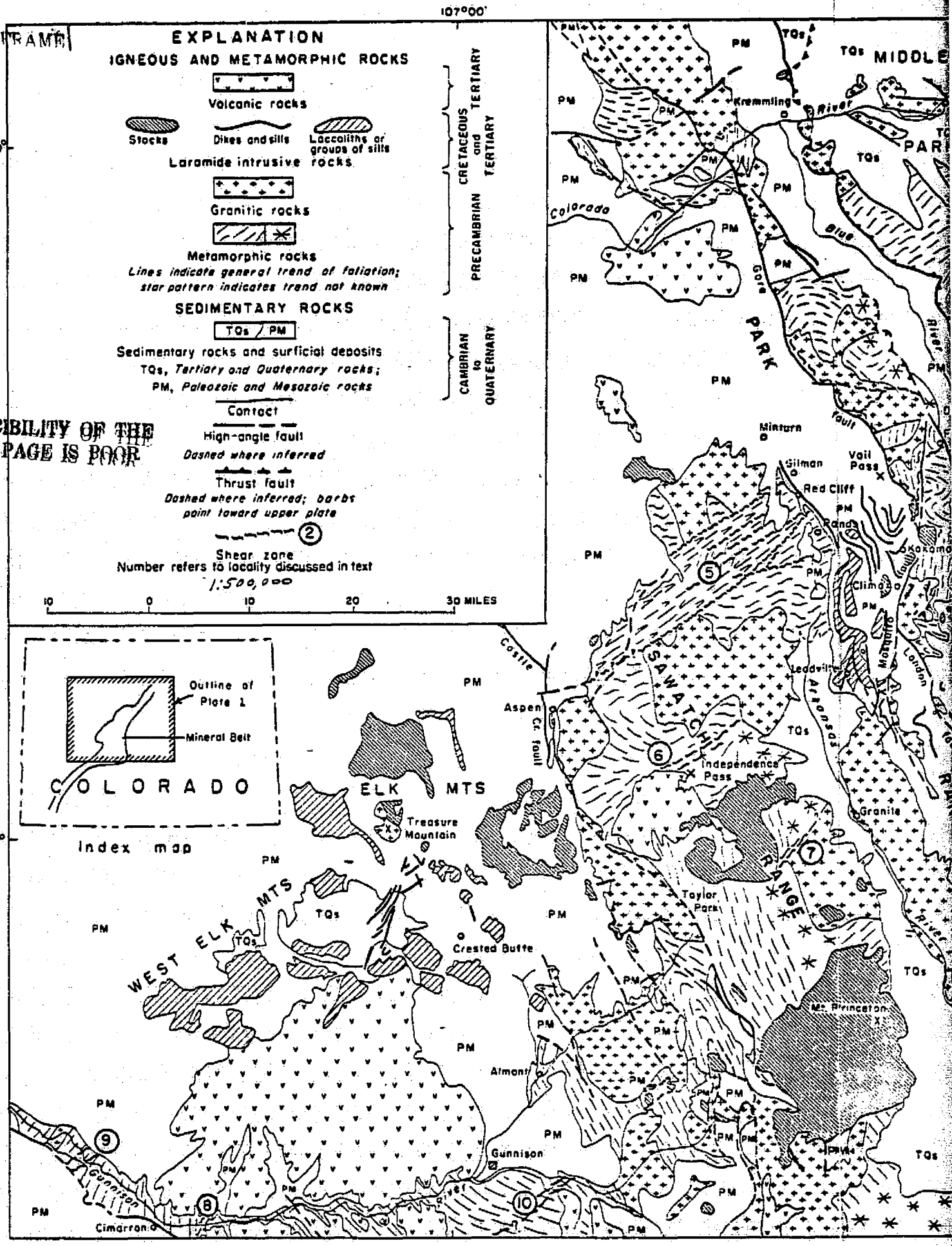

From: U.S.G.S. P.P. 535
(Plate 1)

Geology by W. S. Burbank and R. G. Luedke
1945–47, 1950–58

G STRUCTURE OF PART OF THE SILVERTON CAULDRON AND AREAS NEARBY
SAN JUAN, SAN MIGUEL, AND HINSDALE COUNTIES, COLORADO

PLATE 3a

FOLDOUT FRAME

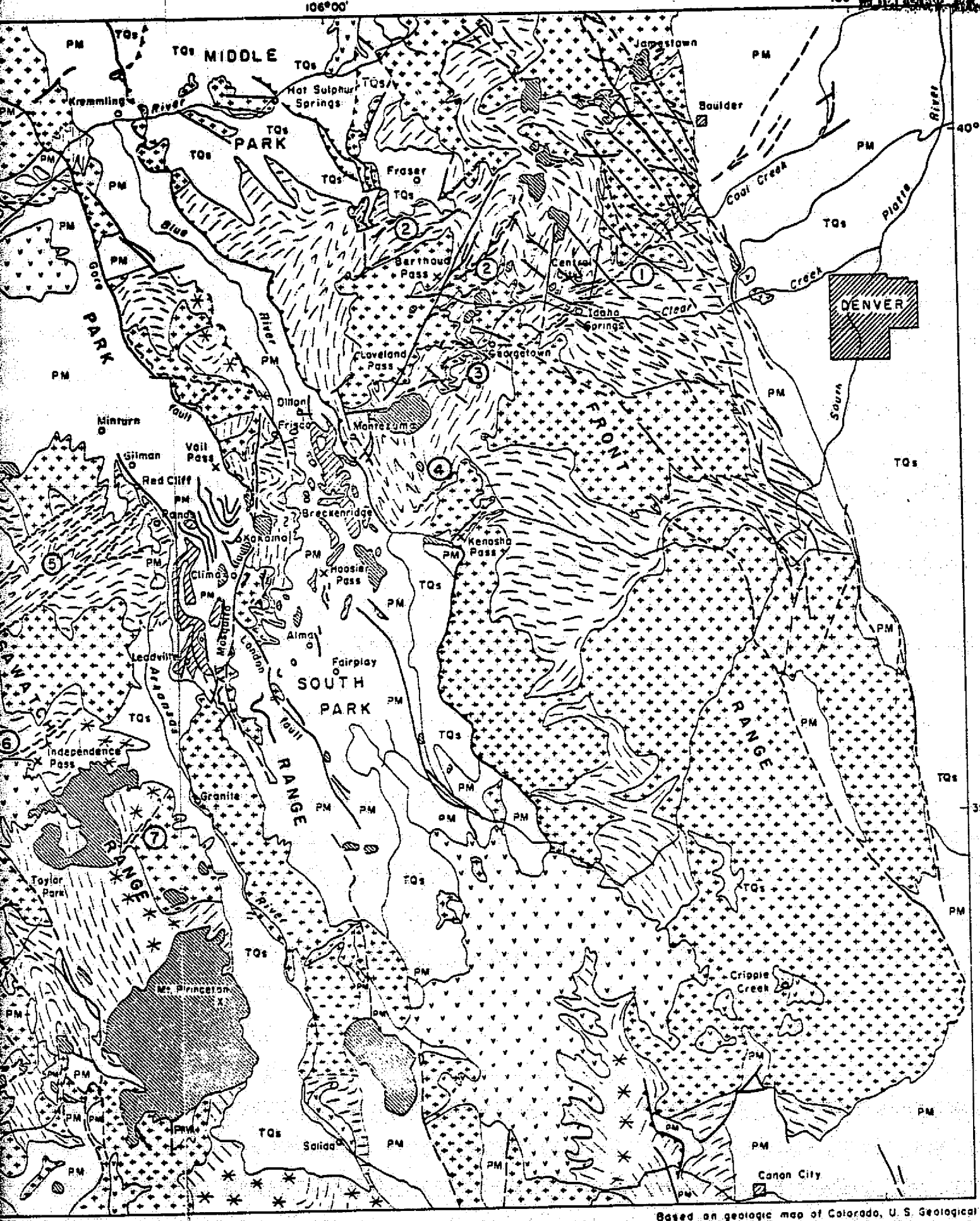



REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

GEOLOGIC SKETCH MAP OF CENTRAL COLORA

TWETO AND SIMS.
Geological Society of America Bulletin, volume 74

PLATE 4




GEOLOGIC SKETCH MAP OF CENTRAL COLORADO

Based on geologic map of Colorado, U. S. Geological Survey, 1935, and Lovering and Goddard (1950, Pl. 1); revised by Ogden Tweto and P. K. Sims, 1960
Includes published data from sources listed under "References" and unpublished data received

PLATE 4 A

# APPENDIX A

Table I. LANDSAT Imagery Used

Northern Front Range area
- LANDSAT - 1
  - 1172-17135
  - 1190-17140
  - 1550-17100
- LANDSAT - 2
  - 2186-17015
  - 2168-17022

Southern Front Range area
- LANDSAT - 1
  - 1172-17141
  - 1190-17143
  - 1153-17143
- LANDSAT - 2
  - 2186-17022
  - 2276-17011

San Luis Valley area
- LANDSAT - 1
  - 1550-17105
  - 1172-17144
- LANDSAT - 2
  - 2276-17013
  - 2186-17024

North Park area
- LANDSAT - 1
  - 1515-17165
  - 1551-17154
  - 1191-17195
  - 1461-17172
  - 1299-17200
- LANDSAT - 2
  - 2187-17074

Aspen-Gunnison area
- LANDSAT - 1
  - 1551-17161
  - 1515-17171
  - 1407-17190
  - 1461-17174
  - 1299-17203
- LANDSAT - 2
  - 2259-17070

San Juan Mountains area
- LANDSAT - 1
  - 1551-17163
  - 1191-17204
  - 1461-17181
  - 1425-17190
  - 1299-17205
- LANDSAT - 2
  - 2259-17073

Grand Junction area
- LANDSAT - 1
  - 1516-17225
  - 1156-17260
  - 1462-17233
- LANDSAT - 2
  - 2260-17124

## Table II. Key to Mining Districts

(1) Jamestown-Gold Hill
(2) Caribou-Nederland
(3) Black Hawk-Central City-Idaho Springs-Georgetown
(4) Montezuma-Breckenridge
(5) Kokomo-Climax-Leadville
(6) Battle Mountain (Red Cliff, Gilman)
(7) Homestake
(8) Independence
(9) Aspen-Ashcroft-Snowmass
(10) Marble
(11) Taylor River
(12) Winfield
(13) Cottonwood
(14) Tincup
(15) Pitkin-Ohio City
(16) St. Elmo-Chalk Creek
(17) Garfield-Monarch
(18) Creede
(19) Lake City-Ouray-Silverton-Telluride
(20) Rico

Table III. Geologic maps used in the identification of topolinears

USGS GQ Series

152 Ouray
267 Central City
291 Ironton
443 Berthoud Pass
504 Telluride
512 Marble
536 Dolores Peak
578 Oh-Be-Joyful
631 Bristol Head
788 Maroon Bells
797 Rico
833 Nederland
853 Snowmass Mountain
863 Hayden Peak
932 Highland Peak
933 Aspen
978 Tungsten
1004 Ruedi
1011 Wetterhorn
1052 Spar City
1053 Creede
1177 Rudolph Hill
1178 Powderhorn
1248 Black Hawk
1277 Ward
1287 Houston Gulch

USGS MF Series

176 Gray Head
760 Leadville
761 Montrose

USGS I Series

764 Durango

# APPENDIX B

# SELECTED REFERENCES ON COLORADO'S MINERALIZED BELT

## TABLE OF CONTENTS

PART I -- Selected References on Colorado Mineral Resources

PART II -- Selected References by County

Boulder
Chaffee
Clear Creek
Delta
Dolores
Douglas
Eagle
Fremont
Garfield
Gilpin
Grand
Gunnison
Hinsdale
Jackson
Jefferson
Lake
La Plata
Larimer
Mineral
Montrose
Ouray
Park
Pitkin
Routt
Saguache
San Juan
San Miguel
Summit
Teller

## PART III -- Selected References by Mineral District

Alma

Aspen

Blue River

Bonanza

Breckenridge

Brush Creek

Calumet

Caribou

Cebolla

Central City

Central Jameston

Climax

Cochetopa

Creede

Cripple Creek

Crystal Mountain

Empire

Eureka

Freeland-Lamertine

Georgetown

Gold Brick

Gold Hill

Gilman

Horse Shoe

Idledale

Irwin

Kokomo

Lake Como

La Plata

Lawson-Dumont

Leadville

Magnolia

Marshall Pass

Mineral Point

Monarch

Montezuma

North Gate

Ouray

Placerville

Platoro-Summitville

Poughkeepsie

Powderhorn

Quartz Creek

Red Cliff

Red Mountain

Rico

Silverton

Slick Rock

Sneffels

Summitville

Tarryall

Telluride

Ten Mile

Tin Cup

Tomichi

Tungsten

Twin Lakes

Uncompahgre

Uravan

Ward

Weston Pass

White Pine

# PART I

## SELECTED REFERENCES ON COLORADO MINERAL RESOURCES

## SELECTED REFERENCES ON COLORADO MINERAL RESOURCES


Argall, G. O., Jr., 1949, Industrial minerals of Colorado: Colorado School of Mines Quart., v. 44, no. 2, 477 p., 2 pls.

Aurand, H. A., 1920a, Fluorspar deposits of Colorado: Colorado Geol. Survey Bull. 18, 94 p.

_____ 1920b, Mineral deposits of the Western Slope: Colorado Geol. Survey Bull. 22, 78 p., 2 pls.

Baille, W. N., 1962, Silver in Colorado, CSM Min. Ind. Bulletin, vol. 5, no. 5.

Blanchard, R., and Boswell, P. F., 1935, Limonite of molybdenumite derivation, Economic Geology, vol. 30, no. 6.

