



Note: The relative ages of units in the vertical columns are firmly established, whereas those of the implied relative ages for units of different columns are not well established. See descriptions of map units for known stratigraphic relations.

DESCRIPTION OF MAP UNITS

- a1 ALLUVIUM Includes coarse alluvial fan deposits, stream deposits of gravel, sand, and silt, wind-blown sand, and deposits of silt and clay in closed depressions.
- fp r RHYOLITE OF THE COSO GEOTHERMAL FIELD. Thirty-seven separate extrusions of sparsely porphyritic rhyolite (r) and associated pyroclastic deposits (rp). Rhyolite forms steep-sided, 40 to 300 metre-high domes, several of which are overlain by thin to thick tephra flows about 10 to 100 metres thick. Flow and dome are covered by blocks outcrops to airtight caprocks through which flow and systems of oxidized pyroclastic locally; rhyolite contains no more than 2 percent and generally less than 1 percent phenocrysts; all less than 1 mm long; none of the phenocrysts contains olivine, clinopyroxene, Fe-Ti oxides, biotite, hornblende, clinopyroxene and orthopyroxene present in each dome; pyroclastic deposits of coarse and medium sand together with fragments of Mesozoic basement rocks from explosion rings around some domes and a matrix over the ground in the dome region. The rhyolite carries scattered basaltic xenoliths and rare fragments of Mesozoic igneous rocks; domes and Pleistocene basalt flows overlain extensively in some areas; Pleistocene basaltic and andesitic dikes are abundant in the dome region. The rhyolite is overlain by Pleistocene and Pliocene basalt flows in the vicinity of Volcano Peak (see the following section); (1) eruption of basalt of base valley (bvp) or eruption of a rhyolite dome, (2) eruption of basalt of Volcano Peak (bvp); K/Ar ages of domes range from 0.56 ± 0.19 to 0.41 ± 0.20 m.y. (Lanphere and others, 1975).
- bvp bvp BASALT OF VOLCANO PEAK. Flow (bvp), cinder-bomb cone (bvp), and adjacent cinder-mantle (bvp) of porphyritic, vesicular basalt; contains 1 percent of 0.2-1 mm olivine, 3 percent of 0.1-1 mm plagioclase with rare opaque inclusions, 10 percent of 0.1-1 mm plagioclase, and rare 0.5 mm elongated quartz in a granular groundmass of olivine, clinopyroxene, orthopyroxene and plagioclase; olivine, clinopyroxene, and plagioclase phenocrysts commonly intergrown in clasts; overlies units bwp, bcr, bbr, and bsv; as flow surface and flow channels well preserved; flow followed present stream valleys; K/Ar age 0.038 ± 0.032 m.y. (Lanphere and others, 1975); estimated thickness of flow 2-6 metres.
- bvp bvp BASALT SOUTH OF VOLCANO PEAK. Flow (bvp), two cinder-bomb cones (bvp) and adjacent cinder-mantle (bvp) of porphyritic, vesicular basalt; flow was fed from vent marked by the cone 2.6 km south of Volcano Peak; relation of the second cone to this flow not known; contains 3 percent of 0.1-1 mm olivine, 2 percent of 0.1-1 mm plagioclase with rare opaque inclusions, and 15 percent of 0.1-1 mm plagioclase with olivine inclusions; in a granular groundmass of olivine, clinopyroxene, orthopyroxene, and plagioclase; overlies units bwp, bcr, bbr, and bsv; as flow surface and flow channels well preserved; flow followed present stream valleys; K/Ar age 0.038 ± 0.032 m.y. (Lanphere and others, 1975); estimated thickness of flow 2-6 metres.
- bcr bcr BASALT OF CINDER RIDGE. Small cinder cones (bcr), adjacent cinder-mantle (bcr), and at least two flow (bcr) of porphyritic, vesicular basalt; contains about 2 percent of 0.2 mm and smaller olivine, 2 percent of 0.1-0.8 mm pale yellow olivine units bwp, bbr, and bsv, and is overlain by units bvp, and bsv; such or all of youngest flow appears to have been issued from neck situated at the base of cinder cones; youngest flow contains relatively rare plagioclase and less olivine phenocrysts than underlying flows; as flow surface and flow channels well preserved; magnetic polarity normal; thickness ranges, from 7 to at least 25 metres.
