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URANIUM FAVORABILITY STUDY OF THE PRECAMBRIAN DRIPPING SPRING QUARTZITE, GILA AND PINAL COUNTIES, ARIZONA

BENDIX FIELD ENGINEERING CORPORATION
Grand Junction Operations
Grand Junction, Colorado 81501

June 1976

PREPARED FOR THE U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION,
GRAND JUNCTION OFFICE
UNDER CONTRACT NO. E(05-1)-1664

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R. E. Dickson, J. R. Strand,
W. A. Burgett, and R. C. Zollinger

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RECOMMENDATIONS

We recommend that no further work be done in this area at this time.

CONTENTS

Page

Summary 1

Introduction 3

General 3

Objectives and scope 3

Previous work 3

Procedures 3

Field work 3

Analytical procedures 5

Geology 5

Stratigraphy 5

The gray unit 5

Structure 8

Regional 8

Monoclines 8

Faults 8

Joints and fissures 10

Diabase 10

Uranium deposits 11

Previous exploration and mining 11

Descriptions of deposits 11

Vein-like deposits 11

Blanket-like deposits 12

Mineralogy 12

CONTENTS (continued)

Page

Uranium deposits (continued)

Ore controls 13

Stratigraphic controls 13

Structural controls 13

Association with diabase 14

Exploration guides 14

Favorable areas 14

References cited 17

Appendix A. Analyses of rock samples A-1

ILLUSTRATIONS

FIGURE 1. Location map showing exposures of diabase and Apache Group rocks, Gila and Pinal Counties, Arizona 4

2. Generalized stratigraphic column of the Apache Group in Gila and Pinal Counties, Arizona 6

3. Generalized stratigraphic column of the upper member of the Dripping Spring Quartzite, Gila County, Arizona 7

4. Map of most favorable areas, Dripping Spring Quartzite, Gila and Pinal Counties, Arizona 16

TABLE 1. Equivalent uranium, thorium, and potassium, and carbon contents of selected Apache Group units 9

PLATE 1. Sample locations .... In back pocket

2. Geologic map .... In back pocket

SUMMARY

The present study of the uranium favorability of the Precambrian Dripping Spring Quartzite in Gila and Pinal Counties, Arizona, was done on behalf of the U.S. Energy Research and Development Administration in order to synthesize available information and to determine favorability criteria and favorable areas. Project procedures included rock, stream-sediment, and water sampling; petrographic, radiometric, spectrometric, and chemical analyses.

Dripping Spring Quartzite uranium deposits are predominantly steeply dipping tabular veins. The veins are confined to the potassium-rich, carbonaceous gray unit of the upper member of the formation. They are associated with joints and fissures, mainly with those in the north-northeast set of the major system in the region and to a lesser degree with the west-northwest set. The deposits are near monoclines, prediabase and syndiabase faults, and discordant diabase contacts.

The veins are generally relatively small. Few veins are wider than 5 ft, and many are less than 1 ft wide; most veins are from 10 to 30 ft in vertical dimension. The most productive veins have been more than 100 ft long.

A few deposits are blanketlike, secondary uranium-mineral deposits. They are associated mainly with the middle member-upper member contact. Some are in paleochannels or have lithologic features suggestive of channel facies.

Uraninite is the main primary uranium mineral Primary sulfide minerals include pyrrhotite, molybdenite, chalcopyrite, pyrite, marcasite, sphalerite, and cubanite. High-iron sphalerite and well-crystallized uraninite, molybdenite, and pyrrhotite are present.

The following conclusions were reached:

1. There was direct control of vein deposition by joints and fissures in the gray unit.

2. Stratigraphic control was due to reducing conditions induced by disseminated organic carbon and (or) sulfides, or both, in the gray unit.

3. Indirect control was imposed by monocline, prediabase and syndiabase faults, and discordant diabase contacts.

4. Better veins and areas of abundant veins are near thicker diabase sills.

5. Favorable areas are those where the gray unit is near monoclines, prediabase and syndiabase faults, discordant diabase contacts, and thicker diabase sills.

6. No evidence was found to indicate that large, low-grade deposits exist between veins.

7. Low-grade, secondary uranium-mineral-bearing blanketlike deposits are associated with the middle member-upper member contact and paleochannels.

8. There are no petrographic distinctions between the gray unit near veins and away from veins.

9. The anomalous radioactivity in siltstone of the Mescal Limestone in the Pendleton Mesa area is mainly caused by ^{40}K due to the high feldspar content (App. A, sample nos. 15949, 15950, and 16399).

10. The most favorable areas for the discovery of uranium deposits are the Sierra Ancha monocline-Cherry Creek monocline area, the Mescal Mountains, the east Cherry Creek area, the Salt River Canyon area, and the upper Salome Creek area.

INTRODUCTION

GENERAL

This report presents the results of a study of the uranium favorability of the younger Precambrian Dripping Spring Quartzite in Gila and Pinal Counties, Arizona. The project was done for the Grand Junction Office of the Energy Research and Development Administration (ERDA).

OBJECTIVES AND SCOPE

Project objectives were to synthesize available geologic information; to determine favorability criteria; and to describe, appraise, and delineate favorable areas of the Dripping Spring Quartzite.

The project area is defined by the outcrops of the younger Precambrian Apache Group (Fig. 1), of which the Dripping Spring Quartzite is a part. The best uranium deposits known in the Dripping Spring are in Gila County, mainly in the Sierra Ancha region and Salt River Canyon vicinity (Pl. 1), and in the Mescal Mountains (Fig. 4). The field work was done mainly in those areas, although Apache Group outcrops in other areas were reconnoitered. Field work was done from May 5 to October 9, 1975. Laboratory work and data analysis continued until February 15, 1976.

PREVIOUS WORK

Uranium was discovered in the Dripping Spring Quartzite at the Red Bluff prospect (Pl. 1) in 1950, and R. J. Wright (1950) and E. P. Kaiser (1951) investigated those deposits. Subsequent reports include those by Mead and Wells (1953), Wells and Rambosek (1954), Magleby and Mead (1955), Sharp (1956), and Williams (1957). Much of the information about the stratigraphy and uranium deposits of the Dripping Spring Quartzite is presented by Granger and Raup (1956, 1959, 1964, 1969a, 1969b). Particular acknowledgment is made here to avoid overly frequent attribution in the text.