Branch of Mineral Classification, Conservation Division, 1971, Reported occurrences of selected minerals in Colorado: U.S. Geol. Survey Mineral Inv. Resource Map MR-57.

Burbank, W. S., Lovering. T. S., Goddard, E. N., and Eckel, E. B., 1935 [repr. 1967], Geologic map of Colorado: U.S. Geol. Survey, Colorado Geol. Survey, and Colorado Metal Mining Fund.

Burke, M. B., 1964, Molybdenum: Colorado School Mines Mineral Industries Bull., v. 7, no. 1, 14 p.

Bush, A. L., 1951, Sources of lightweight aggregates in Colorado: Colorado Sci. Soc. Proc., v. 15, no. 8, p. 305-368.

Butler, B. S., 1929, Relation of the ore deposits of the southern Rocky Mtn. region in the Colorado Plateau, Colorado Science Society Proc., No. 12.

Butler, G. [illegible], 1914, The clays of eastern Colorado: Colorado Geol. Survey Bull. 8, 353 p.

Colorado Metal Mining Fund Board, 1960, Tungsten mines of Colorado: Colorado Metal Mining Fund Board, 78 p.

_____ 1961, Colorado vanadium -- A composite study: Colorado Metal Mining Fund Board, 155 p.

Del Rio, S. M., 1960, Mineral resources of Colorado, first sequel: Denver, Colo., Publishers Press, 764 p., 6 pls.

Eckel, E. B., 1961, Minerals of Colorado -- a 100-year record: U.S. Geol. Survey Bull. 1114, 399 p., 1 pl.

Finch, J. W., 1931, General correlation and synchrony of the Colorado ore deposits, Colorado Scientific Soc. Proc., vol. 12, no. 11.

Fischer, R. P., 1936, Peculiar hydrothermal copper-bearing veins of the northeastern Colorado Plateau, Economic Geology, vol. 31, no. 6.

Fischer, R. P., Burbank, W. S., Cannon, H. L., and others, 1946, Map showing mineral deposits of Colorado: U. S. Geol. Survey Missouri Basin Studies Map 8.

Gabelman, J. W., 1952, Definition of a mineral belt in south central Colorado., Geol. Soc. Am., vol. 63, no. 12.

Gabelman, J. W., 1960, Tectonic control of the mineral belts in the southwestern Colorado metallogenic province, Am. Ingt. Min. Met. and Retro. Eng., vol. 217.

Harrer, C. M., and Tesch, W. J., Jr., 1959, Reconnaissance of iron occurrences in Colorado: U. S. Bur. Mines Inf. Circ. 7918, 82 p.

Henderson, C. W., 1926, Mining in Colorado -- A history of discovery, development, and production: U. S. Geol. Survey Prof. Paper 138, 263 p., 1 pl.

Heyl, A. V., 1964, Oxidized zinc deposits of the United States, including parts on Colorado, U.S.G.S. Bulletin 1135-C.

Holt, R. D., 1972, Bibliography, coal resources in Colorado: Colorado Geol. Survey Bull. 34-A, 32 p.

Horner, R. R., and Coghill, W. H., 1921, Investigation of low-grade and complex ores in Colorado: U.S. Bur. Mines Report Invest. 2206.

Jones, O. M. 1914, Bibliography of Colorado geology and mining with subject index from the earilest exploration to 1912, Colorado Geol. Survey Bull. 7.

Landis, E. R., 1959, Coal resources of Colorado: U. S. Geol. Survey Bull. 1072-C, 101 p., 2 pls.

Larrabee, D. M., Clabaugh, S. E., Griffitts, W. R., Fischer, E. C., Fox, E. L., and Bryson, R. P., 1946, Construction materials and nonmetallic minerals of Colorado--Report and data sheets: U. S. Geol. Survey, 543 p.

Larrabee, D. M., Clabaugh, S. E., Griffitts, W. R., and others, 1947, Map showing construction materials and nonmetallic mineral resources of Colorado: U. S. Geol. Survey Missouri Basin Studies Map 10.

Lovering, T. S., 1930, Localization of ore in the schists and gneisses of the mineral belt of the Front Range, Colorado, Colorado Science Soc. Proc., vol. 12, no. 7.

Lovering, T. S. and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado, U.S.G.S. Prof. Paper 223.

Marsh, W. R., and Queen, R. W., 1974, Map showing localities and amounts of metallic mineral production in Colorado: U.S. Geol. Survey Mineral Inv. Resources Map MR-58.

Muilenburg, G. A., 1919, Manganese deposits of Colorado: Colorado Geol. Survey Bull. 15, 76 p.

Sharps, T. I., 1963, Dimension stone in Colorado: Colorado School Mines Mineral Industries Bull, v. 6, no. 1, 12 p.

Tweto, Ogden, 1963, Precambrian ancestry of the Colorado mineral belt, G.S.A. Bulletin, vol. 74, no. 8.

U. S. Geological Survey, and Colorado Mining Industrial Development Board, 1968, Mineral and water resources of Colorado [Report for the use of U. S. Senate Committee on Insular Affairs, 88th Cong., 2nd sess.]: Washington, U. S. Govt. Printing Office, 302 p.

Vanderwilt, J. W., 1947, Field conference in central Colorado, Rocky Mtn. Geologists Assn. Guidebook.

Vanderwilt, J. W., 1947, Mineral resources of Colorado: Denver, Colo., Colorado Mining Assoc., 547 p., 34 pls.

Van Sant, J. N., 1959, Refractory-clay deposits of Colorado: U. S. Bur. Mines Rept. Inv. 5553, 156 p.

Williamson, D. R., 1961, Guide to Colorado gold deposits: Colorado School Mines Mineral Industries Bull,, v. 4, no. 3, 12 p.

_____1963, Colorado gypsum and anhydrite: Colorado School Mines Mineral Industries Bull., v. 6, no. 2, 20 p.

Williamson, D. R., and Burgin, Lorraine, 1960, Limestone occurrences in Colorado: Colorado School Mines Mineral Industries Bull., v. 3, no. 1, 12 p.

Worchester, P. G., 1919, Molybdenum deposits of Colorado with general notes on the molybdenum industry, Colo. Geol. Sur., Bulletin 14.

# PART II

## SELECTED REFERENCES BY COUNTY

## SELECTED REFERENCES ON BOULDER COUNTY MINERAL RESOURCES


Baillie, W. N., 1962a, Feldspar occurrences in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 4, 12 p.

_____1962b, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Bastin, E. S., and Hill, J. M., 1917, Economic geology of Gilpin County and adjacent parts of Clear Creek and Boulder Counties, Colorado: U. S. Geol. Survey Prof. Paper 94, 379 p., 10 pls.

Belser, Carl, 1955, A study of the tungsten potential in Boulder County, Colo.: U. S. Bur. Mines Inf. Circ. 7721, 39 p.

_____1960, Tungsten mining and milling in Boulder County, Colo.: U. S. Bur. Mines Inf. Circ. 7936, 54 p.

Chase, G. H., and McConaghy, J. A., 1972, Generalized surficial geologic map of the Denver area, Colorado: U. S. Geol. Survey Misc. Geol. Inv. Map I-731.

Colton, R. B., and Fitch, H. R., 1974, Map showing potential sources of gravel and crushed-rock aggregate in the Boulder-Fort Collins-Greeley area, Front Range Urban Corridor, Colorado: U. S. Geol. Survey Misc. Geol. Inv. Map I-855-D.

Emmons, S. F., Cross, Whitman, and Eldridge, G. E., 1896, Geology of the Denver Basin in Colorado: U. S. Geol. Survey Mon. 27, 556 p., 5 pls.

George, R. D., 1908, The main tungsten area of Boulder Co., Colorado, Colorado Geol. Sur. no. 1.

Goddard, E. N., and Lovering, T. S., 1942, Nickel deposit near Gold Hill, Boulder County, Colorado: U. S. Geol. Survey Bull. 931-O, 13 p., 1 pl.

Hild, J. H., and Ames, E. W., 1949, Investigation of Jamestown fluorite deposits, Boulder County, Colo.: U. S. Bur. Mines Rept. Inv. 4483, 10 p.

Larsen, V. E., 1950, The hard rock geology of Boulder Co., Colorado, Compass, vol. 27, no. 3.

Lindgren, W., 1907, Some gold and tungsten deposits of Boulder Co., Colorado, Economic Geology, vol. 2.

Loomis, F. B., 1937, Boulder County Tungsten Ores, Economic Geology, vol. 32.

Lovering, T. S., 1932, Preliminary map showing the relations of ore deposits to geologic structure in Boulder Co., Colorado, Colorado Sci. Soc. Proc., vol. 13, no. 3.

_____, 1941, The origin of tungsten ores of Boulder Co., Colorado, Economic Geology, vol. 36, no. 3.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

Lovering, T. S., and Tweto, Ogden, 1953, Geology and ore deposits of the Boulder County tungsten district, Colorado: U. S. Geol. Survey Prof. Paper 245, 199 p., 27 pls.

Lowrie, R. L., 1966, Analysis of the coal industry in Boulder-Weld coalfield, Colorado: U. S. Bur. Mines Rept. Inv. 6726, 79 p.

Martin, G. C., 1909, The Niobrara limestone of northern Colorado as a possible source of Portland cement material: U. S. Geol. Survey Bull. 380-J, p. 314-326.

_____1910, Coal of the Denver Basin, Colorado: U. S. Geol. Survey Bull. 381-C, p. 297-306.

Schwochow, S. D., Shroba, R. R., and Wicklein, P. C., 1974a, Sand, gravel, and quarry aggregate resources, Colorado Front Range counties: Colorado Geol. Survey Spec. Pub. 5-A, 43 p., 3 pls.

_____1974b, Atlas of sand, gravel, and quarry aggregate resources, Colorado Front Range counties: Colorado Geol. Survey Spec. Pub. 5-B, 212 pls.

Sharps, T. I., 1962, Colorado mica: Colorado School Mines Mineral Industries Bull., v. 5, no. 1, 15 p.

_____1965a, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

_____1965b, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Tweto, Ogden, 1947, Scheelite in the Boulder District, Colorado, Economic Geology, vol. 42, no. 1.

Wahlstrom, E. E., 1940, Ore Deposits at Camp Albion, Boulder Co, Colorado, Economic Geology, vol. 35, no. 4.

Warne, J. D., and Everett, F. D., 1953, Investigation of the Boulder County tungsten district, Boulder County, Colo.: U. S. Bur. Mines Rept. Inv. 4973, 30 p.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines Inf. Circ. 7770, 61 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

_____1920, The geology of the Ward region, Boulder County, Colorado: Colorado Geol. Survey Bull. 21, 74 p., 2 pls.

## SELECTED REFERENCES ON CHAFFEE COUNTY MINERAL RESOURCES


Adams, J. W., 1953, Beryllium deposits of the Mount Antero region, Chaffee County, Colorado: U. S. Geol. Survey Bull. 982-D, 24 p.

Ames, E. W., 1946, Exploration of the Jewell Tunnel zinc property, Chaffee County, Colorado: U. S. Bur. Mines Rept. Inv. 3933, 12 p.

Baillie, W. N., 1962a, Feldspar occurrences in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 4, 12 p.

_____1962b, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Belser, Carl, 1956, Tungsten potential in Chaffee, Fremont, Gunnison, Lake, Larimer, Park, and Summit Counties, Colo.: U. S. Bur. Mines Inf. Circ. 7748, 31 p.

Crawford, R. D., 1910, A preliminary report on the geology of the Monarch mining district, Chaffee County, Colorado: Colorado Geol. Survey Bull. 1, 78 p.

_____1913, Geology and ore deposits of the Monarch and Tomichi districts, Colorado: Colorado Geol. Survey Bull. 4, 317 p., 5 pls.

Dings, M. G., and Robinson, C. S., 1957, Geology and ore deposits of the Garfield quadrangle, Colorado: U. S. Geol. Survey Prof. Paper 289, 110 p., 13 pls.

F. M. Fox and Associates, 1974, Reconnaissance engineering geology report for Planning Districts 7 and 13, State of Colorado: Colorado Geol. Survey Environmental Geology Rept. 3, 44 p., 2 pls.

Hazen, S. W., Jr., 1956, Exploration of lead and zinc at the Madonna Mines, Monarch mining district, Chaffee County, Colo.: U. S. Bur. Mines Rept. Inv. 5218, 38 p.

Heinrich, E. W., 1948, Fluorite and rare earth mineral peymatites of Chaffee and Fremont Counties, Colorado, Am. Mineralogist, vol. 33.

Lindgren, Waldemar, 1908, Notes on copper deposits in Chaffee, Fremont, and Jefferson Counties, Colorado: U. S. Geol. Survey Bull. 340-B, p. 157-174.

Sharps, T. I., 1962, Colorado mica: Colorado School Mines Mineral Industries Bull., v. 5, no. 1, 15 p.

_____1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON CLEAR CREEK COUNTY MINERAL RESOURCES


Baillie, W. N., 1962a, Feldspar occurrences in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 4, 12 p.

_____1962b, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Bastin, E. S., and Hill, J. M., 1917, Economic geology of Gilpin County and adjacent parts of Clear Creek and Boulder Counties, Colorado: U. S. Geol. Survey Prof. Paper 94, 379 p., 10 pls.

Braddock, W. A., 1969, Geology of the Empire quadrangle, Grand, Gilpin, and Clear Creek Counties, Colorado: U. S. Geol. Survey Prof. Paper 616, 56 p., 3 pls.

Gardner, E. D., and Guiteras, J. R., 1937, Placer operations of Humphreys Gold Corporation, Clear Creek, Colo.: U. S. Bur. Mines Inf. Circ. 6961, 16 p.

Guiteras, J. R., 1939, Mining and milling methods and costs at the Alice Unit of the American Smelting and Refining Co., Alice, Colo.: U. S. Bur. Mines Inf. Circ. 7058, 15 p.

