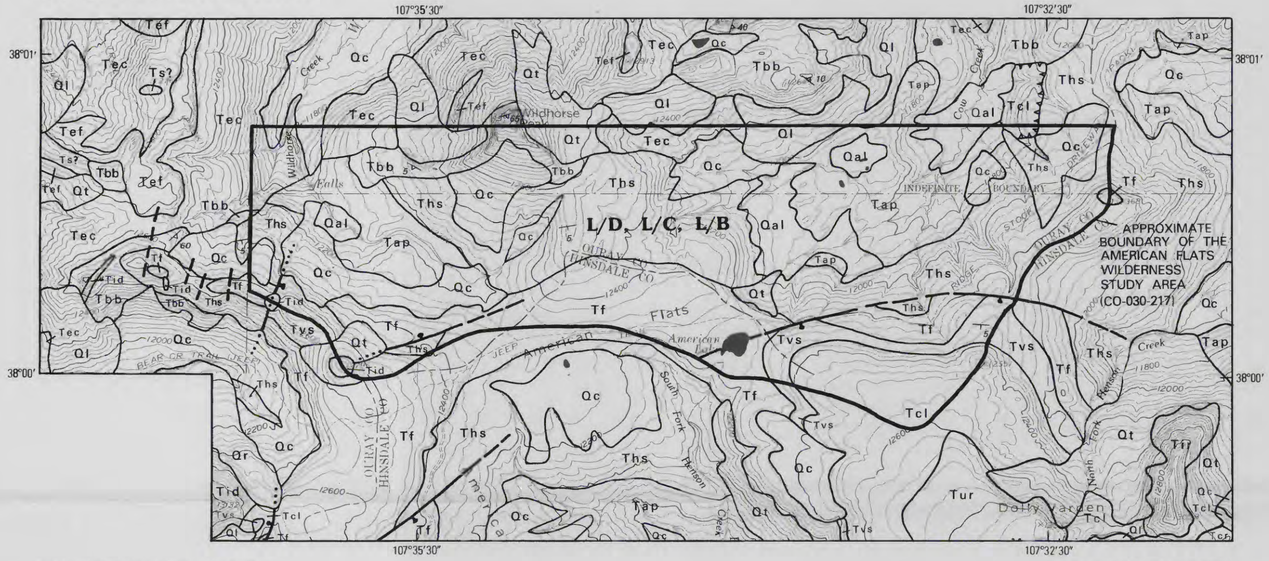
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

BULLETIN 1715-A
PLATE 1



Base from U.S. Geological Survey, Handies Peak, 1955, and Wetterhorn Peak, 1963

Geology modified from Lipman (1976a)

APPROXIMATE MEAN DECLINATION, 1955

SCALE 1:24 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

COLORADO

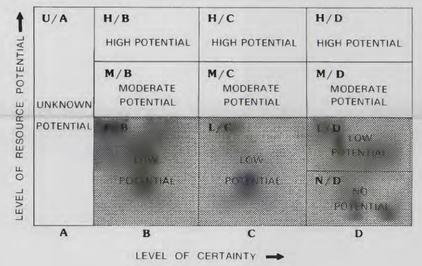
EXPLANATION OF MINERAL RESOURCE POTENTIAL

[Entire area has no potential for oil, gas, or coal (certainty level D)]

L/D, L/C, L/B **Geologic terrane having low resource potential for commodities 2 and 5 (certainty level D), for commodities 1 and 6 (certainty level C), and for commodities 3 and 4 (certainty level B)**

Commodities

1. **Vein deposits (Ag, Au, Zn, Pb, Cu)**
2. **Breccia-pipe deposits (Ag, Pb, Zn, Cu, Au)**
3. **Porphyry-type molybdenum and copper deposits**
4. **Rhyolite-related uranium deposits**
5. **Gravel**
6. **Geothermal energy sources**