PROCEDURES

FIELD WORK

The field work involved reconnaissance; prospect examination; and rock, stream-sediment, and water sampling. Twenty-five of the known uranium prospects and mines were examined and sampled. Grab samples of rocks in favorable zones laterally away from the deposits were taken at approximately 50-ft intervals. Rock samples of the favorable unit of the Dripping Spring Quartzite away from areas of known deposits were also collected. The objectives were (1) to discern petrologic, chemical, or radiometric distinctions useful as exploration guides; and (2) to assess the likelihood of large, low-grade deposits.

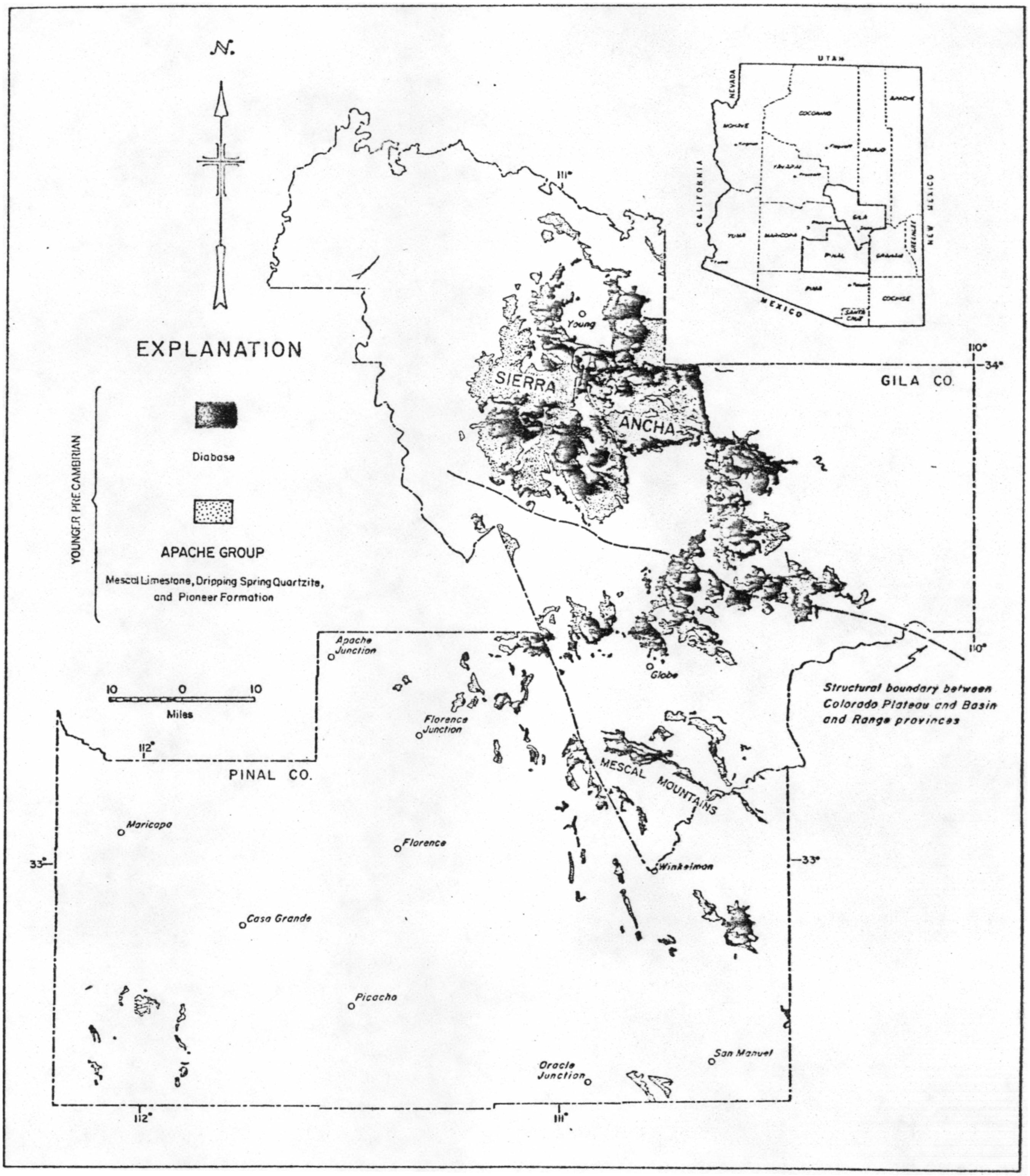


Figure 1. Location map showing exposures of diabase and Apache Group rocks, Gila and Pinal Counties, Arizona.

Samples of the diabase were collected for petrologic examination and to obtain geochemical data. Fourteen of the samples compose a suite taken vertically through a sill in Salt River Canyon (sample 15663-15677, Pl. 1).

ANALYTICAL PROCEDURES

Thin sections of selected samples of the Dripping Spring and the diabase were petrographically analyzed. Samples were analyzed by gamma-ray spectrometry for equivalent uranium, thorium, and potassium (App. A).

Twelve selected samples of the favorable unit of the Dripping Spring underwent complete semiquantitive emission spectrometric analysis. Partial emission spectrometric analyses for cobalt, chromium, molybdenum, nickel, and vanadium, and atomic absorption analyses for sodium, silver, copper, lead, and zinc were performed on selected samples. Most of the samples of the Apache Group were analyzed chemically for total carbon, organic carbon, and sulfate.