Harrison, J. E., and Leonard, B. F., 1952, Preliminary report on the Jo Reynolds area, Lawson-Dumont district, Clear Creek County, Colorado: U. S. Geol. Survey Circ. 213, 9 p., 2 pls.

Harrison, J. E., and Wells, J. D. 1956, Geology and ore deposits of the Freeland-Lamartine district, Clear Creek County, Colorado: U. S. Geol. Survey Bull. 1032-B, 91 p., 10 pls.

_____1959, Geology and ore deposits of the Chicago Creek area, Clear Creek County, Colorado: U. S. Geol. Survey Prof. Paper 319, 92 p., 13 pls.

Hawley, C. C., and Moore, F. B., 1967, Geology and ore deposits of the Lawson-Dumont-Fall River district, Clear Creek County, Colorado: U. S. Geol. Survey Bull. 1231, 92 p., 4 pls.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

Moench, R. H., and Drake, A. A., Jr., 1966, Economic geology of the Idaho Springs district, Clear Creek and Gilpin Counties, Colorado: U. S. Geol. Survey Bull. 1208, 91 p., 3 pls.

Sharps, T. I., 1962, Colorado mica: Colorado School Mines Mineral Industries Bull., v. 5, no. 1, 15 p.

_____1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

Sharps, T. I., 1965a, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

_____1965b, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Sims, P. K., and others, 1963, Geology of uranium and associated ore deposits, central part of the Front Range mineral belt, Colorado: U. S. Geol. Survey Prof. Paper 371, 119 p., 9 pls.

Sims, P. K., and Sheridan, D. M., 1964, Geology of uranium deposits in the Front Range, Colorado: U. S. Geol. Survey Bull. 1159, 116 p., 5 pls.

Spurr, J. E., and Garrey, G. H., 1908, Economic geology of the Georgetown quadrangle (together with the Empire district), with general geology by S. H. Ball: U. S. Geol. Survey Prof. Paper 63, 422 p., 61 pls.

Tooker, E. W., 1963, Altered wallrocks in the central part of the front range mineral belt, Gilpin and Clear Creek Counties, Colorado, USGS Prof. Paper 434.

Wells, J. D., and Harrison, J. E., 1954, Radioactivity reconnaissance of part of north-central Clear Creek County, Colorado: U. S. Geol. Survey Circ. 345, 9 p.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines Inf. Circ. 7770, 61 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON DELTA COUNTY MINERAL RESOURCES


Johnson, V. H., 1948, Geology of the Paonia coal field, Delta and Gunnison Counties, Colorado: U. S. Geol. Survey Coal Inv. Map.

Lee, W. T., 1909, The Grand Mesa coal field, Colorado: U. S. Geol. Survey Bull. 341-C, p. 316-334.

_____1912, Coal fields of Grand Mesa and the West Elk Mountains, Colorado: U. S. Geol. Survey Bull. 510, 237 p., 1 pl.

Sharps, T. I., 1965, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Speltz, C. N., 1974, Strippable coal resources of Colorado--Location, tonnage, and characterisitcs: U. S. Bur. Mines Prelim. Rept. 195, 68 p.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines Inf. Circ. 7770, 61 p.

Woodruff, E. G., 1912, The coal resources of Gunnison Valley, Mesa and Delta Counties, Colorado: U. S. Geol. Survey Bull. 471-H, p. 565-573.

## SELECTED REFERENCES ON DOLORES COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Coffin, R. C., 1921, Radium, uranium, and vanadium deposits of southwestern Colorado: Colorado Geol. Survey Bull. 16, 231 p., 3 pls.

Finley, E. A., 1951, Geology of the Dove Creek Area, Dolores and Montezuma Counties, Colorado, USGS Oil and Gas Investigations Map, OM-120.

F. M. Fox and Associates, 1974, Reconnaissance engineering geology report for Planning District 9, State of Colorado: Colorado Geol. Survey Environmental Geology Rept. 4, 36 p., 1 pl.

McKnight, E. T., 1974, Geology and ore deposits of the Rico district, Colorado: U. S. Geol. Survey Prof. Paper 723, 100 p., 3 pls.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____, 1965, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Speltz, C. N., 1974, Strippable coal resources of Colorado -- Location, tonnage, and characteristics: U. S. Bur. Mines Prelim. Rept. 195, 68 p.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines Inf. Circ. 7770, 61 p.

## SELECTED REFERENCES ON DOUGLAS COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Feldspar occurrences in Colorado: Colorado School Mines Mineral Industries Bull. v. 5, no. 4, 12 p.

Chase, G. H., and McConaghy, J. A., 1972, Generalized surficial geologic map of the Denver area, Colorado: U. S. Geol. Survey Misc. Geol. Inv. Map I-731.

Emmons, S. F., Cross, Whitman, and Eldridge, G. E., 1896, Geology of the Denver Basin in Colorado: U. S. Geol. Survey Mon. 27, 556 p., 5 pls.

Schwochow, S. D., Stroba, R. R., and Wicklein, P. C., 1974a, Sand, gravel, and quarry aggregate resources, Colorado Front Range Counties: Colorado Geol. Survey Spec. Pub. 5-A, 43 p., 3 pls.

_____1974b, Atlas of sand, gravel, and quarry aggregate resources, Colorado Front Range Counties: Colorado Geol. Survey Spec. Pub. 5-B, 212 pls.

Soister, P. E., 1974, A preliminary report on a zone containing thick lignite beds, Denver Basin, Colorado: U. S. Geol. Survey open-file rept., 48 p.

Trimble D. E., and Fitch, H. R., 1974, Map showing potential sources of gravel and crushed-rock aggregate in the Colorado Springs-Castle Rock area, Front Range Urban Corridor, Colorado: U. S. Geol. Survey Misc. Geol. Inv. Map I-857-A.

## SELECTED REFERENCES ON EAGLE COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Burchard, E. F., 1911, Gypsum deposit in Eagle County, Colorado: U. S. Geol. Survey Bull. 470-G, p. 354-365.

Crawford, R. D., and Gibson, Russell, 1925, Geology and ore deposits of the Red Cliff district, Colorado: Colorado Geol. Survey Bull. 30, 89 p., 3 pls.

Mallory, W. W., 1971, The Eagle Valley Evaporite, northwest Colorado--A regional synthesis: U. S. Geol. Survey Bull. 1311-E, 37 p., 3 pls.

Mallory, W. W., Post, E. V., Ruane, P. J., Lehmbeck, W. L., and Stotelmeyer, R. B., 1966, Mineral resources of the Flat Tops primitive area, Colorado: U. S. Geol. Survey Bull. 1230-C, 30 p., 2 pls.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Tweto, Ogden, and Bryant, Bruce, 1970, Mineral resources of the Gore Range-Eagles Nest Primitive area and vicinity, Summit and Eagle Counties, Colorado: U. S. Geol. Survey Bull. 1319-C, 127 p., 2 pls.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines Inf. Circ. 7770, 61 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON FREMONT COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Feldspar occurrences in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 4, 12 p.

Becker, R. M., Shannon, S. S., and Rose, C. K., 1961, Iron mountain tiffaniferous magnetite deposits, Fremont Co., Colorado, USBM Report Invest. 5864.

Baillie, W. N., 1962, Feldspar occurrences in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 4, 12 p.

Belser, Carl, 1956, Tungsten potential in Chaffee, Fremont, Gunnison, Lake, Larimer, Park, and Summit Counties, Colo.: U. S. Bur. Mines Inf. Circ. 7748, 31 p.

Christman, R. A., Brock, M. R., Pearson, R. C., and Singewald, Q. D., 1959, Geology and thorium deposits of the Wet Mountains, Colorado--A progress report: U. S. Geol. Survey Bull. 1072-H, 44 p., 2 pls.

Christman, R. A., Heyman, A. M., Dellwig, L. F., and Gott, G. B., 1953, Thorium investigations, 1950-52, Wet Mountains, Colorado: U. S. Geol. Survey Circ. 290, 40 p., 5 pls.

F. M. Fox and Associates, 1974, Reconnaissance engineering geology report for Planning Districts 7 and 13, State of Colorado: Colorado Geol. Survey Environmental Geology Rept. 3, 44 p., 2 pls.

Lindgren, Waldemar, 1908, Notes on copper deposits in Chaffee, Fremont, and Jefferson Counties, Colorado: U. S. Geol. Survey Bull. 340-B, p. 157-174.

Sharps, T. I., 1962, Colorado mica: Colorado School Mines Mineral Industries Bull., v. 5, no. 1, 15 p.

_____1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

Speltz, C. N., 1974, Strippable coal resources of Colorado—Location, tonnage, and characteristics: U. S. Bur. Mines Prelim. Rept. 195, 68 p.

Waage, K. M., 1953, Refractory clay deposits of south-central Colorado: U. S. Geol. Survey Bull. 993, 104 p., 5 pls.

Washburne, C. W., 1910, The Canon City coal field, Colorado: U. S. Geol. Survey Bull. 381-C, p. 341-378.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON GARFIELD COUNTY MINERAL RESOURCES


Alderson, V. C., 1925, Colorado oil shale: Colorado School Mines Quart., v. 20, no. 2, 53 p.

Bass, N. W., 1963, Geology of Glenwood Springs quad and vicinity, northwestern Colorado, USGS Bull. 1142-J.

Erdman, C. E., 1934, The Book Cliffs coalfield in Garfield and Mesa Counties, Colorado: U. S. Geol. Survey Bull. 851, 150 p., 10 pls.

Fischer, R. P., 1960, Vanadium-uranium deposits of the Rifle Creek area, Garfield County, Colorado: U. S. Geol. Survey Bull. 1101, 52 p., 4 pls.

Gale, H. S., 1909, Coal fields of northwestern Colorado and northeastern Utah: U. S. Geol. Survey Bull. 341-C, p. 283-315.

_____1910, Coal fields of northwestern Colorado and northeastern Utah: U. S. Geol. Survey Bull. 415, 265 p., 3 pls.

George, R. D., 1921, Oil shales of Colorado: Colorado Geol. Survey Bull. 25, 78 p., 2 pls.

Mallory, W. W., 1971, The Eagle Valley Evaporite, northwest Colorado--A regional synthesis: U. S. Geol. Survey Bull. 1311-E, 37 p., 3 pls.

Mallory, W. W., Post, E. V., Ruane, P. J., Lehmbeck, W. L., and Stotelmeyer, R. B., 1966, Mineral resources of the Flat Tops primitive area, Colorado: U. S. Geol. Survey Bull. 1230-C, 30 p., 2 pls.

Murray D. K., ed., 1974, Guidebook to the energy resources of the Piceance Creek basin--Rocky Mountain Association of Geologists Field Conference, 25th, Denver, Colorado, 1974: Denver, Colo., Rocky Mtn. Assoc. Geologists, 303 p.

Richardson, G. B., 1907, The Book Cliffs coalfield, between Grand River, Colorado, and Sunnyside, Utah: U. S. Geol. Survey Bull. 316-E, p. 302-320.

_____1909, Reconnaissance of the Book Cliffs coalfield, between Grand River, Colorado, and Sunnyside, Utah: U. S. Geol. Survey Bull. 371, 54 p., 4 pls.

## SELECTED REFERENCES ON GILPIN COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Bastin, E. S., and Hill, J. M., 1917, Economic geology of Gilpin County and adjacent parts of Clear Creek and Boulder Counties, Colorado: U. S. Geol. Survey Prof. Paper 94, 379 p., 10 pls.

Braddock, W. A., 1969, Geology of the Empire quadrangle, Grand, Gilpin, and Clear Creek Counties, Colorado: U. S. Geol. Survey Prof. Paper 616, 56 p., 3 pls.

Drake, A. A., Jr., 1957, Geology of the Wood and East Calhoun mines, Central City district, Gilpin County, Colorado: U. S. Geol. Survey Bull. 1032-C, 41 p., 4 pls.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

Moench, R. H., and Drake, A. A., Jr., 1966, Economic geology of the Idaho Springs district, Clear Creek and Gilpin Counties, Colorado: U. S. Geol. Survey Bull. 1208, 91 p., 3 pls.

Moore, F. B., and Butler, C. R., 1952, Pitchblende deposits at the Wood and Calhoun mines, Central City mining district, Gilpin County, Colorado: U. S. Geol. Survey Circ. 186, 8 p., 3 pls.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965a, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

_____1965b, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Sims, P. K., Drake, A. A., Jr., and Tooker, E. W., 1963, Economic geology of the Central City district, Gilpin County, Colorado: U. S. Geol. Survey Prof. Paper 359, 231 p., 12 pls.

Sims, P. K., Osterwald, F. W., and Tooker, E. W., 1955, Uranium deposits in the Eureka Gulch area, Central City district, Gilpin County, Colorado: U. S. Geol. Survey Bull. 1032-A, 31 p., 1 pl.

Sims, P. K., and others, 1963, Geology of uranium and associated ore deposits, central part of the Front Range mineral belt, Colorado: U. S. Geol. Survey Prof. Paper 371, 119 p., 9 pls.

Sims, P. K., and Sheridan, D. M., 1964, Geology of uranium deposits in the Front Range, Colorado: U. S. Geol. Survey Bull. 1159, 116 p., 5 pls.

Tooker, E. W., 1963, Altered wallrocks in the central part of the front range mineral belt, Gilpin and Clear Creek Counties, Colorado, USGS Prof. Paper 439.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines Inf. Circ. 7770, 61 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON GRAND COUNTY MINERAL RESOURCES


Braddock, W. A., 1969, Geology of the Empire quadrangle, Grand, Gilpin, and Clear Creek Counties, Colorado: U. S. Geol. Survey Prof. Paper 616, 56 p., 3 pls.

