U.S. DEPARTMENT OF THE INTERIOR
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OPEN-FILE REPORT OF 95-263
SHEET 1 OF 1

Base from U.S. Geological Survey 1:62,000

Geology mapped mainly between 1979 and 1983 by J.C. Ratte' (1979-83) and W.E. Brooks (1980-81)

SCALE 1:48 000

1 ½ 0 1 2 3 MILES

1 .5 0 1 2 3 KILOMETERS

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

PRELIMINARY GEOLOGIC MAP OF THE BIG LUE MOUNTAINS 15-MINUTE QUADRANGLE, GREENLEE COUNTY, ARIZONA, AND CATRON AND GRANT COUNTIES, NEW MEXICO

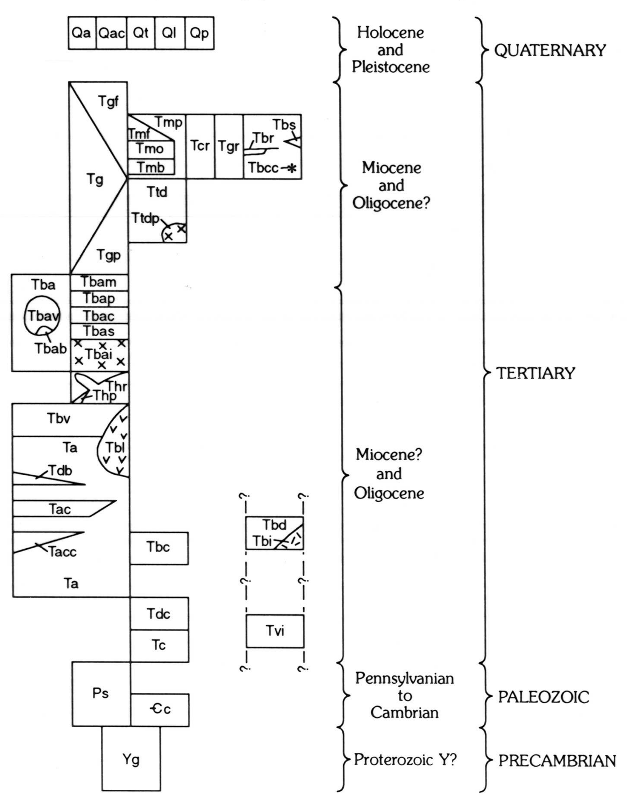
By

James C. Ratte' and William E. Brooks

1995

CORRELATION OF MAP UNITS

(See list of map symbols for identification of dikes)



LIST OF MAP UNITS

Quaternary surficial deposits

Qa — Alluvium

Qt — Terrace gravel

Qac — Alluvium and colluvium

Ql — Landslide deposits

Qp — Pediment deposits

Neogene volcaniclastic sedimentary rocks - may be highly pumiceous and may contain obsidian nodules, which are shown as "ap," Apache tears, at designated map localities, and clasts of fluidal Neogene rhyolite where derived from local rhyolite source areas.

Tg — Gila Formation, undivided

Tgf — Gila Formation, mudflow facies; mapped separately only on Pat Mountain in northwest corner of quadrangle

Tgp — Gila Formation, pumiceous facies; mapped separately only in northwest corner of quadrangle at Pat Mountain and northwest of Harden Cienega. Can be difficult to distinguish from bedded pyroclastic rocks of rhyolite dome complexes, Tmp

Miocene basalt - 17-20 Ma, where dated

Tb — Basalt flows interlayered with Gila Formation

Tbs — Basaltic scoria, cinders, and tuff layers

Tbcc — Basaltic cinder cone

Miocene rhyolite and dacite

Rhyolite of Mule Creek - ~17-18 Ma

Tmf — Lava flows

Tmp — Pyroclastic rocks; may include pyroclastic surge, pyroclastic flows, tuff, and reworked pyroclastic deposits