LEVELS OF RESOURCE POTENTIAL

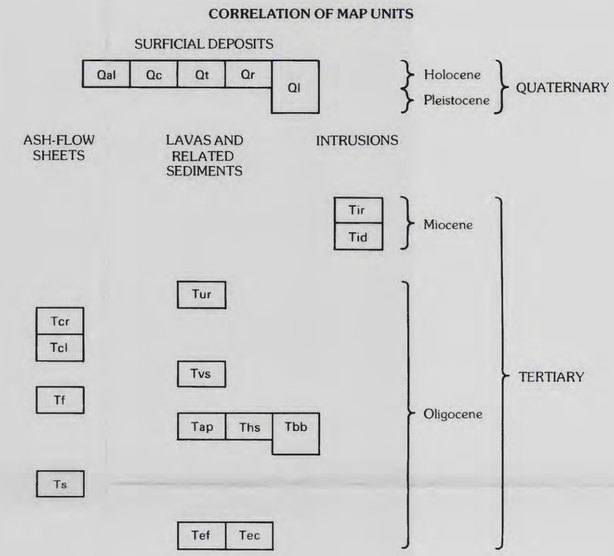
- **H** High mineral resource potential
- **M** Moderate mineral resource potential
- **L** Low mineral resource potential
- **U** Unknown mineral resource potential
- **N** No known mineral resource potential

LEVELS OF CERTAINTY

- **A** Available data not adequate
- **B** Data indicate geologic environment and suggest level of resource potential
- **C** Data indicate geologic environment, give good indication of level of resource potential, but do not establish activity of resource-forming processes
- **D** Data clearly define geologic environment and level of resource potential and indicate activity of resource-forming processes in all or part of the area

Diagram showing relationships between levels of mineral resource potential and levels of certainty. Shading shows levels that apply to this study area

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

[Descriptions are modified slightly from Lipman (1976a). Terminology of rock units follows that of Lipman and others (1973) and Lipman (1976a). Volcanic rock names assigned according to Le Maitre (1984). Most potassium-argon ages are from Lipman and others (1970, 1976) as recalculated by Hon and Mehnert (1983)]

SURFICIAL DEPOSITS

Holocene deposits

Qal **Alluvium**—Silt, sand, gravel, and peaty material in valley bottoms. Locally includes colluvial deposits at margins of valley bottoms

Qc **Colluvium**—Poorly sorted silt- to boulder-sized material on slopes and in steep valleys. Locally includes small alluvial-fan, talus, landslide, and glacial moraine deposits

Qt **Talus**—Angular rock fragments as much as 3 ft in diameter, forming talus cones, talus aprons, and scree slopes. Grades into colluvium (Qc) with increase in sand and silt content

Qr **Rock glacier**—Lobate deposit of angular rock fragments, generally lacking fine-grained material on the upper surface

Holocene and Pleistocene deposits

Ql **Landslide deposits**—Poorly sorted material derived from bedrock and glacial deposits; include small earthflow, block-slump, and block-slide deposits. Locally intergrade with large block slides and slumps (indicated by tooth pattern)

MIOCENE INTRUSIVE ROCKS

Tir **Rhyolite**—Dome of buff to white, high-silica rhyolite contains 10-20 percent phenocrysts of quartz, sanidine, sodic plagioclase, and sparse biotite. Brown glassy zones locally preserved near contacts. Small rafted pendants of an associated block- and ash-flow deposit are preserved in the northeastern part of the complex. The rhyolite dome has been dated at 18.7 m.y. by the potassium-argon method (K. Hon and H. H. Mehnert, unpub. data, 1985)

Tid **Dacite**—Plugs and irregularly shaped intrusions of gray porphyritic mafic dacite and silicic andesite containing 10-30 percent phenocrysts of plagioclase, sanidine, biotite, and sparse pyroxene. The pyroxene is mostly altered to chlorite

OLIGOCENE ASH-FLOW SHEETS

Tcr **Carpenter Ridge Tuff**—Nonwelded gray to densely welded red-brown rhyolitic ash-flow sheet containing 2-5 percent phenocrysts (mainly plagioclase, sanidine, and biotite). Erupted about 28 m.y. ago