Grout, F. F., Worcester, P. G., and Henderson, Junius, 1913, Reconnaissance of the geology of the Rabbit Ears region, Routt, Grand, and Jackson Counties, Colorado: Colorado Geol. Survey Bull. 5, pt. 1, 57 p.

Kinney, D. M., Izett, G. A., King, R. U., and Taylor, R. B., 1968, The Poison Ridge volcanic center and related mineralization, Grand and Jackson Counties, Colorado: U. S. Geol. Survey Circ. 594, 8 p.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

## SELECTED REFERENCES ON GUNNISON COUNTY MINERAL RESOURCES


Baillie, W. N., 1962a, Feldspar occurrences in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 4, 12 p.

_____1962b, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Belser, Carl, 1956, Tungsten potential in Chaffee, Fremont, Gunnison, Lake, Larimer, Park, and Summit Counties, Colo.: U. S. Bur. Mines Inf. Circ. 7748, 31 p.

Crawford, R. D., and Worcester, P. G., 1916, Geology and ore deposits of the Gold Brick district, Colorado: Colorado Geol. Survey Bull. 10, 116 p., 3 pls.

Dings, M. G., and Robinson, C. S., 1957, Geology and ore deposits of the Garfield quadrangle, Colorado: U. S. Geol. Survey Prof. Paper 289, 110 p., 13 pls.

Harder, E. C., 1909, The Taylor Peak and Whitepine iron-ore deposits, Colorado: U. S. Geol. Survey Bull. 380-E, p. 188-198.

Hill, J. M., 1909, Notes on the economic geology of southeastern Gunnison County, Colorado: U. S. Geol. Survey Bull. 380-A, p. 21-40.

Hunter, J. F., 1914, The Aberdeen granite quarry near Gunnison, Colorado: U. S. Geol. Survey Bull. 540-K, p. 359-362.

Johnson, V. H., 1948, Geology of the Paonia coal field, Delta and Gunnison Counties, Colorado: U. S. Geol. Survey Coal Inv. Map.

Lee, W. T., 1912, Coal fields of Grand Mesa and the West Elk Mountains, Colorado: U. S. Geol. Survey Bull. 510, 237 p., 1 pl.

McLellan, R. R., 1956, Brown Derby pegmatites, Gunnison County, Colo.: U. S. Bur. Mines Rept. Inv. 5204, 21 p.

Olson, J. C., Hedlund, D. C., and Hansen, W. R., 1968, Tertiary volcanic stratigraphy in the Powderhorn-Black Canyon region, Gunnison and Montrose Counties, Colorado: U. S. Geol. Survey Bull. 1251-C, 29 p., 1 pl.

Olson, J. C., and Wallace, S. R., 1956, Thorium and rare-earth minerals in Powderhorn district, Gunnison County, Colorado: U. S. Geol. Survey Bull. 1027-O, 28 p., 2 pls.

Sharps, T. I., 1962, Colorado mica: Colorado School Mines Mineral Industries Bull., v. 5, no. 1, 15 p.

_____1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

Sharps, T. I., 1965a, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

_____1965b, Tungsten in Colorado: Colorado school Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

Toenges, A. L., Turnbull, L. A., Davis, J. D., and Reynolds, D. A., 1947, Investigation of the coal deposits in the Coal Creek district, Gunnison County, Colo.--Progress report 1: U. S. Bur. Mines Rept. Inv. 4104, 20 p.

Toenges, R. L., Turnbull, L. A., Davis, J. D., Reynolds, D. A., Parks, B. C., Cooper, H. M., and Abernethy, R. F., 1952, Coal deposit, Coal Creek district, Gunnison County, Colo.--Reserves, coking properties, and petrographic and chemical characteristics: U. S. Bur. Mines Bull. 501, 83 p.

Vanderwilt, J. W., 1938, Geology and mineral deposits of the Snowmass Mountain area, Gunnison County, Colorado: U. S. Geol. Survey Bull. 884, 184 p., 1 pl.

Wilson, S. R., and Young, W. A., 1953, Investigation of the New Anniversary-Bucky pegmatite, Gunnison County, Colo.: U. S. Bur. Mines Rept. Inv. 4939, 7 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON HINSDALE COUNTY MINERAL RESOURCES


Brillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Burbank, W. S., and Luedke, R. G., 1969, Geology and ore deposits of the Eureka and adjoining districts, San Juan Mountains, Colorado: U. S. Geol. Survey Prof. Paper 535, 73 p., 8 pls.

Fischer, R. P., Luedke, R. G., Sheridan, M. J., and Raabe, R. G., 1968, Mineral resources of the Uncompahgre primitive area, Colorado: U. S. Geol. Survey Bull. 1261-C, 91 p., 3 pls.

Irving, J. D., and Bancroft, Howland, 1911, Geology and ore deposits near Lake City, Colorado: U. S. Geol. Survey Bull. 478, 128 p., 5 pls.

Larsen, E. S., 1911, The economic geology of Carson camp, Hinsdale County, Colorado: U. S. Geol. Survey Bull 470-B, p. 30-38.

_____1913, Alunite in the San Cristobal quadrangle, Colorado: U. S. Geol. Survey Bull. 530, p. 179-183.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado, with a section on iron resources on the Irving Formation: U. S. Geol. Survey Bull. 1261-F, 187 p., 2 pls.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON JACKSON COUNTY MINERAL RESOURCES


Beekly, A. L., 1915, Geology and coal resources of North Park, Colorado: U. S. Geol. Survey Bull. 596, 121 p., 1 pl.

Grout, F. F., Worcester, P. G., and Henderson, Junius, 1913, Reconnaissance of the geology of the Rabbit Ears region, Routt, Grand, and Jackson Counties, Colorado: Colorado Geol. Survey Bull. 5, pt. 1, 57 p.

Kinney, D. M., Izett, G. A., King, R. U., and Taylor, R. B., 1968, The Poison Ridge volcanic center and related mineralization, Grand and Jackson Counties, Colorado: U. S. Geol. Survey Circ. 594, 8 p.

Lovering T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

Speltz, C. N., 1974, Strippable coal resources of Colorado--Location, tonnage, and characteristics: U. S. Bur. Mines Prelim. Rept. 195, 68 p.

Steven, T. A., 1960, Geology and fluorspar deposits, Northgate district, Colorado: U. S. Geol. Survey Bull. 1082-F, 99 p., 4 pls.

Warne, J. D., 1947, Northgate fluorspar, Jackson County, Colorado: U. S. Bur. Mines Rept. Inv. 4106, 23 p.

## SELECTED REFERENCES ON JEFFERSON COUNTY MINERAL RESOURCES


Adams, J. W., Gude, A. J., 3rd, and Beroni, E. P., 1953, Uranium occurrences in the Golden Gate Canyon and Ralston Creek areas, Jefferson County, Colorado: U. S. Geol. Survey Circ. 320, 16 p.

Adams, J. W., 1956, Wall rock control of certain pitchblende deposits in Golden Gate Canyon, Jefferson County, Colorado, USGS Bulletin 1030-G.

Baillie, W. N., 1962, Feldspar occurrences in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 4, 12 p.

Bird, A. G., 1956, Primary pitchblende deposits at the Ralston Creek Mine, Uranium Mag., vol. 3, no. 8.

_____, 1957, Uranium deposits in Golden Gate Canyon and Ralston Creek area of Jefferson County, Colorado, Mines Mag., vol. 47, no. 3.

Chase, G. H., and McConaghy, J. A., 1972, Generalized surficial geologic map of the Denver area, Colorado: U. S. Geol. Survey Misc. Geol. Inv. Map I-731.

Emmons, S. F., Cross, Whitman, and Eldridge, G. E., 1896, Geology of the Denver Basin in Colorado: U. S. Geol. Survey Mon. 27, 556 p., 5 pls.

Goldstein, E. H., 1957, Geology of the Dakota Formation Uranite Deposit near Morrison, Colorado, Economic Geology v. 52, no. 7.

Hawley, C. C., 1969, Geology and beryllium deposits of the Lake George (or Badger Flats) beryllium area, Park and Jefferson Counties, Colorado: U. S. Geol. Survey Prof. Paper 608-A, 44 p., 4 pls.

Haynes, V., 1958, Rare earth mineralization in the White Cloud Mine near South Platte, Jefferson County, Colorado, GSA Bull., vol. 69, no. 12.

Lindgren, Waldemar, 1908, Notes on copper despoits in Chaffee, Fremont, and Jefferson Counties, Colorado: U. S. Geol. Survey Bull. 340-B, p. 157-174.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

Malde, H. E., 1955, Surficial geology of the Luisville Quad., Colorado, USGS Bull. 996-E.

Martin, G. C., 1910, Coal of the Denver Basin, Colorado: U. S. Geol. Survey Bull. 381-C, p. 297-306.

Schwochow, S. D., Shroba, R. R., and Wicklein, P. C., 1974a, Sand, gravel, and quarry aggregate resources, Colorado Front Range Counties: Colorado Geol. Survey Spec. Pub. 5-A, 43 p., 3 pls.

_____1974b, Atlas of sand, gravel, and quarry aggregate resources, Colorado Front Range Counties: Colorado Geol. Survey Spec. Pub. 5-B, 212 p.

Sharps, T. I., 1962, Colorado mica: Colorado School Mines Mineral Industries Bull., v. 5, no. 1, 15 p.

Sheridan, D. M., Maxwell, C. H., and Albee, A. L., 1967, Geology and uranium deposits of the Ralston Buttes district, Jefferson County, Colorado, with sections on Paleozoic and younger sedimentary rocks by Richard Van Horn: U. S. Geol. Survey Prof. Paper 520, 121 p., 8 pls.

Sims, P. K., and Sheridan, D. M., 1964, Geology of uranium deposits in the Front Range, Colorado: U. S. Geol. Survey Bull. 1159, 116 p., 5 pls.

Soule, J. H., 1960, Mining methods and costs, Schwartzwalder uranium mine, Jefferson County, Colo.: U. S. Bur. Mines Inf. Circ. 7963, 24 p.

Trimble, D. E., and Fitch, H. R., 1974, Map showing potential sources of gravel and crushed-rock aggregate in the Greater Denver area, Front Range Urban Corridor, Colorado: U. S. Geol. Survey Misc. Geol. Inv. Map I-856-A.

Woodmansee, W. C., 1959, Geology and ore deposits of the Schwartzwalder Uranium Mine, Ralston Creek area, Jefferson County.

## SELECTED REFERENCES ON LAKE COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Behre, C. H., Jr., 1953, Geology and ore deposits of the west slope of the Mosquito Range, Colorado: U. S. Geol. Survey Prof. Paper 235, 176 p., 20 pls.

Belser, Carl, 1956, Tungsten potential in Chaffee, Fremont, Gunnison, Lake, Larimer, Park, and Summit Counties, Colo.: U. S. Bur. Mines Inf. Circ. 7748, 31 p.

Butler, B. S., and Vanderwilt, J. W., 1933, The Climax molybdenum deposit, Colorado, with a section on history, production, metallurgy, and development by C. W. Henderson: U. S. Geol. Survey Bull. 846-C, 42 p., 3 pls.

Darnell, R. P., 1970, Silver potential and economic aspects of the Leadville district, Lake County, Colo.: U. S. Bur. Mines Inf. Circ. 8464, 105 p.

Ebbley, N. E., Jr., and Schumacher, J. I., 1949, Investigation of the Fairview Hill area manganese deposits, Leadville, Lake County, Colo.: U. S. Bur. Mines Rept. Inv. 4589, 18 p.

Emmons, S. F., 1886, Geology and mining industry of Leadville, Colo., with atlas: U. S. Geol. Survey Mon. 12, 770 p., 35 pls.

Emmons, S. F., Irving, J. D., and Loughlin, G. F., 1927, Geology and ore deposits of the Leadville mining district, Colorado: U. S. Geol. Survey Prof. Paper 148, 368 p.

Hedges, J. H., 1940, Mineral industries surveys of the United States--Colorado, Lake County, possibilities of manganese production at Leadville, Colo.: U. S. Bur. Mines Inf. Circ. 7125, 23 p.

Howell, J. V., 1919, Twin Lakes district of Colorado: Colorado Geol. Survey Bull. 17, 108 p., 2 pls.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

Pierson, C. T., and Singewald, Q. D., 1954, Occurrences of uranium-bearing minerals in the St. Kevin district, Lake County, Colorado: U. S. Geol. Survey Circ. 321, 17 p.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965a, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Sharps, T. I., 1965b, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8., no. 5, 16 p.

Singewald, Q. D., 1955, Sugar Loaf and St. Kevin mining districts, Lake County, Colorado: U. S. Geol. Survey Bull. 1027-E, 50 p., 2 pls.

Vanderwilt, J. W., 1932, Preliminary geologic notes on Galena Mountain, a part of Snowmass area, Colorado, Colorado Sci. Soc. Proc. vol. 13, no. 1.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines INf. Circ. 7770, 61 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 pl. 2 pls.

## SELECTED REFERENCES ON LA PLATA COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Barnes, H., Geology of the Ignacio area, Ignacio and Pagosa Springs Quads, La Plata and Archuleta Counties, Colorado, USGS Oil and Gas Invest. Map OM-138.

Barnes, H., et al., Geology and fuel resources of the Red Mesa area, La Plata and Montezuma Counties, Colorado, USGS Oil and Gas Invest. Map OM-149.

Cross, W., et al., 1899, La Plata Folio, USGS Geologic Folio 60.

Eckel, E. B., 1949, Geology and ore deposits of the La Plata district, Colorado: U. S. Geol. Survey Prof. Paper 219, 179 p.

F. M. Fox and Associates, 1974, Reconnaissance engineering geology report for Planning District 9, State of Colorado: Colorado Geol. Survey Environmental Geology Rept. 4, 36 p., 1 pl.