Tmo — Perlitic obsidian and obsidian breccia; includes nonhydrated obsidian nodules (marekanites), locally called Apache tears

Tmb — Pumiceous, brown, glassy flow and flow breccia

Rhyolite of Coal Creek - ~19 Ma

Tcr — Local vent and flow along lower Coal Creek

Rhyolite at Grassy Mountain

Tgr — Undated porphyritic rhyolite plug

Dacite of Tennessee Creek - ~22 Ma

Ttd — Domal lava flows; porphyritic dacite with plagioclase and hornblende phenocrysts

Ttdp — Probable vent for dacite flows

Partially welded tuff

Tbr — Thin, discontinuous, rhyolitic ash-flow tuff interlayered with basalt flows, Tb, and Gila Formation, Tg, in northwestern part of quadrangle

Bearwallow Mountain Andesite ~24-26 Ma

Tba — Generally fine-grained, basaltic andesite to dacitic lava flows

Tbap — Coarsely porphyritic lava flows having 1-2 cm plagioclase phenocrysts

Tbam — Lahar or mudflow deposits

Tbas — Thin volcaniclastic sedimentary rocks and andesitic tuff interlayered with andesitic lava flows

Tbac — Thin ash and cinder layers interlayered with andesitic lava flows

Tbav — Bearwallow Mountain Andesite eruptive centers. Marked by major or minor, bedded, cinder and ash deposits, as in the northeast corner of the quadrangle, south of the San Francisco River, or by tightly jointed intrusive plug rock, as on the southwest flank of Baldy Mountain

Tbab — Breccia pipe at Cold Spring Mountain eruptive center, north of Six Shooter Gap

Tbai — Coarsely porphyritic andesitic intrusive bodies. "Intrusion" along Tillie Hall Canyon in southeast corner of quadrangle has syenite pods and segregations and a syenitic cap or roof, suggesting interpretation as a possible lava lake. A K-Ar plagioclase age of 24.5±0.8 Ma supports its correlation with Bearwallow Mountain Andesite, but K-Ar dates on two of the other, similar andesitic intrusions, farther northwest, give incompatible ages of 28-30 Ma, although all intrude the rhyolite of Hells Hole

Rhyolite of Hells Hole ~27-28 Ma?

Thr — Intrusive-extrusive rhyolite and dacite; major body in southeast quarter of quadrangle is largely aphyric and low-silica (less than 72 percent silica). Other facies, mainly west of main body, are even less silicic and may have sparse small phenocrysts of plagioclase, biotite, and hornblende, which are mostly altered

Thp — Small outcrops of rhyolitic pyroclastic rocks underlie rhyolite lava flows west of Hells Hole at south edge of quadrangle

Volcanic sequence in the Big Lue Mountains ~27-28 Ma?

Tbv — Rhyolitic, dacitic, and andesitic lava flows, flow breccia, and pyroclastic rocks in the upper part of the Big Lue Mountains sequence

Ta — Fine-grained to porphyritic, and commonly amygdaloidal lava flows in the lower part of the Big Lue Mountains volcanic sequence

Tdb — Dacitic to rhyolitic lava flows and possible intrusive rocks interlayered with or intruding andesite flows in lower part of Big Lue Mountains volcanic sequence

Tac — Coarsely porphyritic andesite lava flows at or near base of Big Lue Mountains volcanic sequence

Tbl — Eruptive complex near the head of Limestone Gulch includes a cinder cone remnant, domal vent, agglomerate, pyroclastic rocks, and andesitic to dacitic lava flows

Tacc — Andesitic cinder cone remnant east of Limestone Gulch

Volcanic complex of Bird Canyon ~27-28 Ma?