GEOLOGY

STRATIGRAPHY

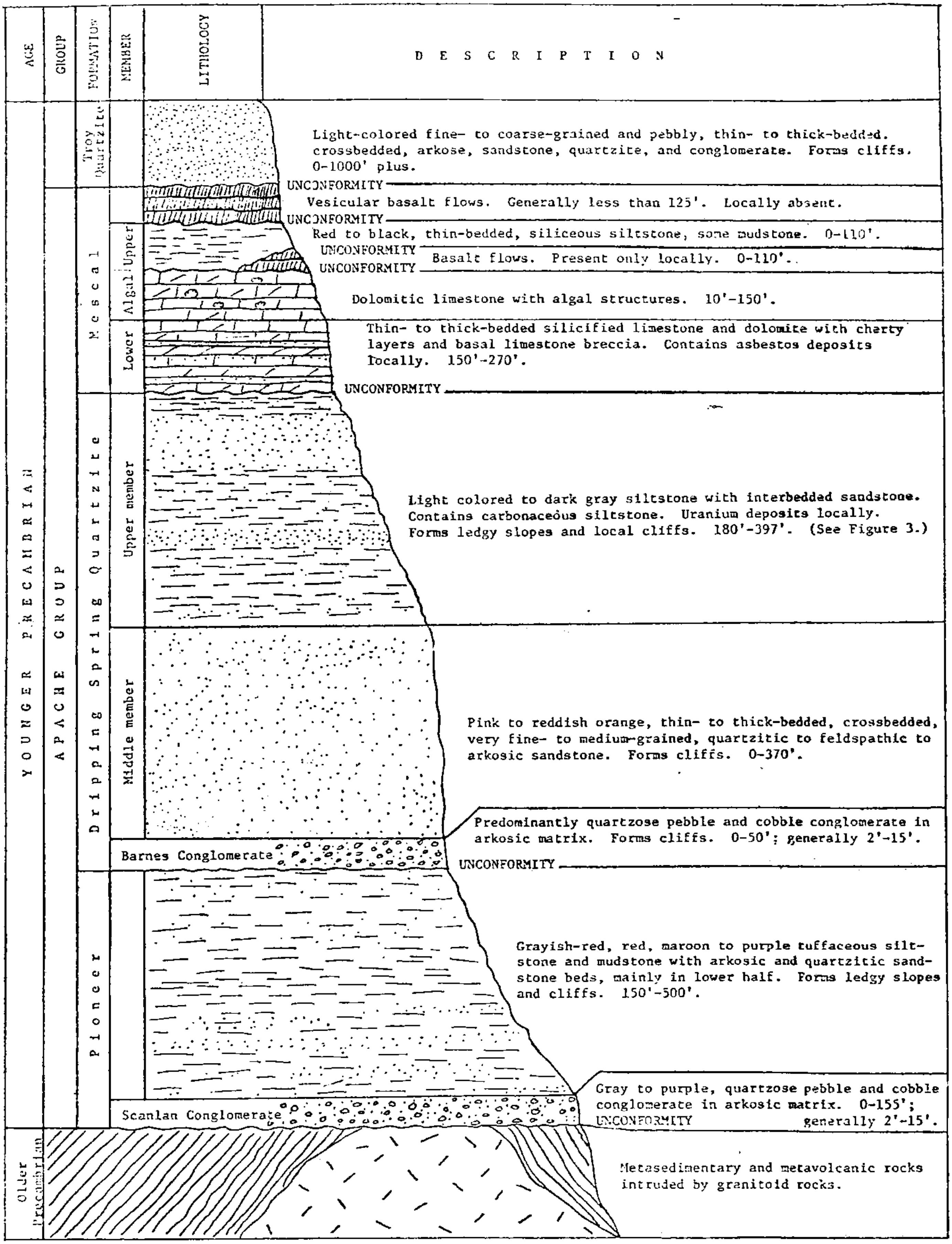
The younger Precambrian Apache Group lies unconformably on older Precambrian rocks and is overlain unconformably by late Precambrian Troy Quartzite. The Apache Group includes the Pioneer Formation, with its basal Scanlan Conglomerate Member, the Dripping Spring Quartzite, the Mescal Limestone, and basalt. Descriptions, thickness, and distinguishing characteristics of the stratigraphic units in the Apache Group are presented in Figures 2 and 3.

The Dripping Spring Quartzite consists of the basal Barnes Conglomerate Member, the middle member, and the upper member. The upper member is divided into the red, gray, buff, and white units.

The Gray Unit

The gray unit of the upper member of the Dripping Spring is predominantly a potassium-rich, carbonaceous siltstone interbedded with minor sandstone beds. The sediments of this unit (and those of the red unit and the lower part of the buff unit) were deposited on vast tidal flats that were periodically inundated by shallow seas. Organic carbon is present. The high potassium content is due mainly to the high feldspar content. Feldspar composes more that 60 percent of the rock in places. The gray unit consists, in ascending stratigraphic order, of the gray facies, the gray sandstone and barren quartzite, and the black facies (Fig. 3).

The gray facies is composed of medium- to light-gray, laminated to very thin bedded, moderately to well indurated, carbonaceous, feldspathic to arkosic and tuffaceous(?) siltstone and local, very fine grained sandstone layers. The cement is predominantly siliceous and generally has a



Light-colored fine- to coarse-grained and pebbly, thin- to thick-bedded. crossbedded, arkose, sandstone, quartzite, and conglomerate. Forms cliffs. 0-1000' plus.

Vesicular basalt flows. Generally less than 125'. Locally absent.

Red to black, thin-bedded, siliceous siltstone, some mudstone. 0-110'.

Basalt flows. Present only locally. 0-110'.

Dolomitic limestone with algal structures. 10'-150'.

Thin- to thick-bedded silicified limestone and dolomite with cherty layers and basal limestone breccia. Contains asbestos deposits locally. 150'-270'.

Light colored to dark gray siltstone with interbedded sandstone. Contains carbonaceous siltstone. Uranium deposits locally. Forms ledgy slopes and local cliffs. 180'-397'. (See Figure 3.)

Pink to reddish orange, thin- to thick-bedded, crossbedded, very fine- to medium-grained, quartzitic to feldspathic to arkosic sandstone. Forms cliffs. 0-370'.