Gardner, J. H., 1909, The coal field between Durango, Colorado, and Monero, New Mexico: U. S. Geol. Survey Bull. 341-C, p. 352-363.

Schafer, P. A., 1945, Ore minerals of the La Plata Mountains, Colorado, compared with other Telluride Districts, Economic Geology, vol. 40, no. 3.

Shaler, M. K., 1907, A reconnaissance survey of the western part of the Durango-Gallup coal field of Colorado and New Mexico: U. S. Geol. Survey Bull. 316-F, p. 375-426.

Shaler, M. K., and Gardner, J. H., 1907, Clay deposits of the western part of the Durango-Gallup coal field of Colorado and New Mexico: U. S. Geol. Survey Bull. 315-I, p. 296-302.

Speltz, C. N., 1974, Strippable coal resources of Colorado -- Location, tonnage, and characteristics: U. S. Bur. Mines Prelim. Rept. 195, 68 p.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado, with a section on iron resources of the Irving Formation: U. S. Geol. Survey Bull. 1261-F, 187 p., 2 pls.

Taff, J. A., 1907, The Durango coal district, Colorado: U. S. Geol. Survey Bull. 316-E, p. 321-337.

Wanek, A. A., 1959, Geology and fuel resources of the Mesa Verde area, Montezuma and La Plata Counties, Colorado: U. S. Geol. Survey Bull. 1072-M, 56 p., 3 pls.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON LARIMER COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Feldspar occurrences in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 4, 12 p.

Bain, G. W., 1950, Mineralized localization in the Treasure Mountain granite, Colorado, GSA Bull., vol. 61, no. 12.

Belser, Carl, 1956, Tungsten potential in Chaffee, Fremont, Gunnison, Lake, Larimer, Park, and Summit Counties, Colo.: U. S. Bur. Mines Inf. Circ. 7748, 31 p.

Gilkey, M. M., 1960, Hyatt Ranch pegmatite, Larimer County, Colo.: U. S. Bur. Mines Rept. Inv. 5643, 18 p.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

Martin, G. C., 1909, The Niobrara limestone of northern Colorado as a possible source of Portland cement material: U. S. Geol. Survey Bull. 380-J, p. 314-326.

_____1910, Coal of the Denver Basin, Colorado: U. S. Geol. Survey Bull. 381-C, p. 297-306.

Schwochow, S. D., Shroba, R. R., and Wicklein, P. C., 1974a, Sand, gravel, and quarry aggregate resources, Colorado Front Range Counties: Colorado Geol. Survey Spec. Pub. 5-A, 43 p., 3 pls.

_____1974b, Atlas of sand, gravel, and quarry aggregate resources, Colorado Front Range Counties: Colorado Geol. Survey Spec. Pub. 5-B, 212 pls.

Sharps, T. I., 1962, Colorado mica: Colorado School Mines Mineral Industries Bull., v. 5, no. 1, 15 p.

_____1965, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

Sims, P. K., Phair, George, and Moench, R. H., 1958, Geology of the Copper King uranium mine, Larimer County, Colorado: U. S. Geol. Survey Bull. 1032-D, 53 p., 3 pls.

Thurston, W. R., 1950, Exploration of the Buckhorn Mica Mine, Larimer Co., Colorado, USGS Report Open File, no. 59.

_____, 1951, Exploration of the Big Boulder Prospect, Larimer Co., Colorado, USGS Tem. Report 106.

_____, 1955, Pegmatites of the Crystal Mountain district, Larimer County, Colorado: U. S. Geol. Survey Bull. 1011, 185 p., 13 pls.

Van Zandt, P. C., 1928, Colorado Portland Cement Company new dry process plant -- Boettcher, Colo., plant proof that a dry plant can be built to have all the advantages of the wet-process plant: Rock Products, v. 31, no. 13, p. 42-59.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

Wyant, D. G., 1951, Treasure Hill area, Larimer County, Colorado, USGS Tem. Report 9B.

## SELECTED REFERENCES ON MINERAL COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Emmons, W. H., and Larsen, E. S., 1913, A preliminary report on the geology and ore deposits of Creede, Colorado: U. S. Geol. Survey Bull. 530, p. 42-65.

_____1923, Geology and ore deposits of the Creede district, Colorado: U. S. Geol. Survey Bull. 718, 198 p., 2 pls.

Larsen, E. S., 1913, Alunite in the San Cristobal quadrangle, Colorado: U. S. Geol. Survey Bull. 530, p. 179-183.

Larsen, E. S., and Hunter, J. F., 1913, Two sulphur deposits in Mineral County, Colorado: U. S. Geol. Survey Bull. 530, p. 363-369.

Meeves, H. C., and Darnell, R. P., 1968, Study of the silver potential, Creede district, Mineral County, Colorado: U. S. Bur. Mines Inf. Circ. 8370, 58 p.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado, with a section on iron resources on the Irving Formation: U. S. Geol. Survey Bull. 1261-F, 187 p., 2 pls.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines Inf. Circ. 7770, 61 p.

## SELECTED REFERENCES ON MONTROSE COUNTY MINERAL RESOURCES


Coffin, R. C., 1921, Radium, uranium, and vanadium deposits of southwestern Colorado: Colorado Geol. Survey Bull. 16, 231 p., 3 pls.

Fischer, R. P., 1944, Simplified geologic map of the vanadium region of southwestern Colorado and southeastern Utah: U. S. Geol. Survey Strategic Minerals Inv. Map 3-226.

Fischer, R. P., and Hilpert, L. S., 1952, Geology of the Uravan mineral belt: U. S. Geol. Survey Bull. 988-A, 13 p., 3 pls.

Gott, G. B., and Erickson, R. L., 1952, Reconnaissance of uranium and copper deposits in parts of New Mexico, Colorado, Utah, Idaho, and Wyoming: U. S. Geol. Survey Circ. 219, 16 p.

Holmes, R. W., and Harrer, C. M., 1952, Investigation of the Colorado Copper Co. properties, Mesa and Montrose Counties, Colo.: U. S. Bur. Mines Rept. Inv. 4869, 11 p.

Olson, J. C., Hedlund, D. C., and Hansen, W. R., 1968, Tertiary volcanic stratigraphy in the Powderhorn-Black Canyon region, Gunnison and Montrose Countyies, Colorado: U. S. Geol. Survey Bull. 1251-C, 29 p., 1 pl.

Speltz, C. N., 1974, Strippable coal resources of Colorado--Location, tonnage, and characteristics: U. S. Bur. Mines Prelim. Rept. 195, 68 p.

## SELECTED REFERENCES ON OURAY COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Belser, Carl, 1956, Tungsten potential in the San Juan area -- Ouray, San Juan, and San Miguel Counties, Colo.: U. S. Bur. Mines INf. Circ. 7731, 18 p.

Burbank, W. S., 1933, Vein systems of the Arrastre Basin and regional geologic structure in the Silverton and Telluride Quads, Colorado, Colorado Sci. Soc. Proc., vol. 13, no. 5.

Burbank, W. S., and Luedke, R. G., 1969, Geology and ore deposits of the Eureka and adjoining districts, San Juan Mountains, Colorado: U. S. Geol. Survey Prof. Paper 535, 73 p., 8 pls.

Cross, W., et al., 1907, Ouray Folio, USGS Geologic Folio 153.

Deshayes, E. V., and Young, W. E., 1948, Camp Bird lead-zinc deposits, Ouray County, Colorado: U. S. Bur. Mines Rept. Inv. 4230, 19 p.

Fischer, R. P., Luedke, R. G., Sheridan, M. J., and Raabe, R. G., 1968, Mineral resources of the Uncompahgre primitive area, Colorado: U. S. Geol. Survey Bull. 1261-C, 91 p., 3 pls.

Hazen, S. W., Jr., 1949, Lead-zinc-silver in the Poughkeepsie district and part of the Upper Uncompahgre and Mineral Point districts, Ouray and San Juan Counties, Colo: U. S. Bur. Mines Rept. Inv. 4508, 110 p.

Kelly, V. C., 1946, Stages and epochs of mineralization in the San Juan Mountains, Colorado, as shown by the Dunmore Mine, Ouray County, Colorado, Economic Geology, vol. 41, no. 2.

King, W. H., and Allsman, P. T., 1950, Reconnaissance of metal mining in the San Juan Region, Ouray, San Juan and San Miguel Counties, Colorado, USBM Information Circ. 7554.

Ransome, F. L., 1901, A report on the economic geology of the Silverton quadrangle, Colorado: U. S. Geol. Survey Bull. 182, 265 p., 7 pls.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965a, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

_____1965b, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U.S. Bur. Mines Inf. Circ. 7770, 61 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON PARK COUNTY MINERAL RESOURCES


Baillie, W. N., 1962a, Feldspar occurrences in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 4, 12 p.

_____1962b, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Belser, Carl, 1956, Tungsten potential in Chaffee, Fremont, Gunnison, Lake, Larimer, Park, and Summit Counties, Colo.: U. S. Bur. Mines Inf. Circ. 7748, 31 p.

Guiteras, J. R., 1940, Mining and milling methods and costs in the Alma district, Colorado: U. S. Bur. Mines Inf. Circ. 7101, 63 p.

Hawley, C. C., 1969, Geology and beryllium deposits of the Lake George (or Badger Flats) beryllium area, Park and Jefferson Counties, Colorado: U. S. Geol. Survey Prof. Paper 608-A, 44 p., 4 pls.

Hawley, C. C., and Griffitts, W. R., 1968, Distribution of beryllium, tin, and tungsten in the Lake George area, Colorado: U. S. Geol. Survey Circ. 597, 18 p.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

Muilenburg, G. A., 1925, Geology of the Tarryall district, Park County, Colorado: Colorado Geol. Survey Bull. 31, 64 p., 1 pl.

Patton, H. B., Hoskin, A. J., and Butler, C. M., 1912, Geology and ore deposits of the Alma district, Park County, Colorado: Colorado Geol. Survey Bull. 3, 284,p., 3 pls.

Pierson, C. T., and Singewald, Q. D., 1953, Results of reconnaissance for radioactive minerals in parts of the Alma district, Park County, Colorado: U. S. Geol. Survey Circ. 294, 9 p., 1 pl.

Sharps, T. I., 1962, Colorado mica: Colorado School Mines Mineral Industries Bull., v. 5, no. 1, 15 p.

_____1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

Singewald, Q. D., 1942, Stratigraphy, structure, and mineralization in the Beaver-Tarryall area, Park County, Colorado: U. S. Geol. Survey Bull. 928-A, 44 p., 3 pls.

Singewald, Q. D., 1950, Gold placers and their geologic environment in northwestern Park County, Colorado: U. S. Geol. Survey Bull. 955-D, 69 p. 6 pls.

Singewald. Q. D., and Butler, B. S., 1941, Ore deposits in the vicinity of the London fault of Colorado: U. S. Geol. Survey Bull. 911, 74 p., 8 pls.

_____, 1931, Preliminary report on the geology of Mount Lincoln and the Russia Mine, Park County, Colorado, Colorado Sci. Soc. Proc., vol. 12, no. 12.

Speltz, C. N., 1974, Strippable coal resources of Colorado--Location, tonnage, and characteristics: U. S. Bur. Mines Prelim. Rept. 195, 68 p.

Washburne, C. W., 1910, The South Park coalfield, Colorado: U. S. Geol. Survey Bull. 381-C, p. 307-316.

Wilmarth, V. R., 1959, Geology of the Garo uranium-vanadium copper deposit, Park County, Colorado: U. S. Geol. Survey Bull. 1087-A, 21 p., 5 pls.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON PITKIN COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Harder, E. C., 1909, The Taylor Peak and Whitepine iron-ore deposits, Colorado: U. S. Geol. Survey Bull. 380-E, p. 188-198.

Mallory, W. W., 1971, The Eagle Valley Evaporite, northwest Colorado--A regional synthesis: U. S. Geol. Survey Bull. 1311-E, 37 p., 3 pls.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

Spurr, J. E., 1898, Geology of the Aspen mining district, Colorado, with atlas: U. S. Geol. Survey Mon. 31, 260 p., 30 pls.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON ROUTT COUNTY MINERAL RESOURCES


Bass, N. W., 1954, Geology and mineral fuels of Mount Harris, Pilot Knob, Elkhart Creek and Daton Peak quadrangles, Routt and Moffat Counties, Colorado: U. S. Geol. Survey open-file rept.

Bass, N. W., Eby, J. B., and Campbell, M. R., 1955, Geology and mineral fuels of parts of Routt and Moffat Counties, Colorado: U. S. Geol. Survey Bull. 1027-D, 107 p.

Campbell, M. R., 1923, The Twentymile Park district of the Yampa coalfield, Routt County, Colorado: U. S. Geol. Survey Bull. 748, 82 p., 1 pl.

Crawford, R. D., Willson, K. M., and Perini, V. C., 1920, Some anticlines of Routt County, Colorado: Colorado Geol. Survey Bull. 23, 61 p., 3 pls.

Fenneman, N. M., and Gale, H. S., 1906, The Yampa coalfield, Routt County, Colorado, with a chapter on the character and use of the Yampa coals: U. S. Geol. Survey Bull. 297, 96 p., 3 pls.

Gale, H. S., 1908a, Gold placer deposits near Lay, Routt County, Colorado: U. S. Geol. Survey Bull. 340-A, p. 84-95.

_____1908b, Carnotite and associated minerals in western Routt County: U. S. Geol. Survey Bull. 340-C, p. 257-262.

_____1909, Coal fields of northwestern Colorado and northeastern Utah: U. S. Geol. Survey Bull. 341-C, p. 283-315.

Grout, F. F., Worcester, P. G., and Henderson, Junius, 1913, Reconnaissance of the geology of the Rabbit Ears region, Routt, Grand, and Jackson Counties, Colorado: Colorado Geol. Survey Bull. 5, pt. 1, 57 p.