Tbd — Domal accumulation of dacitic to andesitic lava flows, flow breccia, and minor pyroclastic rocks

Tbi — Dacitic intrusive? rocks south of Pat Mountain in northwest corner of quadrangle

Volcanic complex of Indian Creek

Tvi — Andesitic to rhyolitic complex is exposed only in or adjacent to the northern part of the Dix Creek horst, north of the San Francisco River. Includes hornblende-bearing andesitic or dacitic lava flows, two near-vent accumulations of scoriaceous cinders and bombs, and a small rhyolitic plug or other intrusion at river level along the San Francisco River. The age and geologic relationships of these units are uncertain. A thin, discontinuous ignimbrite layer, 0-5 meters thick, seems to be interlayered with, or possibly overlies, the scoriaceous rocks; it contains euhedral hornblende and sphene phenocrysts, as well as quartz and sanidine, and thus resembles 28-Ma Bloodgood Canyon Tuff, except for the hornblende crystals, which could be exotic

Bloodgood Canyon Tuff 28 Ma

Tbc — Rhyolite ash-flow tuff. Moderately phenocryst-rich distal portion of outflow sheet from Bursum caldera in Mogollon Mountains about 25-30 km east of the Big Lue Mountains quadrangle. Interlayered with amygdaloidal andesite in the lower part of the Big Lue Mountains volcanic sequence

Davis Canyon Tuff 29 Ma

Tdc — Rhyolite ash-flow tuff. Phenocryst-poor distal outflow sheet from suspected caldera source in Mogollon Mountains in New Mexico

Cooney Tuff ~34 Ma

Tc — Rhyolitic to dacitic ash-flow tuff tentatively correlated with part of the Cooney Tuff in the western part of the Mogollon Mountains, where it may have an origin in a source caldera

Paleozoic sedimentary rocks

Ps — Paleozoic sedimentary rocks, undivided. Includes Cambrian to Carboniferous rocks exposed only in the southwestern corner of the quadrangle and along and west of Limestone Gulch near the western border of the quadrangle

Ꞓc — Coronado sandstone mapped separately in most places in southwest corner of quadrangle

Precambrian granite

Yg — Red, somewhat gneissic granite in southwest corner of quadrangle

Geologic contact

Fault, showing dip where known. Dashed where approximately located or inferred; dotted where concealed. Bar and ball on downthrown side. Strike and plunge of slickensides indicate oblique movement. Solid triangles indicate trace of fault marked by breccia and (or) gouge

Strike and dip of bedded rocks

Horizontal or less than 5°

Inclined

Apparent strike and dip

Strike and dip of flow structure in lava flows or compaction foliation in tuffs

Inclined

Vertical

Form lines showing local trace of bedding, flow layering, or flow boundaries

Local volcaniclastic sandstone beds or scoriaceous cinders and tuff

Vitrophyre layer in rhyolite of Hells Hole

Volcanic vent, plug, cinder cone, or other evidence of a volcanic eruptive center; queried where uncertain

Altered rocks that might be related to mineralization

Prospect pit(s)

Quartz and (or) calcite vein(s)

Sample locality

Nos. 1-29, radiometric age samples

Dikes

Miocene basalt dikes

Silicic dikes

Biotite porphyry dikes

Andesitic dikes

Andesitic dike occupying fault

Cinder dike

Pebble dike with Precambrian rock clasts

Cinders and bombs

Obsidian nodules (Apache tears) in volcaniclastic rocks

Approximate location of geothermal, G, and other springs, S, along the San Francisco River (Witcher, 1979; Ratté, Hassemer, Martin, and Briggs, 1982)

NOTEWORTHY GEOLOGIC FEATURES

1. Location of the Big Lue Mountains quadrangle near the junction of major northeast- and northwest-trending regional structures. Major northeast-trending structures include the Morenci lineament (Mayo, 1958; Chapin and others, 1978) and the Morenci-Reserve fault zone (Ratté, 1989, figs. 1 and 3; Futa and Ratté, 1989). Major northwest-trending structures are the Laramide Burro uplift (Elston, 1958) and associated northwest-trending faults that control the southwest escarpment of the Big Lue Mountains and the northwest trend of the Gila River valley to the southeast (Drewes and others, 1985; Ratté and Hedlund, 1982; Jones and others, 1967, fig. 40).