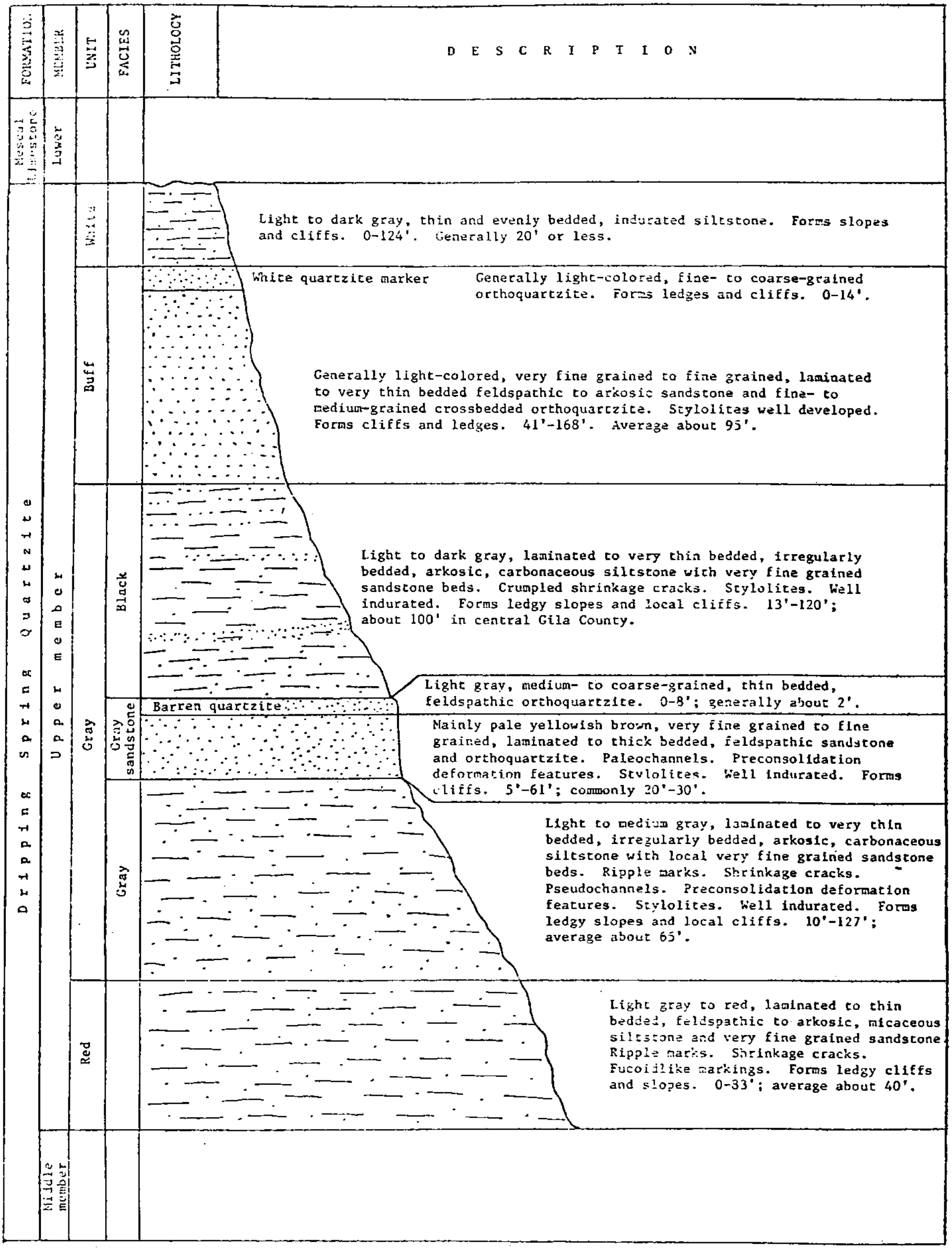
Predominantly quartzose pebble and cobble conglomerate in arkosic matrix. Forms cliffs. 0-50'; generally 2'-15'.

Grayish-red, red, maroon to purple tuffaceous siltstone and mudstone with arkosic and quartzitic sandstone beds, mainly in lower half. Forms ledgy slopes and cliffs. 150'-500'.

Gray to purple, quartzose pebble and cobble conglomerate in arkosic matrix. 0-155'; generally 2'-15'.

Metasedimentary and metavolcanic rocks intruded by granitoid rocks.

Figure 2. Generalized stratigraphic column of the Apache Group in Gila and Pinal Counties, Arizona (after Granger and Raup, 1964; Shride, 1967).



Light to dark gray, thin and evenly bedded, indurated siltstone. Forms slopes and cliffs. 0-124'. Generally 20' or less.

Generally light-colored, fine- to coarse-grained orthoquartzite. Forms ledges and cliffs. 0-14'.

Generally light-colored, very fine grained to fine grained, laminated to very thin bedded feldspathic to arkosic sandstone and fine- to medium-grained crossbedded orthoquartzite. Stylolites well developed. Forms cliffs and ledges. 41'-168'. Average about 95'.

Light to dark gray, laminated to very thin bedded, irregularly bedded, arkosic, carbonaceous siltstone with very fine grained sandstone beds. Crumpled shrinkage cracks. Stylolites. Well indurated. Forms ledgy slopes and local cliffs. 13'-120'; about 100' in central Gila County.

Light gray, medium- to coarse-grained, thin bedded, feldspathic orthoquartzite. 0-8'; generally about 2'.

Mainly pale yellowish brown, very fine grained to fine grained, laminated to thick bedded, feldspathic sandstone and orthoquartzite. Paleochannels. Preconsolidation deformation features. Stylolites. Well indurated. Forms cliffs. 5'-61'; commonly 20'-30'.

Light to medium gray, laminated to very thin bedded, irregularly bedded, arkosic, carbonaceous siltstone with local very fine grained sandstone beds. Ripple marks. Shrinkage cracks. Pseudochannels. Preconsolidation deformation features. Stylolites. Well indurated. Forms ledgy slopes and local cliffs. 10'-127'; average about 65'.

Light gray to red, laminated to thin bedded, feldspathic to arkosic, micaceous siltstone and very fine grained sandstone. Ripple marks. Shrinkage cracks. Fucoidlike markings. Forms ledgy cliffs and slopes. 0-33'; average about 40'.

Figure 3. Generalized stratigraphic column of the upper member of the Dripping Spring Quartzite, Gila County, Arizona (after Granger and Raup, 1964).

cherty appearance in this section. Total carbon content (predominantly organic) ranges from about 0.02 to 0.56 percent and averages about 0.11 percent (Table 1). The gray facies is distinguished by its gray color, thin irregular bedding, steep ledgy slopes, and, locally, cigar-shaped pseudochannels. Thickness of the unit ranges from about 10 to 127 ft and averages about 65 ft.

The gray sandstone consists of very fine grained to medium-grained feldspathic sandstone and orthoquartzite. Distinguishing characteristics are preconsolidation deformation structures near the base with topographic expression as cliffs and ledgy cliffs. The gray sandstone generally ranges from 15 to 35 ft thick in Gila County and is commonly 20 to 30 ft thick.

A thin, medium- to coarse-grained quartzite bed (termed the "barren quartzite" by Granger and Raup, 1964) caps the gray sandstone in many areas. It is rarely more than 2 ft thick. Uranium deposits immediately above and below the barren quartzite generally end against it or are interrupted by it.

The black facies is composed of light-gray to dark-gray, laminated to very thin bedded, indurated carbonaceous, siliceous, feldspathic to arkosic, tuffaceous siltstone with some sandstone layers. Carbon content (predominantly organic) ranges from about 0.08 to 2.20 percent and averages about 0.64 percent (Table 1), the highest average carbon content of any unit in the Apache Group. The thickness of the black facies ranges from 10 to 127 ft and averages about 65 ft in Gila County.

STRUCTURE

Regional

The project area lies within the Mexican Highland and Sonoran Desert sections of the Basin and Range Province. Structurally, the Sierra Ancha and Salt River Canyon areas resemble the Colorado Plateau. The plateau's present southern physiographic boundary is the Mogollon Rim, a south- and southwestward-facing erosional escarpment (Fig. 1 and Pl. 1).

