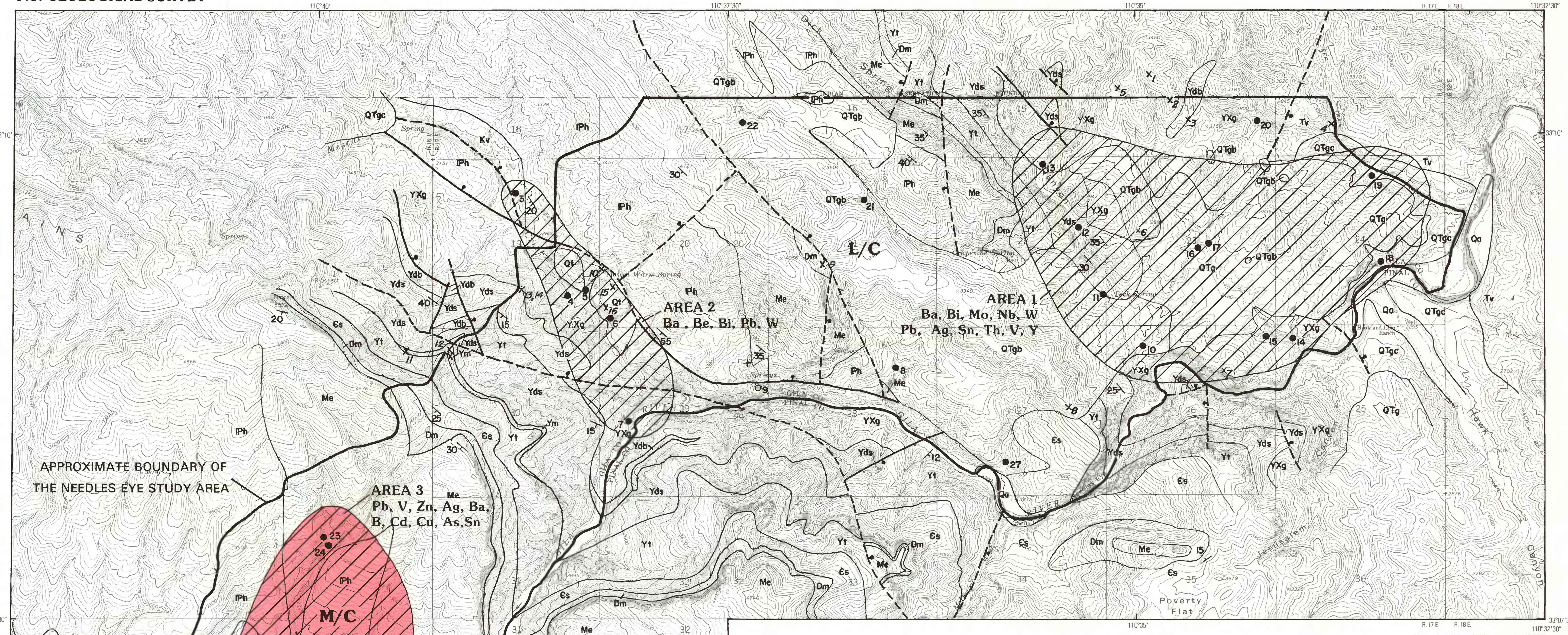
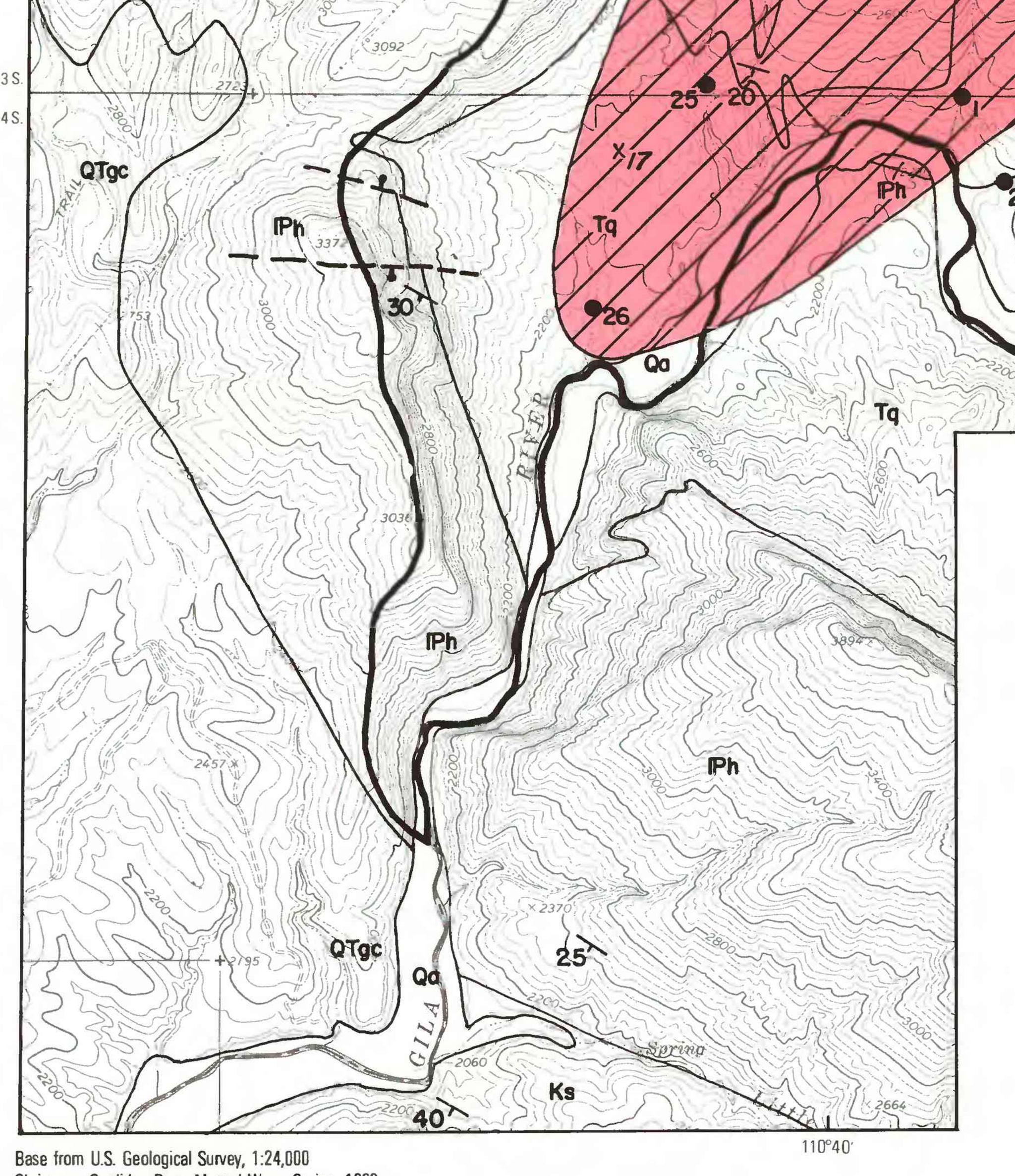