Tcl **Crystal Lake Tuff**—Nonwelded gray to densely welded red-brown rhyolitic ash-flow sheet containing 2-5 percent phenocrysts (mainly plagioclase, sanidine, and biotite). Petrographically very similar to the overlying Carpenter Ridge Tuff, but commonly contains more abundant small rock fragments and larger pumice lenses. Erupted from the Silverton caldera about 28 m.y. ago

Tf **Fish Canyon Tuff**—Nonwelded light-gray to densely welded dark-gray, dacitic ash-flow sheet containing about 50 percent phenocrysts (mainly plagioclase, sanidine, biotite, and hornblende). Sparse resorbed quartz, accessory sphene, and hornblende without augite constitute a distinctive phenocryst assemblage. Potassium-argon age 27.8 m.y. (Kunk and others, 1985)

Ts **Sapinero Mesa Tuff**—Nonwelded gray to densely welded red-brown rhyolitic ash-flow sheet containing 2-5 percent phenocrysts (mainly plagioclase, sanidine, and biotite). Erupted from the San Juan and Uncompahgre calderas about 29 m.y. ago

LAVAS AND SEDIMENTARY ROCKS OF THE OLIGOCENE WESTERN SAN JUAN CALDERAS

Volcanics of Uncompahgre Peak—Lava flows within the northern and eastern parts of the Uncompahgre caldera

Tur **Rhyolite**—Flow of light-tan to white, flow-laminated, phenocryst-poor rhyolite. Contains 1-5 percent phenocrysts, mostly plagioclase and sanidine, and sparse biotite

Tvs **Local volcaniclastic sedimentary rocks**—Mostly gray-green tuffaceous sandstone and shale. Similar in appearance to sandstone of Henson Member (Ths) of Silverton Volcanics, but occur at higher stratigraphic levels within Uncompahgre and San Juan calderas

Silverton Volcanics—Lava flows of intermediate to silicic composition and related volcaniclastic sediments that accumulated with and adjacent to the San Juan and Uncompahgre calderas after their collapse, but before subsidence of the Silverton caldera

Tap **Pyroxene andesite member**—Andesitic lava flows that largely overlie the Burns Member (Tbb), but locally interfinger complexly with it. Consists of dark-gray, coarsely porphyritic andesite containing 15-25 percent phenocrysts of plagioclase and augite. Thin, tabular flows averaging 30-60 ft thick that occur exclusively in northern parts of the Uncompahgre and San Juan calderas

Ths **Henson Member**— Volcaniclastic sedimentary rocks that interfinger complexly with both the Burns Member (Tbb) and the pyroxene andesite member (Tap). Consists of green-gray tuffaceous sandstone containing abundant grains of plagioclase, augite, and andesitic rock fragments

Tbb **Burns Member**—Relatively silicic lava flows that interfinger with the pyroxene andesite member (Tap) and the Henson Member (Ths). Consists of light-to dark-gray, thick biotite dacite flows and domes containing 15-30 percent phenocrysts of plagioclase, biotite, and augite

OLIGOCENE EARLY INTERMEDIATE-COMPOSITION LAVAS AND RELATED ROCKS

Tef **Lava flow**—Andesitic to dacitic lava flow, probably erupted from the Cow Creek volcanic center

Tec **Volcaniclastic facies**—Mostly reworked bedded conglomerates, sandstones, and mudflow breccias containing clasts of dark andesite and dacite. Accumulated as clastic aprons on flanks of penecontemporaneous volcanoes and between them. Equivalent to San Juan Formation

Contact

Fault—Dashed where approximately located; dotted where concealed or occupied by intrusive rocks. Bar and ball on downthrown side

Block-slump fault—Teeth point toward direction of slumping

Strike and dip of beds

Strike and dip of foliation

MINERAL RESOURCE POTENTIAL MAP OF THE AMERICAN FLATS WILDERNESS STUDY AREA, OURAY AND HINSDALE COUNTIES, COLORADO