Monoclines

The five monoclines known to affect the Apache Group lie in north-central Gila County (Pl. 1) and trend approximately northward. All have been intruded by diabase and have influenced its emplacement. Four monoclines are downwarped to the east; one (the Cherry Creek monocline) is downwarped to the west. Displacements range between about one hundred and several hundred feet.

Faults

Prediabase and syndiabase faults are mainly high-angle normal faults and are predominant in the Sierra Ancha-Salt River Canyon region.

TABLE 1. Equivalent uranium, thorium, and potassium, and carbon contents of selected Apache Group units

Rock Unit	Location	Equivalent Uranium (ppm)		Equivalent Thorium (ppm)		Equivalent Potassium (percent)		Total Carbon (percent)		Number of Samples Analyzed	
		Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	U, Th, & K	C
Pioneer Formation	Bull Canyon Road	2.4 - 2.6	2.5	8.4-13.6	11.0	3.04- 6.02	4.53	0.082-0.196	0.139	2	2
Dripping Spring Quartzite											
Barnes Conglomerate member	Gila & Pinal Counties	0.5 - 4.5	1.8	3.4-14.0	6.3	0.55- 4.00	2.25	--	0.041	19	1
Middle member	Gila County	0.3 - 3.6	2.3	0.8- 6.9	3.4	1.00- 7.30	4.37	--	0.106	4	1
Upper member											
Gray unit	Away from known uranium deposits	1.2 - 6.9	3.9	2.5-18.8	8.8	1.92- 9.83	7.24	--	--	14	--
Gray facies	Near known uranium deposits (excluding veins)	1.3 -68.8	22.3	3.6-18.3	12.5	6.21-10.89	9.20	0.016-0.560	0.110	24	36
Black facies	Near known uranium deposits (excluding veins)	3.6-101.7	25.2	4.7-22.2	10.6	5.14-11.66	8.83	0.082-2.196	0.643	46	53
Mescal Limestone											
Siltstone member	Asbestos Spring Pendleton Mesa Red Bluff bench	2.1 - 8.1	3.6	4.2-10.8	8.5	7.77-10.59	9.38	--	--	4	--

Most of them trend northward, some trend eastward, and a few trend randomly. Some of the faults influenced diabase emplacement and may have served as channelways for uraniferous solutions.

Shattered zones are locally present parallel to bedding planes in moderately dipping beds. They may represent slight differential movement associated with folding.

Joints and Fissures

Pre-uranium-mineralization joints and fissures are characteristically irregular and steeply dipping. Two sets of joints constitute the major joint system in the Sierra Ancha region. Their average trends are N. 17° E. and N. 77° W.

Most joints in the project area are planar joints of relatively constant dip and strike. They are generally much shorter in vertical and horizontal dimensions than the irregular joints. The planar joints generally cut the uranium deposits and are younger than the deposits.

DIABASE

Diabase sills and interconnecting feeder dikes have intruded all of the younger Precambrian formations in the project area. The sills are areally large and vary between a few tens of feet and almost 1,000 ft in thickness. The sills are generally concordant but have discordant contacts locally.

The dikes compose only a small part of the diabase. They rarely exceed 200 ft in width and are generally much narrower.

Evidence for forceful intrusion, such as shattering of enclosing rocks, is lacking. The magma probably welled up along faults, invaded the sedimentary rocks along planes of weakness, and caused their passive inflation. There were probably multiple intrusions of the diabase (Nehru and Prinz, 1970).

The diabase is a medium- to dark-gray, medium- to coarse-grained basaltic rock consisting mainly of plagioclase, augite, and olivine. Accessory minerals include apatite, ilmenite-magnetite, biotite, sphene, and zircon.

Alteration is common and varies from slight to intense. Alteration products include kaolinite-sericite and prehnite from plagioclase; hornblende, biotite, serpentine-chlorite, tremolite-actinolite, and epidote from augite; and serpentine-chlorite, and biotite-bowlingite from olivine.

Differentiation facies are present in places. Albite-rich syenite layers, where found, generally lie at or near the tops of sills. Narrow syenite dikes locally intrude sedimentary rocks. Narrow aplite dikes and thin aplite sills are sparse to abundant, mainly in association with the Sierra Ancha sheet. The aplite dikes intrude diabase, sedimentary rocks, and hornfels. The sills generally lie between the diabase and the Dripping Spring and commonly consist of aplite-cemented hornfels breccia. Very narrow, subparallel to randomly oriented black deuteric veinlets, consisting mainly of hornblende, are locally abundant and are found predominantly in diabase. The deuteric veinlets contain zircon crystals with pleochroic haloes caused by radiation damage due to uranium decay.

Metamorphic effects are mainly the baking and induration of sedimentary rocks adjacent to diabase contacts. In places, hornfels was formed near the diabase. Hornfels, derived from rocks of the upper member of the Dripping Spring, is particularly evident in the Workman Creek area (Pl. 1).

Isotopic age determinations indicate that the diabase and uraninite in the uranium deposits have a comparable minimum age - somewhat more than 1 b.y. (Granger and Raup, 1969b, p. 24-25).

URANIUM DEPOSITS

PREVIOUS EXPLORATION AND MINING

Between 1950 and 1960, several hundred uranium claims were staked in the project area, and about 100 deposits were discovered. By June 1957, production had virtually stopped, and shipments totaled about 21,000 tons. The average grade was just under 0.02 percent U_3O_8. Almost 90 percent of the ore came from seven mines (after Granger and Raup, 1969b): Hope (6,300 tons), Red Bluff (2,000 tons), Suckerite (2,453 tons), Lucky Boy (2,430 tons), Lucky Stop (2,383 tons), Little Joe (1,753 tons), and Lost Dog (1,400 tons).

DESCRIPTIONS OF DEPOSITS

Vein-like Deposits

The vein-like deposits are found only in the gray unit, mainly in the black facies. The veins generally are steeply dipping, tabular deposits with irregular dip and strike.

Most of the veins cannot be megascopically distinguished from barren rock. Their attitudes, dimensions, and trends, however, indicate that deposition probably took place along central joints or fissures. Some veins do follow central joints, breccia zones, or filled fissures. Veins commonly diverge from their central fractures and trend away from them.

The portions of known veins that exceed 0.10 percent U_3O_8 range in vertical dimension from a few feet to about 80 ft. Most veins are between 10 and 30 ft in vertical dimension.

The veins range in length from a few feet to about 600 ft. Most of the veins in the seven most productive prospects exceed 100 ft in length. Vein zones, consisting of discontinuous or en echelon veins, are as much as 1,200 ft long.