Base from U.S. Geological Survey, 1:24,000
Christmas, Coolidge Dam, Mescal Warm Spring, 1968

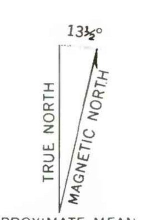
Geology from Willden (1964, map scale 1:62,500), modified by F.S. Simons

SCALE 1:24 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929



APPROXIMATE MEAN DECLINATION, 1968

LEVEL OF RESOURCE POTENTIAL ↑	A	B	C	D
	U/A UNKNOWN POTENTIAL	H/B HIGH POTENTIAL	H/C HIGH POTENTIAL	H/D HIGH POTENTIAL
		M/B MODERATE POTENTIAL	M/C MODERATE POTENTIAL	M/D MODERATE POTENTIAL
		L/B LOW POTENTIAL	L/C LOW POTENTIAL	L/D LOW POTENTIAL
				N/D NO POTENTIAL

LEVEL OF CERTAINTY →

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

Qa, Qt — QUATERNARY
Unconformity
QTg (QTgb, QTgc) — QUATERNARY / TERTIARY
Unconformity
Tv, Tq — TERTIARY
Kv, Ks — CRETACEOUS
Unconformity
Ph — PENNSYLVANIAN
Me — MISSISSIPPIAN
Dm — DEVONIAN
Unconformity
Ꞓs — CAMBRIAN
Unconformity
Ydb, Yt, Ym, Yds — MIDDLE PROTEROZOIC
Unconformity
YXg — MIDDLE OR EARLY PROTEROZOIC

EXPLANATION OF MINERAL RESOURCE POTENTIAL

M/C **Geologic terrane having moderate resource potential, with certainty level C, for Pb, V, Zn, Ag, Ba, B, Cd, Cu, As, and Sn**

L/C **Geologic terrane having low mineral resource potential, with certainty level C, for fuels and geothermal energy**