2. Pre-Tertiary rocks, including Precambrian gneissic granite and Paleozoic sedimentary rocks, are exposed locally and are overlapped by Tertiary volcanic rocks in the southwest corner of the quadrangle. This relationship is permissive for the possible extension, or other occurrences, of Laramide-age silicic porphyry intrusions such as host the world-class porphyry copper deposits in the adjacent Morenci-Metcalf mining district (Lindgren, 1905).

3. Traces of gold, silver, and copper that occur within the quadrangle are apparently confined to quartz and calcite veins along the Dix Creek and Limestone Gulch faults (Ratté, 1982; Ratté, Hassemer, Martin, and Lane, 1982; Ratté and others, 1994) and small veins in the pre-Tertiary rocks near Red Hill.

4. Other commodities of possible commercial interest in the quadrangle are pumice and perlite associated with the eruptive centers of the rhyolite of Mule Creek in the northeastern part of the quadrangle, and geothermal springs along the San Francisco River proximal to the Dix Creek fault (Witcher, 1979; Ratté, Hassemer, Martin, and Briggs, 1982; Ratté, Hassemer, Martin, and Lane, 1982).

5. Volcanic activity in the Big Lue Mountains quadrangle was concentrated mainly in two periods: (1) between about 28 Ma, the age of the Bloodgood Canyon Tuff, and 24 Ma, the approximate age of the youngest Bearwallow Mountain Andesite activity; (2) between about 21 Ma and 17 Ma, the range in age of the bimodal association of basalt and rhyolite interlayered with the Gila Formation volcaniclastic rocks. These Miocene age rhyolites are present mainly in the eastern part of the quadrangle, whereas the basalts are confined to the northern half.

6. The southern half of the quadrangle is dominated by the rhyolite intrusive-extrusive volcanic complex of the rhyolite of Hells Hole (Ratté and Hedlund, 1982). The rhyolite consists of several facies that range in composition from low-silica rhyolite, about 72 percent SiO_2, to dacite, and from nearly aphyric to weakly porphyritic, with a few percent phenocrysts, mainly plagioclase and biotite, and less common hornblende. The facies were not separated in mapping, but the extensive dome-flow complex, mainly east of Arizona Highway 78, is essentially aphyric, whereas the scattered bodies to the west of the main body are of mixed composition and texture. These scattered bodies, which include the White Peaks plugs and the Chalk Peak dike, probably represent a separate eruptive and intrusive center. This interpretation is supported by the concentration of both silicic and intermediate to mafic composition dikes and coarsely porphyritic mafic plutons, Tbai, in the Rattlesnake, Buzzard's Roost, Rustler's Canyon, and Black Jack Canyon drainages. Although the dike pattern has strong northwest and northeast trends, which probably reflect the inherited regional structural trends, the pattern is here interpreted as an essentially radial pattern related to a composite, silicic to mafic, volcanic center.

7. Numerous other intrusive and extrusive eruptive centers are scattered throughout the quadrangle, including partially exhumed cinder cones, plugs, and dikes associated with the Bearwallow Mountain Andesite and the Miocene basalt. Coalescing tuff rings and lava flow domes of the Miocene rhyolite are concentrated in the northeast part of the quadrangle.

8. Geophysical surveys, not presented here, show the magnetic and gravity expression of some of the volcanic centers, as well as the dominant northeasterly and northwest structural trends in the Big Lue Mountains quadrangle and adjoining areas (U.S. Geological Survey, 1972; Martin, 1981, 1982).