The veins are relatively narrow. The uranium content decreases from central zones outward, and the veins grade into barren rock. The portions of veins exceeding 0.10 percent U_3O_8 are generally a few inches to a few feet wide. Few veins are more than 5 ft wide, and many are less than 1 ft wide.

The Lucky Boy and Suckerite deposits (Pl. 1) are in shattered zones parallel to the stratification in moderately dipping beds. (The Suckerite deposits are in a xenolith that is probably not in its original position, however.) The Lucky Boy deposit is about 250 ft long, 70 ft wide, and from a few inches to several feet thick. The Suckerite deposit is about 200 ft long, 120 ft wide, and from 3 to 5 ft thick.

Blanket-like Deposits

The blanket-like deposits are roughly parallel to bedding planes. Their dimensions are not well known, but they are generally thin. Zones of anomalous radioactivity range from a few inches to a few feet thick, up to at least 300 ft long, and about 20 to 30 ft wide.

The deposits are generally low grade. Only locally are there small volumes of rock that contain more than 0.10 percent eU_3O_8.

Mineralogy

Uraninite is the principal primary uranium mineral in the veins. It is present as small, thin, fissure and cavity fillings and disseminated grains. Uraninite zones in the veins are generally less than 1 ft wide. All the known uraninite lies within 300 ft of diabase. Most of the higher-grade uraninite-bearing ore is within 100 ft of diabase. Uraninite is especially important in the uranium deposits in the hornfels derived from the metamorphism of gray unit rocks. Primary uranium minerals have not been found in the blanketlike deposits.

Metatorbernite is the most abundant secondary uranium mineral and is found in most of the deposits. It is present in fractures and on bedding planes or is disseminated.

Primary sulfide minerals associated with the uranium deposits include chalcopyrite, cubanite, galena, molybdenite, marcasite, pyrite, iron-rich sphalerite, and pyrrhotite. Well-crystallized grains of molybdenite, pyrrhotite, and uraninite are found in places.

Primary gangue minerals include ankerite, clays, calcite, chlorite, fluorite, and phlogopite. Quartz is not abundant.

Limonite is found in all the deposits. It is present as disseminated grains, veinlets, fracture coatings, coatings on other minerals, and fissure-filling material. Fractures of the north-northeast and west-northwest sets are commonly limonite-filled. Some of the limonite-filled fractures are radioactive, some are not.

ORE CONTROLS

Stratigraphic Controls

The restriction of primary uranium deposits to the gray unit is probably the result of reducing conditions induced by sulfides, carbon, or both. The gray unit contains minor but significant amounts of disseminated pyrite and carbon, most of which is organic, particularly in the black facies.

Indirect, subsidiary stratigraphic control is suggested by the relation of many veins to the barren quartzite. Some veins end against the barren quartzite or are interrupted by it. The most favorable veins are in the black facies, especially in the basal 40 ft. The next most favorable interval is in the gray facies, 20 to 30 ft below the barren quartzite. The gray sandstone and barren quartzite may have provided channelways for uraniferous solutions.

Structural Controls

The primary uranium veins were directly controlled by joints and fissures, predominantly by those of the north-northeast set and to a lesser extent by those of the west-northwest set. At least two veinlike deposits (Lucky Boy and Suckerite) were controlled by shattered zones parallel to the stratification in moderately dipping beds. Joints, fissures, and shattered zones evidently served as channelways for solutions and as depositional sites for uranium minerals.

Most of the uranium deposits are near monoclines (Pl. 1). The relation suggests an association among joints and fissures, prediabase faults, diabase dikes, thicker diabase sills, discordant diabase contacts, and monoclinal folding.

Many deposits are associated with discordant contacts of diabase sills and with diabase dikes in faults. For example, the Red Bluff veins are near a diabase dike in a fault, and the deposits in upper Salome Creek (Cataract, Great Gain, May, Blevins Canyon, and Fairview) are near a discordant diabase contact that may represent a fault.

Control of the low-grade, blanketlike secondary uranium deposits by sedimentary structures is suggested by the association of some blanketlike deposits with paleochannels or with rocks suggestive of channel facies. It is also suggested by the association of some deposits with the middle member-upper member contact. The Blevins Canyon deposit is in a paleochannel cut into the top of the middle member, and the Cataract deposit is in what may be thin channel-fill lenses. The paleochannels and upper contact of the middle member may have provided conduits for uranium-bearing solutions. The lack of primary mineralization in the blaket-like deposits suggests mobilization and redistribution of uranium.

Association with Diabase

Most of the uranium deposits are near discordant diabase contacts. All of the veins with uraninite are within about 300 ft of diabase or its projected contacts. The better uraninite-bearing veins are within 100 ft of diabase.

The better deposits and areas of most abundant deposits are associated with thicker diabase sills. Most of the deposits are associated with the Sierra Ancha sill. No deposits of significant size or grade are associated with thin diabase sills.

There is spatial association of the veins in the Workman Creek, Cherry Creek, and Red Bluff areas with aplite dikes and black deuteric veinlets. Many of the larger, more productive veins are found in those areas. Whether or not the relationship is genetically significant is not known.

The spatial association of the uranium deposits with the diabase may reflect the source and (or) transport mechanisms. It may be that the mechanisms involved the expulsion of late-stage uranium-bearing hydrothermal solutions from the diabase (Granger and Raup, 1969b; Neuerburg and Granger, 1960). Williams (1957) invoked the remobilization of syngenetic uranium from blocks of Dripping Spring supposedly partly assimilated by diabase. The remobilization of syngenetic uranium by hydrothermal solutions that invaded the gray unit near diabase is another alternative hypothesis. It is possible that sulfur isotope studies could help resolve this problem.

EXPLORATION GUIDES

Favorable areas are characterized by the association of the gray unit with monoclines, prediabase and syndiabase faults, discordant diabase contacts, and thicker diabase sills. Deposits in shattered zones parallel to bedding planes may be associated with moderately dipping beds near discordant diabase contacts.

No petrographic distinctions were discerned between gray unit samples taken near uranium deposits and those taken away from deposits. No geochemical distinctions were discerned which would serve as exploration guides.

It is generally difficult to distinguish the deposits from barren rock megascopically. Mining was guided by radiometry. Exploration with radiometric instruments is the most efficacious propecting method.

FAVORABLE AREAS

Favorable areas are characterized by the association of the gray unit with monoclines, prediabase and syndiabase faults, discordant diabase contacts, and thicker diabase sills. Deposits in shattered zones parallel to bedding planes may also be associated with moderately dipping beds.