Area from which geochemical samples were anomalous in the elements shown

DESCRIPTION OF MAP UNITS

Qa **Alluvium (Quaternary)**—Unconsolidated terrace deposits, alluvial fans, and alluvium at three places along the Gila River

Qt **Tufa (Quaternary)**—Light-gray, cavernous, locally dense tufa in terraces deposited by Mescal Warm Spring and other springs along northeastern side of Mescal Creek. Largest terrace is 0.5 mi long and 400 ft thick

Gila Conglomerate (Quaternary and Tertiary)

QTg **Interbedded conglomerate and basalt flows**—Conglomerate clasts are mainly of underlying rocks and of rocks exposed nearby; locally are almost entirely of Horquilla Limestone (unit Ph). Possibly several hundred feet thick

QTgb **Basalt flows**—Thin flows of dark-gray vesicular olivine basalt; contain olivine phenocrysts as much as 5 millimeters across. Underlie a northwest-trending area of about 2 square miles in middle of study area, where they may be as much as 1,000 ft thick; also several small occurrences near eastern end of study area

QTgc **Conglomerate**—Shown separately in small areas in and adjoining eastern and southwestern parts of study area. Dips steeply and is overlain unconformably by unit QTg in lower Hawk Canyon, just southeast of eastern end of study area. About 100 ft thick

Tv **Silicic volcanic rocks (Tertiary)**—Light-colored silicic lavas. Contain sparse small phenocrysts of biotite and feldspar. Underlie small area at eastern end of study area; only few tens of feet thick

Tq **Quartz monzonite porphyry (Tertiary)**—Laccolith of light-gray, medium-grained porphyry containing phenocrysts of plagioclase as much as 1 centimeter across and smaller grains of hornblende and biotite in an aplitic groundmass. Intrudes Escabrosa Limestone (unit Me) and Horquilla Limestone (unit Ph); the Horquilla was converted to fine-grained white marble for 10-15 ft from contact. Deeply weathered, not very resistant, underlies low area where crossed by Gila River in southwestern end of study area. Biotite from quartz diorite porphyry (quartz monzonite porphyry of this report) at Christmas, just southwest of study area, has been dated by the potassium-argon method at 62 m.y. (million years) (Creasey and Kistler, 1962)

Kv **Volcanic and sedimentary rocks (Cretaceous)**—Andesitic flows, flow breccias, and tuff. Underlie a narrow belt 1 mi long in Mescal Creek just northwest of study area, where they rest unconformably on Horquilla Limestone (unit Ph). 200-300 ft thick

Ks **Sedimentary rocks (Cretaceous)**—Gray, grayish-green, and light-brown sandstone, shale, and conglomerate. Exposed only just south of southwestern end of study area, where they unconformably overlie Horquilla Limestone (unit Ph) and are several hundred feet thick

Ph **Horquilla Limestone (Pennsylvanian)**—Gray to light-gray, thin- to thick-bedded, fine-grained, fossiliferous limestone. Forms conspicuous dip slopes on southwestern flank of Mescal Mountains and southwestern side of ridge between Mescal Creek and Dick Spring Canyon. Conformable with underlying Escabrosa Limestone (unit Me). 1,500-1,800 ft thick

Me **Escabrosa Limestone (Mississippian)**—Light- to dark-gray, mostly thick-bedded to massive limestone, cherty limestone, and limestone or chert breccia. Contains abundant crinoid debris and solitary corals. Resistant to erosion; forms cliffs along crest of Mescal Mountains and also underlies high ridge east of Mescal Warm Spring and ridge southwest of Dick Spring Canyon. Overlies Martin Formation (unit Dm) conformably. Uniformly about 500 ft thick

Dm **Martin Formation (Devonian)**—Upper part is green shale, poorly exposed, 50-75 ft thick. Lower part is yellowish-gray to light-brown, medium- to thin-bedded, fine-grained dolomite with some dark-gray to brown, coarser grained fetid dolomite; about 200 ft thick. Formation has same distribution as Escabrosa Limestone. Rests concordantly on rocks ranging in age from Cambrian to Middle Proterozoic; however, contact is an unconformity that in Mescal Mountains represents more than two geologic periods, and on ridge northeast of Dick Spring Canyon, more than three geologic periods