Mallory, W. W., 1971, The Eagle Valley Evaporite, northwest Colorado--A regional synthesis: U. S. Geol. Survey Bull. 1311-E, 37 p., 3 pls.

Speltz, C. N., 1974, Strippable coal resources of Colorado--Location, tonnage, and characteristics: U. S. Bur. Mines Prelim. Rept. 195, 68 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON SAGUACHE COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Burbank, W. S., 1932, Geology and ore deposits of the Bonanza mining district, Colorado, with a section on history and production by C. W. Henderson: U. S. Geol. Survey Prof. Paper 169, 166 p., 4 pls.

Patton, E. B., 1915, Geology and ore deposits of the Bonanza district, Saguache County, Colorado: Colorado Geol. Survey Bull. 9, 136 p., 2 pls.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

Siebenthal, C. E., 1910, Geology and water resources of the San Luis Valley, Colorado: U. S. Geol. Survey Water-Supply Paper 240, 128 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON SAN JUAN COUNTY MINERAL RESOURCES


Atwood, W. W. and Mather, K. F., 1932, Physiography and quaternary geology of the San Juan Mtns., USGS Prof. Paper 166.

Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Bastin, E. S., 1923, Silver enrichment in the San Juan Mountains, Colorado, USGS Bull. 735-D.

Bejnar, W., 1949, Lithologic control of ore deposits in the San Juan Mtns., Colorado, Compass, vol. 26, no. 2.

Belser, Carl, 1956, Tungsten potential in the San Juan area -- Ouray, San Juan, and San Miguel Counties, Colo.: U. S. Bur. Mines Inf. Circ. 7731, 18 p.

Burbank, W. S., 1951, The Sunnyside, Ross Basin, and Bonita Fault systems nd their associated ore deposits, San Juan Co., Colorado, Colorado Sci. Soc. Proc., vol. 15, no. 7.

Burbank, W. S., and Luedke, R. G., 1969, Geology and ore deposits of the Eureka and adjoining districts, San Juan Mountains, Colorado: U. S. Geol. Survey Prof. Paper 535, 73 p., 8 pls.

Cross, W., and Larsen, E. S., 1935, A brief review of the geology of the San Juan region of southwestern Colorado, USGS Bull. 843.

Fischer, R. P., Luedke, R. G., Sheridan, M. J., and Raabe, R. G., 1968, Mineral resources of the Uncompahgre primitive area, Colorado: U. S. Geol. Survey Bull. 1261-C, 91 p., 3 pls.

F. M. Fox and Associates, 1974, Reconnaissance engineering geology report for Planning District 9, State of Colorado: Colorado Geol. Survey Environmental Geology Rept. 4, 36 p., 1 pl.

Hazen, S. W., Jr., 1949, Lead-zinc-silver in the Poughkeepsie district and part of the Upper Uncompahgre and Mineral Point districts, Ouray and San Juan Counties, Colo.: U. S. Bur. Mines Rept. Inv. 4508, 110 p.

Hild, J. H., 1959, Exploration of lead-zinc deposits in the Ross Basin-Lake Como area, San Juan Co., Colorado, USBM Report Invest. 5518.

King, W. H., and Allsman, P. T., 1950, Reconnaissance of metal mining in the San Juan region, Ouray, San Juna, and San Miguel Counties, Colorado, USBM Information Cir. 7554.

Larsen, E. S., and Cross, W., 1956, Geology and petrology of the San Juan region, southwestern Colorado, USGS Prof. Paper 258.

Ransome, F. L., 1901, A report on the economic geology of the Silverton quadrangle, Colorado: U. S. Geol. Survey Bull. 182, 265 p., 7 pls.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

Steven, T. A., Schmitt, L. J., Jr., Sheridan, M. J., and Williams, F. E., 1969, Mineral resources of the San Juan primitive area, Colorado, with a section on iron resources on the Irving Formation: U. S. Geol. Survey Bull. 1261-F, 187 p., 2 pls.

Varnes, D. J., 1963, Geology and ore deposits of the South Silverton mining area, San Juan County, Colorado: U. S. Geol. Survey Prof. Paper 378-A, 56 p., 7 pls.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines Inf. Circ. 7770, 61 p.

Woolsey, L. H., 1907, Lake Fork extension of the Silverton mining area, Colorado: U. S. Geol. Survey Bull. 315-A, p. 26-30.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

Young, W. E., 1966, Manganese occurrences in the Eureka-Animas Forks areas of the San Juan Mountains, San Juan County, Colo.: U. S. Bur. Mines Inf. Circ. 8303, 52 p.

## SELECTED REFERENCES ON SAN MIGUEL COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Belser, Carl, 1956, Tungsten potential in the San Juan area—Ouray, San Juan, and San Miguel Counties, Colo.: U. S. Bur. Mines Inf. Circ. 7731, 18 p.

Bush, A. L., Bromfield, C. S., and Pierson, C. T., 1959, Areal geology of the Placerville quadrangle, San Miguel County, Colorado: U. S. Geol. Survey Bull. 1072-E, 87 p., 3 pls.

Coffin, R. C., 1921, Radium, uranium, and vanadium deposits of southwestern Colorado: Colorado Geol. Survey Bull. 16, 231 p., 3 pls.

Fischer, R. P., 1944, Simplified geologic map of the vanadium region of southwestern Colorado and southeastern Utah: U. S. Geol. Survey Strategic Minerals Inv. Map 3-226.

Fischer, R. P., and Hilpert, L. S., 1952, Geology of the Uravan mineral belt: U. S. Geol. Survey Bull. 988-A, 13 p., 3 pls.

Fischer, R. P., Luedke, R. G., Sheridan, M. J., and Raabe, R. G., 1968, Mineral resources of the Uncompahgre primitive area, Colorado: U. S. Geol. Survey Bull. 1261-C, 91 p., 3 pls.

Hess, F. L., 1913, Notes on vanadium deposits near Placerville, Colorado: U. S. Geol. Survey Bull. 530, p. 142-156.

King, W. H., and Allsman, P. T., 1950, Reconnaissance of metal mining in the San Juan region, OUray, San Juan and San Miguel Counties, Colorado, USBM Infromation Circ. 7554.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965a, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

_____1965b, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Speltz, C. N., 1974, Strippable coal resources of Colorado—Location, tonnage, and characteristics: U. S. Bur. Mines Prelim. Rept. 195, 68 p.

Vhay, J. S., 1962, Geology and mineral resources of the area south of Telluride, Colorado: U. S. Geol. Survey Bull. 1112-G, 101 p., 7 pls.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines Inf. Circ. 7770, 61 p.

Williamson, D. R., 1961, Guide to Colorado gold deposits, CSM Min. Ind. Bull., vol. 4, no. 3.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON SUMMIT COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Belser, Carl, 1956, Tungsten potential in Chaffee, Fremont, Gunnison, Lake, Larimer, Park, and Summit Counties, Colo.: U. S. Bur. Mines Inf. Circ. 7748, 31 p.

Bergendahl, M. H., and Koschmann, A. H., 1971, Ore deposits of the Kokomo-Tenmile district, Colorado: U. S. Geol. Survey Prof. Paper 652, 53 p. 2 pls.

Hamilton, W. H., and McLellan, R. R., 1955, Investigation of the Kokomo zinc deposits, Summit County, Colo.: U. S. Bur. Mines Rept. Inv. 5138, 28 p.

Lovering, T. S., 1934, Geology and ore deposits of the Breckenridge mining district, Colorado: U. S. Geol. Survey Prof. Paper 176, 64 p.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

McCulloch, R. B., and Huleah, W. P., 1946, Exploration of the Big-Foun zinc-silver mine, Summit County, Colorado, USBM Report Invest. 3884.

Neuerburg, G. J., Botinelly, Theodore, and Watterson, J. R., 1974, Molybdenite in the Montezuma district of central Colorado: U. S. Geol. Survey Circ. 704, 21 p.

Randall, J. A., 1958, Geology and ore deposits of upper Mayflower Gulch, Summit County Colorado, USGS Open File Report 455.

Ransome, F. L., 1911, Geology and ore deposits of the Breckenridge district, Colorado: U. S. Geol. Survey Prof. Paper 75, 187 p., 7 pls.

Sharps, T. I., 1963, Lead and zinc in Colorado: Colorado School Mines Mineral Industries Bull., v. 6, no. 6, 15 p.

_____1965a, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

_____1965b, Sulphur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Singewald, Q. D., 1951, Geology and ore deposits of the upper Blue River area, Summit County, Colorado: U. S. Geol. Survey Bull. 970, 73 p., 7 pls.

Tweto, Ogden, and Bryant, Bruce, 1970, Mineral resources of the Gore Range-Eagles Nest Primitive area and vicinity, Summit and Eagle Counties, Colorado: U. S. Geol. Survey Bull. 1319-C, 127 p., 2 pls.

Wideman, F. L., 1957, A reconnaissance of sulfur resources in Wyoming, Colorado, Utah, New Mexico, and Arizona: U. S. Bur. Mines Inf. Circ. 7770, 61 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

## SELECTED REFERENCES ON TELLER COUNTY MINERAL RESOURCES


Baillie, W. N., 1962, Silver in Colorado: Colorado School Mines Mineral Industries Bull., v. 5, no. 5, 18 p.

Gott, G. B., McCarthy, J. H., Jr., Van Sickle, G. H., and McHugh, J. B., 1969, Distribution of gold and other metals in the Cripple Creek district, Colorado: U. S. Geol. Survey Prof. Paper 625-A, 17 p., 2 pls.

Konselman, A. S., 1940, Mining methods and costs at the South Burns Shaft of Golden Conqueror Mines, Inc., Cripple Creek, Colo.: U. S. Bur. Mines Inf. Circ. 7094, 13 p.

Lindgren, Waldemar, and Ransome, F. L., 1906, Geology and gold deposits of the Cripple Creek district, Colorado: U. S. Geol. Survey Prof. Paper 54, 516 p.

Lovering, T. S., and Goddard, E. N., 1950, Geology and ore deposits of the Front Range, Colorado: U. S. Geol. Survey Prof. Paper 223, 319 p., 30 pls.

Sharps, T. I., 1965a, Tungsten in Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 5, 16 p.

_____1965b, Sulfur deposits of Colorado: Colorado School Mines Mineral Industries Bull., v. 8, no. 6, 8 p.

Worcester, P. G., 1919, Molybdenum deposits of Colorado, with general notes on the molybdenum industry: Colorado Geol. Survey Bull. 14, 131 p., 2 pls.

# PART III

## SELECTED REFERENCES BY MINERAL DISTRICT

## ALMA DISTRICT


Behre, C. H., Jr., 1953, Geology and ore deposits of the western slope of the Mosquito Range, USGS Prof. Paper 235.

Guiteras, J. R., 1940, Mining and milling in the Alma District, Colorado, USBM IC 7101.

Klugman, M. A., 1964, Mb/Ca Ratios in Carbonate wall rock in the Alma-Horseshoe District, Colorado, Am. Inst. Min. Met. and Petro. Eng., Soc. Min. Eng., Tr. voj. 229, no. 2.

Patton, H. B., Hoskin, A. J., and Butler, G. M., 1912, Geology and ore deposits of the Alma District, Park Co., Colorado, Colorado Geological Survey, No. 3.

Singewald, Q. D., 1932, Suggestions for prospecting in the Alma District, Colorado, Cohorado Sci. Soc. Proc., vol. 13, no. 4.

_____, 1935, Relations of hydrothermic alternation of porphyries to ore deposition in the Alma District, Colorado, Economic Geology, vol. 30, no. 5.

Singewald, Q. D., and Butler, B. S., 1930, Preliminary geologic map of the Alma mining district, Colorado, Colorado Sci. Soc. Proc., vol. 12, no. 9.

_____, 1936, Structure and mineralization along the London Fault, Colorado, AIME, Tech. Pub. no. 754.

_____, 1941, Ore deposits in the vicinity of the London Fault of Colorado, USGS Bulletin 911.

## ASPEN DISTRICT

Vanderwilt, J. W., 1935, Revision of structure and stratigraphy of the Aspen District, Colorado, Economic Geology, vol. 30, no. 3.

Volin, M. E., and Hilo, J. H., 1950, Investigation of Smuggler lead-zinc mine Aspen, Pitkin Co., Colorado, USBM Report Invest. 4696.

BLUE RIVER DISTRICT

Singewald, Q. D., 1951, Geology and ore deposits of the upper Blue River area, Summit County, Colorado, USGS Bull. 970.

_____, 1929, A collapsed dome in the Bonanza mine district, Colorado, Washington Acad. Sci. J., vol. 19, no. 13.

Burbank, W. S., 1932, Geology and ore deposits of the Bonanza mining district, USGS Prof. Paper 169.

Patton, H. B., 1915, Geology and ore deposits of the Bonanza district, Saguache Co., Colorado, Colorado Geol. Survey no. 9.

BRECKENRIDGE DISTRICT

Lovering, J. S., 1934, Geology and ore deposits of the Breckenridge mining district, Colorado, USGS Prof. paper 176.

## BRUSH CREEK DISTRICT

Gabelman, J. W., 1950, Geology of the Fulford and Brush Creek mining districts, Eagle County, Colorado, Mining Yearbook (Colo. Mining Assoc.).

## CALUMET DISTRICT

Rainwater, E. H., 1934, Geology and ore deposits of the Calumet district, Colorado, Geological Soc. Am. Proc. For. 1933.

_____, et al., 1936, Contact ore deposition at the Calumet iron mine, Colorado, Economic Geology, vol. 31, no. 8.

## CARIBOU DISTRICT

King, R. U., 1952, Vein deposits of uranium at the Caribou mine, Boulder Co., Colorado, USGS Tem-13A.