BIG LUE MOUNTAINS AGE SAMPLES

[Numbers in parentheses refer to entry numbers, sample descriptions and analytical data in Marvin and others, 1987. Ages determined by fission-track (FT) or conventional potassium-argon methods (K-Ar)]

BASALT INTERLAYERED IN GILA FORMATION

Map no.

1 BL-241-82 (198)
17.7±0.6 Ma (K-Ar, whole-rock)

2 BL-253B-81 (38)
19.0±1.2 Ma (K-Ar, whole-rock)

3 BL-204A-82 (39)
19.1±1.1 Ma (K-Ar, whole-rock)

RHYOLITE AND DACITE INTERLAYERED IN GILA FORMATION

4 BL-2-77 (36)
17.7±0.6 (K-Ar, glass)

5 BL-202-82 (35)
18.3±0.7 (K-Ar, glass)

6 BL-209-81 (37)
19.0±0.7 Ma (K-Ar, whole-rock)

7 BL-59-83 (195)
21.3±1.8 Ma (K-Ar, plagioclase)

8 BL-88-79 (33)
21.8±1.4 Ma (K-Ar, hornblende)

BEARWALLOW MOUNTAIN ANDESITE

9 MC-27-79 (43) [location in Mule Creek quadrangle]
24.5±0.8 Ma (K-Ar, plagioclase)

10 BL-375-81 (31)
25.0±0.9 Ma (K-Ar, plagioclase)

11 BL-389-81 (32)
26.2±1.0 Ma (K-Ar plagioclase)

12 BL-95-82 (30)
29.5±1.1 Ma (K-Ar, upgraded plagioclase)
28.7±1.1 Ma (K-Ar, plagioclase)

13 BL-292-82 (196) Dacite vitrophyre plug(?), satellitic to Cold Spring Mountain volcanic center
24.2±0.9 (K-Ar, whole-rock)

VOLCANIC ROCKS OF INDIAN CREEK

14 BL-55-80 (16)
33.0±4.8 Ma (FT, zircon)

VOLCANIC ROCKS OF BIRD CANYON

15 BL-321-81 (26)
27.8±1.6 Ma (K-Ar, plagioclase)

16 BL-333-81 (28)
28.0±1.0 Ma (K-Ar, biotite)

17 BL-322-81 (27)
30.4±1.1 Ma (K-Ar, biotite)
25.7±1.6 Ma (K-Ar, plagioclase)

VOLCANIC ROCKS OF BIG LUE MOUNTAINS VOLCANIC SEQUENCE

Rhyolite and dacite

18 BL-90B-83 (197)
27.2±1.0 Ma (K-Ar, hornblende)
20.1±1.1 Ma (K-Ar, plagioclase)

19 BL-392-81 (23)
27.5±1.0 Ma (K-Ar, whole-rock)

20 BL-148a-79 (24)
27.6±5.5 Ma (FT, zircon)

21 BL-130-83 (211)
28.1±1.0 Ma (K-Ar, biotite)
24.1±1.3 Ma (K-Ar, plagioclase)

Andesite

22 BL-271-82 (199)
27.5±1.0 Ma (K-Ar, whole-rock)

23 BL-64-82 (17)
27.9±1.0 Ma (K-Ar, whole-rock)

RHYOLITE OF HELLS HOLE

24 BL-48-82 (19)
27.1±1.0 (K-Ar, biotite)
32.9±1.2 (K-Ar, plagioclase)

25 BL-85-79 (18)
28.4±1.0 Ma (K-Ar, plagioclase)

26 BL-47-81 (22)
28.4±1.0 Ma (K-Ar, biotite)
26.1±3.2 Ma (FT, zircon)
20.7±6.0 Ma (FT, apatite)

27 BL-11-81 (21)
28.6±1.0 Ma (K-Ar, biotite)
25.5±2.6 Ma (FT, zircon)

28 BL-117-81 (20)
28.7±3.7 Ma (FT, zircon)

29 BL-117-82 (201)
29.5±0.9 Ma (K-Ar, hornblende)

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