Ꞓs **Sedimentary rocks (Cambrian)**—Crossbedded brown quartzite and light-gray to light-brown sandstone; some wavy-bedded dolomitic sandstone near top. Probably includes rocks assigned to Cambrian Bolsa Quartzite and the overlying Cambrian Abrigo Limestone elsewhere in southeastern Arizona. Within study area, is conformable with underlying Troy Quartzite (unit Yt) of Middle Proterozoic age; at one place, rest on rusty weathered zone 1-1.5 ft thick on the Troy. Elsewhere nearby, unconformably overlies Middle Proterozoic diabase, Mescal Formation, and Dripping Spring Quartzite, and Middle or Early Proterozoic granitic rocks. Occurs in Mescal Mountains and along Gila River just west of Dick Spring Canyon; 300-400 ft thick

Ydb **Diabase (Middle Proterozoic)**—Dark-gray to dark-greenish-gray, medium-grained diabase. Forms sills in Dripping Spring Quartzite, and dikes and irregular bodies in Proterozoic granitic rocks; also intrudes Troy Quartzite near but outside of study area. Small occurrences in west-central and eastern parts of area. Isotopically dated diabase from various places in southern Arizona has ages of from 1,075±50 m.y. to 1,200 m.y. (Shride, 1967, p. 77)

Yt **Troy Quartzite (Middle Proterozoic)**—Upper part is white, light-gray, or reddish-gray, medium- to thick-bedded, cliff-forming quartzite. Lower part is white, light-gray, brown, or red, medium- to thick-bedded, crossbedded pebble conglomerate, conglomeratic sandstone, and granule sandstone; pebbles are of quartz and chert. In general, is darker, more variegated, and coarser grained than overlying Cambrian quartzite. In most places, conformably overlies Dripping Spring Quartzite (unit Yds); at one place on northwestern edge of study area is separated from the Dripping Spring by thin layer of Mescal Formation. Main outcrop areas are on northeastern flank of Mescal Mountains and along Dick Spring Canyon. Thickness ranges from about 400 ft where study area boundary crosses Mescal Mountains and in Dick Spring Canyon to about 900 ft just east of Needles Eye.

Ym **Mescal Formation (Middle Proterozoic)**—Sandy dolomite, chert, limestone, and marble. In study area, upper part is irregularly layered gray, black, or red chert and chert breccia with dense, finely laminated white chert at top, 55 ft thick; lower part is finely laminated brown dolomite and cherty dolomite 30 ft thick. Exposed only where Mescal Mountains cross northwestern boundary of study area. Conformably overlies Dripping Spring Quartzite.

Yds **Dripping Spring Quartzite (Middle Proterozoic)**—Upper part is light-colored, fine-grained, thin-bedded shaly quartzite; middle part is predominantly pale-red, distinctly thin to medium bedded, crossbedded, fine to very fine grained quartzite that weathers to conspicuous orange and dark brown and shows abundant soft-sediment deformation; lower part is cliff-forming, light-colored, medium- to thick-bedded, fine- to medium-grained feldspathic quartzite. At base locally in Mescal Mountains is thin bed of quartz-pebble conglomerate, the Barnes Conglomerate Member of the Dripping Spring Quartzite (not shown on pl. 1). Rests unconformably on Middle or Early Proterozoic granitic rocks except locally where Middle Proterozoic diabase is intruded along contact. Widely exposed on northeastern flank of Mescal Mountains, where it erodes to steep, rough cliff-and-bench topography; also along Dick Spring Canyon. 400-500 ft thick

YXg **Granitic rocks (Middle or Early Proterozoic)**—Pinkish-gray to reddish-brown, medium- to coarse-grained, porphyritic to equigranular leucogranite; composed almost entirely of feldspar and quartz, contains only traces of altered biotite. Overlain unconformably by Dripping Spring Quartzite, Gila Conglomerate, and Quaternary tufa, and intruded by Middle Proterozoic diabase; contacts with other rocks are faults. Similar rocks elsewhere in southeastern Arizona have been dated isotopically at 1,350-1,660 m.y. (Creasey, 1967, p. 8; Shride, 1967, p. 77)

Contact

Fault—Dashed where approximately located. Bar and ball on downthrown side

Strike and dip of beds

U.S. Bureau of Mines sample locality

Prospect

Alteration zone

×9 **U.S. Geological Survey rock-sample locality**

●3 **U.S. Geological Survey geochemical-sample locality**—Each locality represents a stream-sediment sample, heavy-mineral concentrate, and plant sample. Numbers refer to Harms and others (1985)

MAP SHOWING MINERAL RESOURCE POTENTIAL, GEOLOGY, AND GEOCHEMICAL SAMPLE LOCALITIES, NEEDLES EYE STUDY AREA, GILA COUNTY, ARIZONA