Moore, F. B., 1952, Pitchblende deposit at the Caribou mine, Boulder County, Colorado, GSA Bulletin, vol. 63, no. 12.

_____, 1957, Geology and uranium deposits of the Caribou area, Boulder County, Colorado, USGS Bull. n030-N.

Ridland, G. C., 1949, Development and geology at the Caribou mine, Mining Yearbook (Colorado Mining Assoc.).

_____, 1950, Radioactivity at the Caribou silver mine, Boulder Co., Colorado, Min. Eng., vol. 187, no. 1.

## CEBOLLA DISTRICT

Berkenkomer, R. D., and Hazen, S. W., Jr., 1963, Statistical analysis of diamond drilling sample data from the Cebolla Creek tetaniferous iron deposits, Gunnison County, Colorado, USBM Report Invest. 5679.

Rose, C. K., and Shannon, S. S., Jr., 1960, Cebolla Creek titaniferous iron deposits, Gunnison Co., Colorado, USBM Report Invest. 5679.

## CENTRAL CITY DISTRICT


Armstrong, F. C., 1952, Pitchblende deposits on Quartz Hill, Central City district, Gilpin Co., Colorado, Economic Geology, vol. 47, no. 7. Also in GSA Bulletin, vol. 63, no. 12.

Geology of the Wood and East Calhoun Mines, Central City district, Gilpin Co., Colorado, 1957, USGS Bulletin 1032-C.

King, R. U., 1951, Investigations in the Wood Mine, Colorado, USGS TEM-102 A.

Moore, F. B., and Butler, C. R., 1952, Pitchblende deposits at the Wood and Calhoun Mines, Central City mining district, Gelpin Co., Colorado, USGS Circ. 186.

Pitchblende deposits of the Central City district and the adjoining areas, Gilpin and Clear Creek Counties, 1956, International Conference on peaceful uses of atomic energy, vol. 6.

Sims, P. K., 1955, Uranium deposits in the Eureka Gulch area, Central City district, Gilpin Co., Colorado, USGS Bulletin 1032-A.

_____, 1956, Paragenesis and structure of pitchblende-bearing veins, Central City district, Gilpin Co., Colorado, Economic Geol. vol. 51, no. 8.

_____, 1963, Economic geology of the Central City district, Gelpin Co., Colorado, USGS Prof. Paper 359.

## CENTRAL-JAMESTOWN DISTRICT

Goddard, E. N., 1934, The relation of tertiary intrusives to ore deposition of Jamestown, Colorado, Geologic Soc. of Washington Proceedings. Also in Washington Academy of Science Jour., vol. 24, no. 2.

_____, 1946, Fluorspar deposits of the Jamestown District, Boulder Co., Colorado, Colorado Sci. Soc. Proc., vol. 15, no. 1.

_____, and Glass, J. J., 1937, Deposits of radioactive cerite near Jamestown, Colorado, American Mineralogist, vol. 25., pps. 381-404.

Hild, J. H., 1949, Investigation of Jamestown fluorite deposits, Boulder County, Colorado, USBM Report Invest. 4483.

Phair, George and Kiyoko, O., 1951, Hydrothermal uranothorite in fluorite breccias from the Blue Jay Mine, Jamestown, Boulder County, Colorado, USGS TE Investigation Report 144.

## CLIMAX DISTRICT


Coulter, Wm. J., 1929, Mining molybdenum ore at Climax, Colorado, Eng. Mining Journal, vol. 127, no. 10.

Vanderwilt, J. W., 1933, The molybdenum deposit at Climax, 16th Internat. Geologic Congress, Guidebook 19.

_____, 1942, The occurance and production of molybdenum, Colorado Sch. Mines Quart., vol. 37, no. 4.

_____, 1955, Hydrothermal alteration at the Climax molybdenum deposit, Mining Eng., vol. 7, no. 1.

_____, and Butler, B. S., 1933, The Climax molybdenum deposit of Colorado, Colorado Sci. Soc. Proc., vol. 12, no. 10. Also in USGS Bull. 846.

_____, 1933, The Climax molybdenum deposit with a section on history, production, metallurgy, and development by C. W. Henderson, USGS Bulletin 846 C.

Vanderwilt, J. W., and King, R. U., 1946, Geology of the Climax ore body: closely spaced fractures make block caving of the rock possible, Min. and Metals, vol. 27, no. 474.

Wallace, S. R., et al., 1968, Multiple intrusion and mineralization at Climax, Colorado, Ore Deposits in the United Stated, AIME.

## COCHETOPA DISTRICT

Malan, R. C., 1954, Geology of the uranium deposits in the Cochetopa mining district, Saguache and Gunnison Counties, Colorado, Economic Geology, vol. 54., no. 1.

## CREEDE DISTRICT

Larsen, E. S., 1923, Geology and ore deposits of the Creede district, Colorado, USGS Bulletin 718.

Larsen, E. S., 1929, Recent mining developments in the Creede district, Colorado, USGS Bulletin 811.

Meeves, H. C., and Darnell, R. P., 1968, Study of the silver potential, Creede district, Mineral County, Colorado, USBM Info. Circ. 8370.

Steven, T. A., 1965, Geology and structural controls of ore deposition in the Creede district, San Juan Mts., Colorado, USGS Prof. Paper 487.

## CRIPPLE CREEK DISTRICT


Beebe, A. H., and Johnson, C. H., Mining methods and costs at teh Cresson mine, Cripple Creek, Colorado, USBM Info. Circ. 6806, 1934.

Koschmann, A. H., New light on the geology of the Cripple Creek district, Colorado and its practical significance, Colo. Min. Assoc. Special Pub., 1941.

Koschmann, A. H., Structural control of gold deposits of the Cripple Creek District, Teller Co., Colo., USGS Bull. 955-B, 1949.

_____, and Loughlin, G. F., Geology and ore deposits of the Cripple Creek district, Colo., Colo. Sci. Soc. Proc. 13(6), 1935.

Lindgren, W. and Ransome, F. L., Geology and gold deposits of the Cripple Creek district, Colo., USGS Prof. Paper 54, 1906.

Loughlin, G. F., Ore at deep levels in the Cripple Creek district, Colo., AIME Tr., v. 75, 1927.

Loughlin, G. F., Cripple Creek today, geology of ore deposits, Eng and Min. J. 136(8), Aug., 1935.

_____, Paragenic study of hypogene gold and silver telluride ores of Cripple Creek, Colorado, Pan Amer. Geol., vo. 74, 1940.

Rickard, T. A., The Telluride ores of Cripple Creek and kalgoorlie, AIME Tr., v. 30, 1900.

## CRYSTAL MOUNTAIN DISTRICT

Thurston, William R., Regmatites of the Crystal Mountain district, Larimer County, Colorado, USGS Bull. 1011, 1955.

## EMPIRE DISTRICT

Tapp, W. N., 1948, Influence of depth on the ore deposits of the North Empire mining district, Empire, Colorado, Colorado - Wyoming Acad. Sci. Journ., vol. 3, no. 5.

## EUREKA DISTRICT

Young, Wm. E., 1966, Manganese occurences in the Eureka-Animas Forks areas of the San Juan Mountains, San Juan County, Colorado, USBM Info. Circ. 8303.

## FREELAND-LAMARTINE DISTRICT

Harrison, J. E., 1955, Relation between fracture pattern and hypogene zoning in the Freeland-Lamartine district, Colorado, Economic Geology, vol. 50, no. 3.

Harrison, J. E., and Wells, J. D., 1956, Geology and ore deposits of the Freeland-Lamartine district, Clear Creek County, Colorado USGS Bull. 1032-B.

## GEORGETOWN DISTRICT

Gabelman, J. W., 1949, A self-potential survey of the Georgetown mining district, Colorado, Mines Mag., vol. 34, no. 9.

## GILMAN DISTRICT

Borcherdt, W. O., The Empire Zinc Company's operation at Gilman, Colo., Eng. and Min. J., vo. 132, nos. 3 & 6, 1931.

Radabaugh, R. E., Geology and ore occurence (Gilman), Min. Eng., v. 5, no. 12, 1953.

## GOLD BRICK DISTRICT

Crawford, R. D., and Worcester, P. G., 1916, Geology and ore deposits of the Gold Brick district, Colorado, Colorado Geol. Sur. 10.

## GOLD HILL DISTRICT

Campbell, R. H., Reconnaissance for radioactivity in the Gold Hill mining area, Boulder, Co., Colo., USGS Trace Element Mem. Rept., TEM-563A, 1955.

Goddard, E. N., Preliminary Report on the Gold Hill mining district, Boulder County, Colorado, Colorado Scientific Society Proc. 14(4), 1940.

Goddard, E. N., Nickel deposit near Gold Hill, Boulder County, Colorado, also T. S. Lovering, USGS Bull. 931-0, 1942.

Myers, R. E., The minerals and geology of Gold Hill, Colorado, Rocks and Minerals, v. 22, no. 3, 1947.

## HORSESHOE DISTRICT

Klugman, M. A., Mg/Ca ratios in carbonate wall rock in the Alma-Horseshoe district, Colorado, Am. Inst. Min. Met. and Petro. Engineering, Soc. Min. Eng., Tr. v. 229, no. 2, 1964.

## IDLEDALE DISTRICT

Schlottman, Jerome D., Foothills mine, Idledale district, Jefferson County, Colorado, US At. Energy Comm. [Pub.] RME-138, 1961.

## IRWIN DISTRICT

Socolow, A. A., 1949, Geology of the Irwin district of Colorado, GSA Bulletin, vol. 60, no. 12.

## KOKOMO DISTRICT

Hamilton, W. H., 1955, Investigation of the Kokomo zinc deposits, Summit County, Colorado, USBM Report Invest. 5138.

Koschman, H. H., and Wells, F. G., 1946, Preliminary report on the Kokomo mining district, Summit County, Colorado, Colo. Sci. Soc. Proc., vol. 15, no. 2.

## LAKE COMO

Hild, J. H., and Rose, C. K., 1959, Exploration of Pb-Zn deposits in the Ross Basin-Lake Como area, San Juan County, Colorado, USBM Report Invest. 5518.

## LA PLATA DISTRICT

Atwood, W. W., and Mather, K. F., Physiogrpahy and quaternary geology of the San Juan Mtn., Colorado, USGS Prof. Pap. 166, 1923.

_____, Resurvey of the geology and ore deposits of the La Plata mining district, Colorado, Colo. Sci. Soc. Proc. 13(9), 1936.

_____, Copper ores of the La Plata district, Colorado, and their platinum content, Colo. Sci. Soc. Proc. 13(12), 1938.

Eckel, E. B., and others, Geology and ore deposits of the La Plata district, Colorado, USGS Prof. Pap. 219, 1949.

Galbraith, F. W., Ore minerals of the La Plata Mtns., Colorado compared with other Telluride districts, Econ. Geo., v. 36, 1941.

# LAWSON-DUMONT DISTRICT

Harrison, J. E., and Leonard, B. F., Preliminary report on the Jo Reynolds area, Lawson-Dumont district, Clear Creek County, Colo., USGS Circ. 213, 1952.

## LEADVILLE DISTRICT


Behre, C. H., 1929, Revision of structure and stratigraphy in the Mosquito Range and the Leadville district, Colorado, Colo. Sci. Soc. Proc., vol. 12, no. 3.

Behre, C. H., 1939, Preliminary geological report on the west slope of the Mosquito Range in the vicinity of Leadville, Colorado, Colo. Sci. Soc. Proc., vol. 14, no. 2.

Chapman, E. P., 1939, Newly recognized features of mineral paragenesis at Leadville, Colorado, AIME, Mining Tech., vol. 3, no. 5.

Davidson, R. N., 1950, Hydrothermal alteration effects in the Leadville limestone and their relation to metalization, GSA Bulletin, vol. 61.

Ebbly, N. E., Jr., 1949, Examiniation, mapping, and sampling of mine shafts and underground workings, Leadville, Lake County, Colorado, USBM Report Invest. 4518.

_____, and Schumaker, J. F., 1949, Investigation of the Fairview Hill area manganese deposits, Leadville, Lake County, Colorado, USBM Report Invest. 4589.

Elgin, R. A., et al., 1949, The Leadville drainage tunnel, Lake County, Colorado, USBM Report Invest. 4493.

Emmons, S. F., 1927, Geology and ore deposits of the Leadville mining district, Colorado, USGS Prof. Paper 148.

Hedges, J. H., 1940, Possibilities of manganese production at Leadvill, Colorado, USBM Infor. Circ. 7125.

Loughlin, G. F., 1918, The oxidized zinc ores of Leadville, Colorado, USGS Bull. 681.

_____, 1926, Guides to ore in the Leadville mining district, Colorado, USGS Bulletin 779.

_____, and Behre, C. H., 1934, Zoning of ore deposits in and adjoining the Leadville district, Colorado, Economic Geology, vol. 29, no. 3.

Meeves, H., and Darnell, R. P., 1970, Silver potential and economic aspects of the Leadville District, Colorado, USBM Info. Circ. 8464.

Salsbury, M. H., 1956, The Leadville drainage tunnel second project, Lake County, Colorado, USBM Report Invest. 5284.

## MAGNOLIA DISTRICT

Wilkerson, A. S., Geology and ore deposits of the Magnolia mining district and adjacent area, Boulder County, Colorado, Colo. Sci. Soc. Pro. 14(3), 1939.

_____, Telluride-tungsten mineralization of the Magnolia mining district, Colorado, Econ. Geo. 34(4), 1939.

## MARSHALL PASS DISTRICT

Malan, R. C., 1959, Geology and uranium deposits of the Marshall Pass District, Gunnison, Saguache, and Chaffee Counties, Colorado, address at Colorado Mining Assoc., Denver, Colorado.