The central Sierra Ancha, east Cherry Creek, and Salt River Canyon areas (areas 1, 3, and 4, Fig. 4), associated with the Sierra Ancha, Cherry Creek, and Rock Canyon monoclines, and the Mescal Mountains (area 2, Fig. 4), with moderately dipping beds, are the most favorable areas for the discovery of uranium veins.

Other low-grade blanketlike deposits besides those now known may be associated with basal beds of the upper unit near the top of the middle member, especially where the beds have features suggestive of channel fill and are near discordant diabase contacts such as those west of the blanketlike deposits in the upper Salome Creek area. Areas 1, 2, and 5 (Fig. 4) are favorable areas for such deposits.

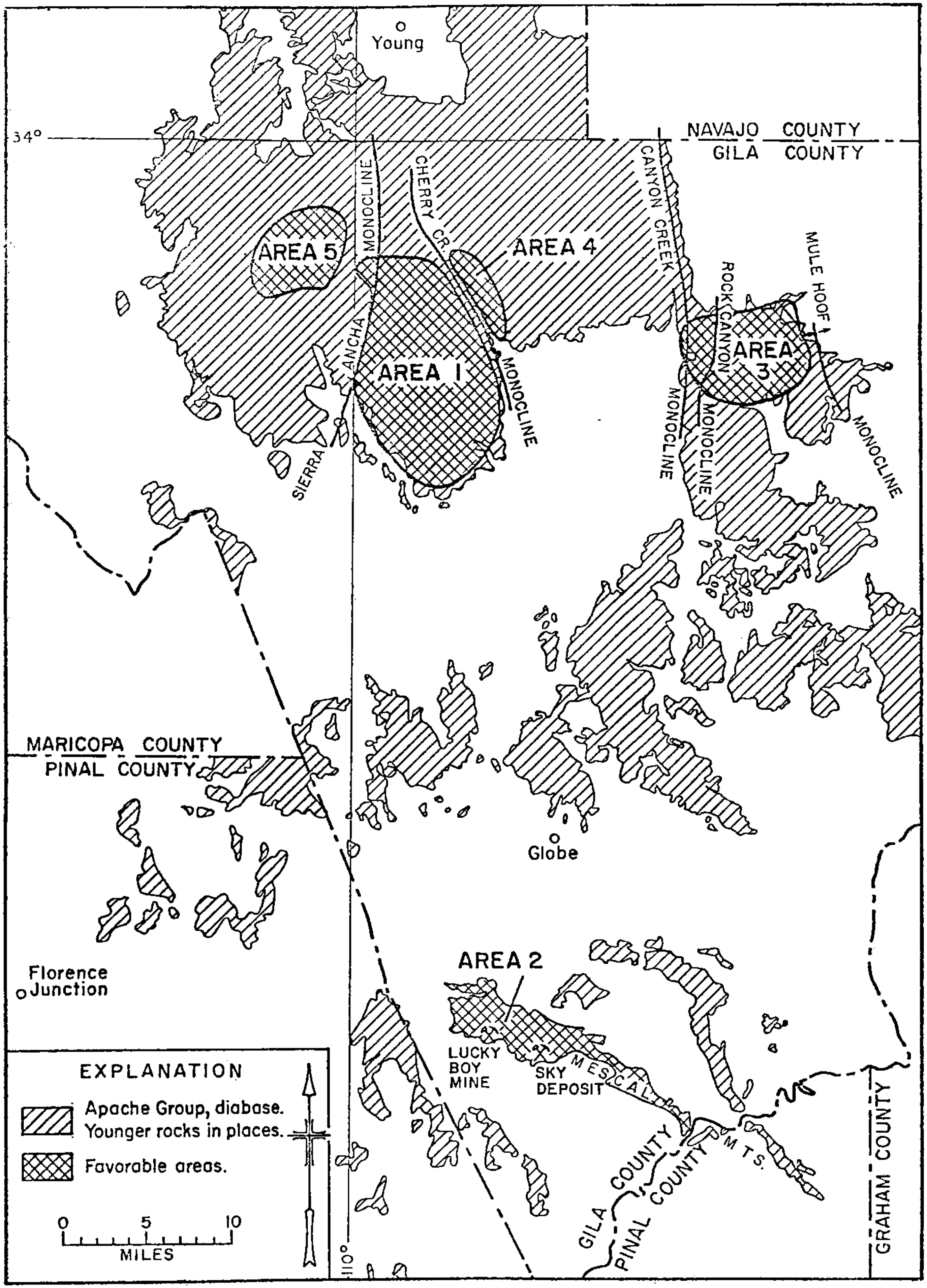


Figure 4. Map of most favorable areas, Dripping Spring Quartzite, Gila County, Arizona.

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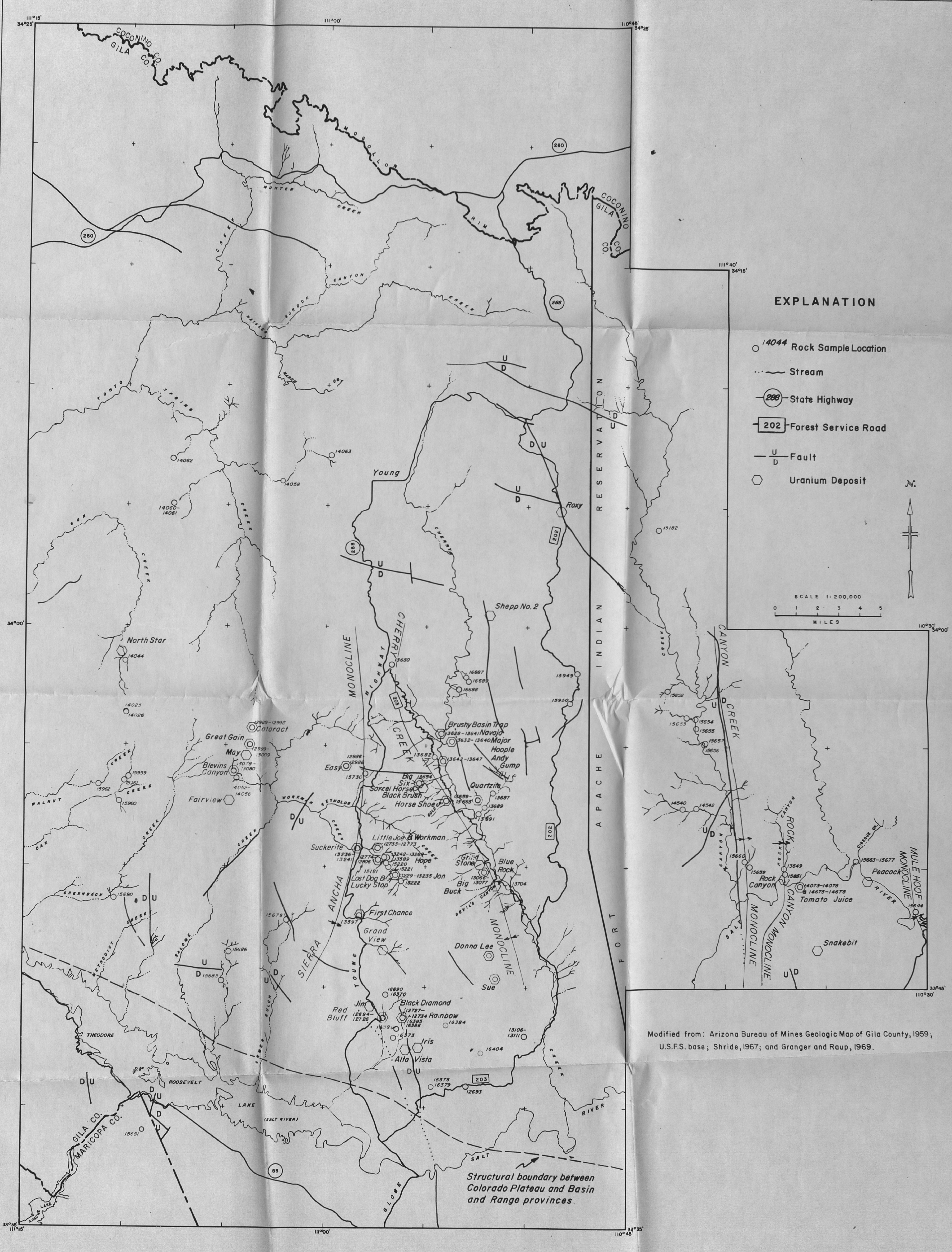
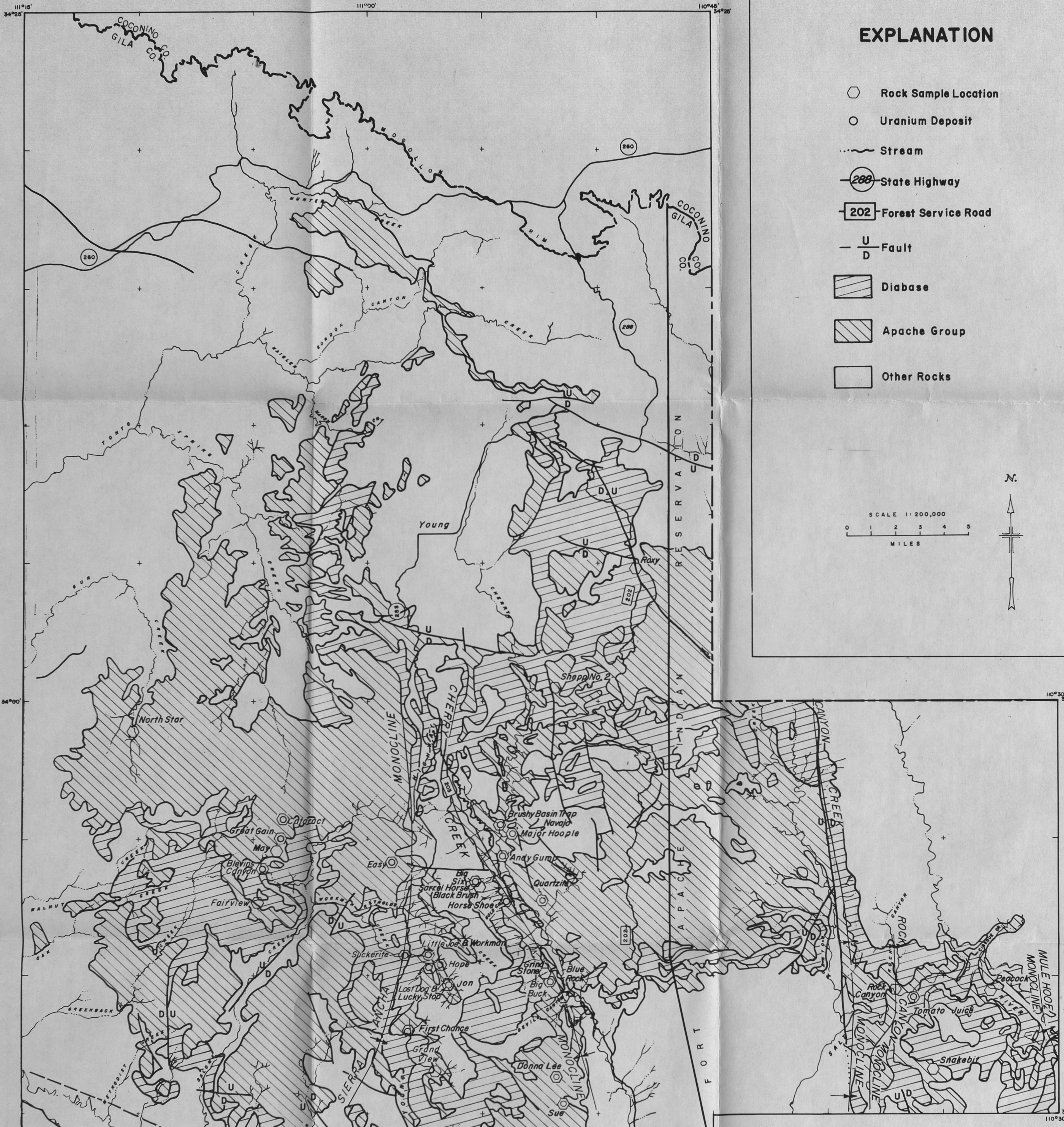


Modified from: Arizona Bureau of Mines Geologic Map of Gila County, 1959; U.S.F.S. base; Shride, 1967; and Granger and Raup, 1969.

Plate 1. Uranium deposits and rock sample localities, Sierra Ancha – Salt River Canyon region, Gila and Pinal Counties, Arizona.



Modified from: Arizona Bureau of Mines Geologic Map of Gila County, 1959; U.S.F.S. base; Shride, 1967; and Granger and Raup, 1969.

Plate 2 Generalized geologic map of the Apache Group and diabase in the Sierra Ancha – Salt River Canyon region, northern Gila County, Arizona