## MINERAL POINT DISTRICT

Hazen, S. W., Jr., 1949, Lead-zinc in the Poughkeepsie district, part of the upper Uncompahgre and Mineral Point districts, Ouray and San Juan Counties, Colo., USBM Report Invest. 4508.

## MONARCH DISTRICT

Crawford, R. D., 1909, Preliminary report on the geology of Monarch mining district, Chaffee County, Colorado, Colorado Geologic Survey, no. 1.

_____, 1913, Geology and ore deposits of the Monarch and Tomichi districts, Colorado, Colorado Geol. Sur., no. 4.

Gabelman, J. W., 1950, Structural control of limestone alteration in the Monarch mining district, Colorado, GSA Bulletin, vol. 61, no. 12.

Hazen, S. W., Jr., 1956, Exploration for lead and zinc at the Madonna mine, Monarch mining district, Chaffee County, Colorado, USBM Report Invest. 5218.

MONTEZUMA DISTRICT

Patton, H. B., 1918, The Montezuma mining district, Summit County, Colorado, Colorado Geologic Survey, no. 18.

## NORTHGATE DISTRICT

Steven, T. A., 1950, Age and structural control of the flourspar deposits in the Northgate District, Colorado, GSA Bulletin, vol. 61, no. 12.

## OURAY DISTRICT

Burbank, W. S., Revision of geologic structure and stratigraphy in the Ouray district of Colorado and its bearing on ore deposits, Colo. Sci. Soc. Proc. 12(6), 1930.

Moehlman, R. S., Ore deposition south of Ouray, Coloardo, Part II, Econ. Geo. 31(4,5), 1936.

## PLACERVILLE DISTRICT

Hatt, John C., Petrology of two clastic dikes from the Placerville district, Colo., Am. J. Sci. 242(4), April, 1944.

Eischer, R. P., and others, Vanadium deposits near Placerville, San Miguel Co., Colorado, Colo. Sci. Soc. Pr., vol. 5, no. 3, 1947.

## PLATORD-SUMMITVILLE DISTRICT

Patton, H. B., 1917, Geology and ore deposits of the Platord-Summitville mining district, Colorado, Colo. Geological Sur. 13.

## POUGHKEEPSIE DISTRICT

Hazen, S. W., Jr., 1949, Pb-Zn in Poughkeepsie district and part of the upper Uncompahgre and Mineral Point districts, Ouray and San Juan Counties, Colorado, USBM Report Invest. 4508.

## POWDERHORN DISTRICT

Olson, J. C., and Wallace, S. R., 1956, Thorium and rare earth minerals in the Powderhorn district, Gunnison County, Colorado, USGS Bull. 1027-O.

## QUARTZ CREEK DISTRICT

Staatz, M. H., and Trites, A. F., 1957, Geology of the Quartz Creek pegmatite district, Gunnison County, Colorado, USGS Prof. Paper 265.

## RED CLIFF DISTRICT

Crawford, R. D., and Gibson, R., Geology and ore deposits of the Red Cliff District, Colo., Colo. Geo. Survey, Bull 30, 1925.

Means, R., Geology and ore deposits of Red Cliff, Colo., Econ. Geo., v. 10, 1915.

## RED MOUNTAIN DISTRICT

Rurbank, W. S., Structural control or ore deposition in the Red Mountain, Sneffels, and Telluride districts of the San Juan Mountains, Colo., Colo. Sci. Soc. Proc., v. 14, no. 5., 1941.

Collins, George E., Localization of ore bodies at Rico and Red Mtn. Colo. as conditioned by geologic structure and history, Colo. Sci. Soc. Proc. 12(12), 1931.

## RICO DISTRICT

Collins, G. E., Localization of ore bodies at Rico and Red Mtn., Colo. as conditioned by geologic structure and history, Colo. Sci. Soc. Proc. 12(12), 1931.

Cross, W. and Ransome, F. L., Rico Folio, USGS Geologic Folio, 130, 1905.

## SILVERTON DISTRICT

Cross, W.; et al., Silverton folio, Geological Folio 120, 1905.

Varnes, David J., Geology and ore deposits of the south Silverton mining area, San Juan Co., Colo., USGS Prof. Pap. 378-A, 1963.

## SLICK ROCK DISTRICT

Shawe, D. R., Geology and uranium-vanadium deposits of the Slick Rock district, San Miguel and Dolores Co., Colo., Inter. Conf. Peace, Uses At. Energy, 2nd Geneva Proceeding, v. 2, 1958.

Shaw, D. R., Heavy minerals as guides to uranium-vanadium ore deposits in the Slick Rock district, Colo., also Howard E. Bowers, USGS Bull. 1167-B, 1961.

## SNEFFELS DISTRICT

Burbank, W. S., Structural control of ore deposition in the Red Mtn., Sneffels, and Telluride districts of the San Juan Mtns., Colo., Colo. Sci. Soc. Pro., v. 14, no. 5, 1941.

## SUMMITVILLE DISTRICT

Patton, H. B., Geology and ore deposits of the Platoro-Summitville mining district, Colo., Colo. Geological Survey, Bull. 13, 1917.

Steven, Thomas A., Geology and ore deposits of the Summitville district, San Juan Mtns., Colo., USGS Prof. Pap. 343, 1960.

## TARRYALL DISTRICT

Muilenburg, G. A., 1925, Geology of the Tarryall district, Park County, Colorado, Colo. Geol. Surv. 31.

## TELLURIDE DISTRICT

Burbank, W. S., Structural control of ore deposition in the Red. Mtn., Sneffels, and Telluride districts of the San Juan Mtsn., Colo., Colo. Sci. Soc. Proc., v. 14, no. 5, 1941.

Vhay, J. S., Geology and mineral deposits of the area south of Telluride, Colo., USGS Bull. 1112-G, 1962.

## TEN MILE DISTRICT

Emmons, S. F., Ten Mile district folio, USGS Geologic Folio 48, 1898.

## TINCUP DISTRICT

Goddard, E. N., 1936, The geology and ore deposits of the Tincup mining district, Gunnifson County, Colorado, Colorado Sci. Soc. Proc., vol. 13, no. 10.

## TOMICHI DISTRICT

Crawford, R. D., 1913, Geology and ore deposits of the Monarch and Tomichi districts, Colo., Colo. Geol. Sur. 4.

## TUNGSTEN DISTRICT

Kirk, C. T., 1916, Tungsten district of Boulder County, Colorado, Mining and Science Press, vol. 112, no. 22.

Lovering, T. S., and Tweto, O., 1953, Geology and ore deposits of the Boulder County Tungsten district, Colorado, USGS Prof. Paper 245.

## TWIN LAKES DISTRICT

Howell, J. V., 1919, Twin Lakes district of Colorado, Colo. Geol. Sur. 17.

## UNCOMPAHGRE DISTRICT

Burbank, W. S., 1940, Structural control of ore deposition in the Uncompahgre district, Ouray County, Colorado, USGS Bull. 906-E.

Fisher, R. P., Luedke, P. G., Sheridan, M. J., and Raabe, R. G., 1968, Mineral resources of the Uncompahgre primitive area, Colo., GSB, 1261-C.

Hazen, S. W., Jr., 1949, Lead-zinc-silver in the Poughkeepsie district and part of the upper Uncompahgre and Mineral Point district, Ouray and San Juan Counties, Colorado, USBM Report Invest. 4508.

Kelly, V. C., 1946, Geology, ore deposits, and mines of the MIneral Point, Poughkeepsie, and upper Uncompahgre districts, Ouray, San Juan, and Hinsdale Counties, Colorado, Colorado Sci. Soc. Proc., vol. 14, no. 7.

## URAVAN DISTRICT

Boardman, R. L., Sedimentary features of upper sandstone lenses of the salt wash member and their relation to uranium-vanadium deposits in the Uravan district, Montrose County, Colo., International Conf. Peace Uses of At. Energy Gen., V. G., 1956.

Botinelly, T., and Weeks, A., Mineralogic classification of uranium-vanadium deposits of the Colorado Plateau, USGS Bull. 1074-A, 1957.

Fischer, R. P., Geology of the Uravan mineral belt, USGS Bull. 988-A, 1952.

Fischer, R. P., and Hilpert, L. S., Geology of the Uravan mineral district, USGS Bull. 988-A, 1952.

Heyl, A. V., Zoning of the Bitter Creek vanadium-uranium deposit near Uravan, Colo., USGS Bull 1042-F, 1957.

Wood, H. A., and Lekas, M. A., Uranium deposits of the Uravan mineral belt, Intermountain Assoc. of Pet. Geologists, 9th Ann. Conf., pp. 208-215, 1958.

## WARD DISTRICT

Wahlstrom, E. E., The age relations of the Ward ores, Boulder County, Colorado, Econ. Geo. 31(1), 1936.

Walker, Stanley M., Ore Deposition in the Columbia and Dew Drop vein systems, Ward district, Boulder County, Colorado, Engineers Bull. (Colo. Soc. Eng.) 10(6,7), 1935.

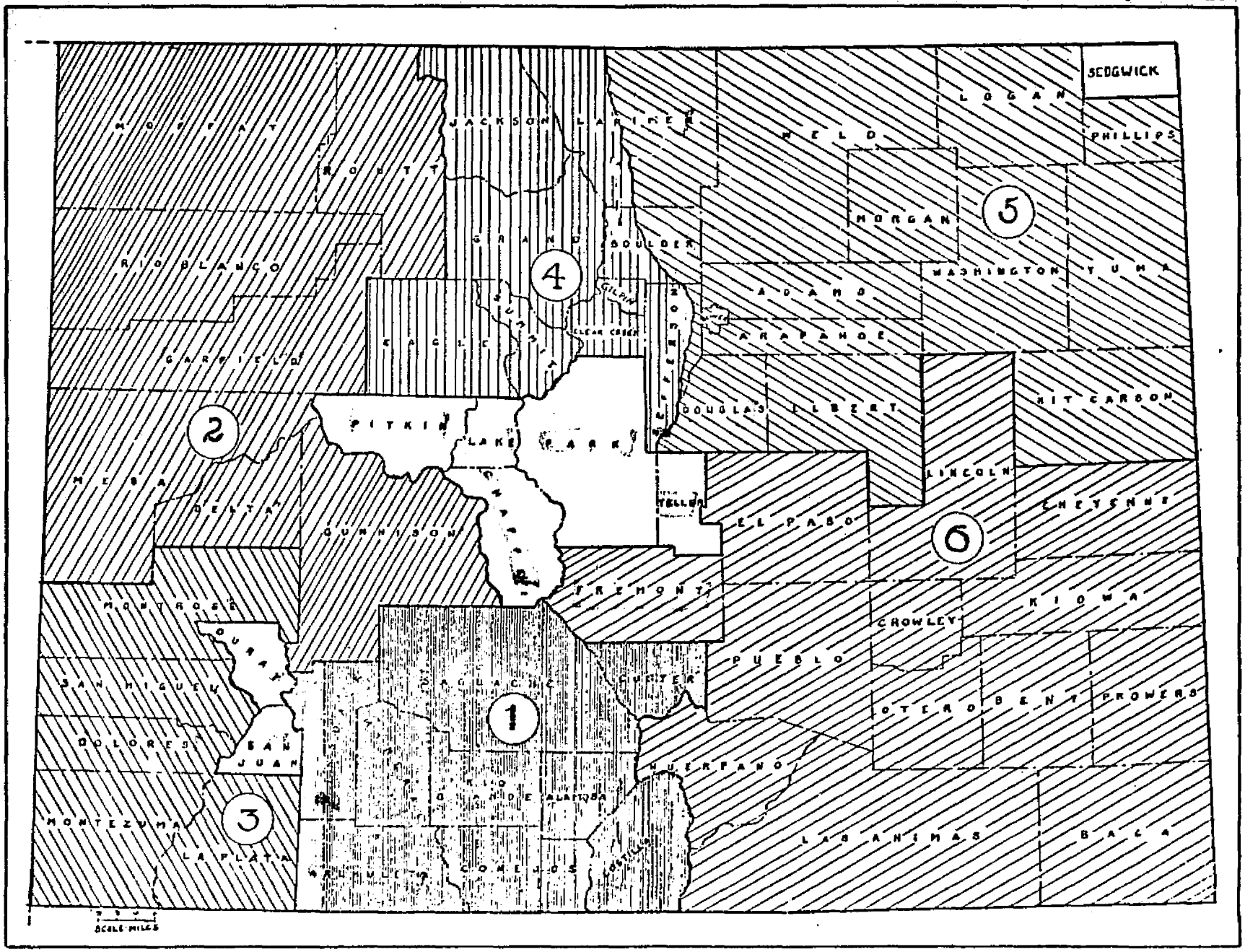
## WESTON PASS DISTRICT

Behre, C. H., The Weston Pass mining district, Lake and Park Counties, Colo., Colo. Sci. Soc. Proc., v. 13, no. 3.

WHITEPINE DISTRICT

Harder, E. C., The Taylor Peak and Whitepine iron ore deposits, Colo., USGS Bul. 380, 1909.

COLORADO SCHOOL OF MINES QUARTERLY




Map showing areas covered by Bibliographies on Geology, published by the Colorado School of Mines.

1—Area covered by present bibliography, v 23, no.4, 1928
2—Northwestern Colorado, C. S. M. Quarterly, Vol. 21, No. 3, July 1926. K
3—Southwestern Colorado, C. S. M. Circular Information, Sept. 1924.
4—Northcentral Colorado, C. S. M. Quarterly, Vol. 22, No. 4, Oct. 1927. K
5—Northeastern Colorado, C. S. M. Circular Information, Jan. 1925. K
6—Southeastern Colorado, C. S. M. Circular Information, Aug. 1925. K