- bwp bwp BASALT WEST OF AIRPORT LAKE. Flow (bwp), cinder cone (bwp), and adjacent cinder-mantle (bwp) of porphyritic, vesicular basalt; contains 1 percent of 0.1-0.8 mm opaque (titanoaugite), 2 percent of 0.1-0.8 mm olivine, and 7 percent of 0.1-0.8 mm plagioclase in a granular groundmass of olivine, clinopyroxene, orthopyroxene, and plagioclase; overlies units bwp, bcr, bbr, and bsv; as flow surface and flow channels well preserved; magnetic polarity normal; thickness ranges, from 7 to at least 25 metres.
- bwp bwp BASALT OF NEMESVILLE. Flow (bwp) and associated cinder deposits (bwp) of porphyritic, vesicular basalt; contains about 1 percent of 0.2-4 mm olivine, less than 1 percent of 0.4-6 mm clinopyroxene, 5 percent of 0.4-6 mm plagioclase, and less than 1 percent of 0.1-10 mm plagioclase in an aphanitic groundmass; flow followed present stream channel; about 3-5 metres thick.
- bp bp BASALT OF AIRPORT LAKE. Flow (bp) and cinder cone (bp) of vesicular basalt; contains 1 percent of 0.1-0.3 mm olivine, 0.5 percent of 0.1-1 mm opaque, and 3 percent of 0.1-1 mm plagioclase in a granular groundmass of olivine, orthopyroxene, and plagioclase; small amounts of Mesozoic basement rocks; overlies units bwp, c, and onf; flow channel and as surface preserved locally; flow followed present stream channel into Airport Lake; about 2 to 3 metres thick; magnetic polarity normal.
- bcw bcw BASALT OF COSO MOUNTAIN. At least three flows of porphyritic, vesicular basalt; contains 3 percent of 0.1-1 mm olivine with opaque inclusions, 1 percent of 1 mm olivine, less than 1 percent of 0.1-0.2 mm opaque, 2 percent of 0.1-1 mm plagioclase, and 10 percent of 0.1-1 mm plagioclase with opaque inclusions in a fine grained groundmass of granular olivine, orthopyroxene, clinopyroxene, and plagioclase; overlies units bwp, bcr, bbr, and bsv; as flow surface preserved locally; magnetic polarity normal; thickness ranges, from 7 to at least 25 metres.
- brh brh BASALT OF RED HILL. Flow (brh) and cinder-bomb cone (brh) of porphyritic, vesicular basalt; contains 1 percent of 0.1-1 mm olivine with opaque inclusions, less than 1 percent yellowish clinopyroxene, 2 percent of 0.1-1 mm plagioclase, and 5 percent of 0.1-1 mm plagioclase with opaque inclusions in a granular groundmass of olivine, orthopyroxene, and plagioclase; overlies units bwp, bcr, bbr, and bsv; as flow surface preserved locally; magnetic polarity normal; thickness ranges, from 7 to at least 25 metres.
- bur bur BASALT OF UPPER LITTLE LAKE BASIN. Flow (bur) and cinder cone (bur) of vesicular basalt; contains 1 percent of 0.2-1 mm olivine, 2 percent of 0.1-1 mm plagioclase in a coarse grained, subophitic groundmass of olivine, orthopyroxene, clinopyroxene, and plagioclase; overlies units bwp, bcr, bbr, and bsv; as flow surface preserved locally; magnetic polarity normal; thickness ranges, from about 5 metres to a maximum exposed thickness of 25 metres where flow ponded in Owens River channel near Little Lake.
- blr blr BASALT OF LOWER LITTLE LAKE BASIN. Cinder-bomb cone (blr) and at least two flow (blr), of porphyritic vesicular basalt; contains 1 percent of 0.1-0.4 mm opaque (titanoaugite), less than 1 percent olivine, 2 percent of 0.2-1 mm pale yellow clinopyroxene, and 10 percent of 0.1-1 mm plagioclase with opaque inclusions in a granular groundmass of olivine, orthopyroxene, and plagioclase; overlies units bwp, bcr, bbr, and bsv; as flow surface preserved locally; magnetic polarity normal; thickness ranges, from about 5 metres to a maximum exposed thickness of 25 metres where flow ponded in Owens River channel near Little Lake.
- brv brv BASALT OF ROSE VALLEY. Flow (brv) and cinder-bomb cone (brv) of porphyritic, vesicular basalt; contains 2-8 percent of 0.1-1 mm olivine, 2-4 percent of 0.2-2 mm yellowish clinopyroxene, and 0-10 percent of 0.2-2 mm plagioclase in a fine grained, granular groundmass of olivine, orthopyroxene, and plagioclase; overlies units bwp, bcr, bbr, and bsv; as flow surface preserved locally; magnetic polarity normal; thickness ranges, from about 5 metres to a maximum exposed thickness of 25 metres where flow ponded in Owens River channel near Rose Valley.
- ba BASALT OF AIRPORT LAKE. Porphyritic vesicular basalt flow; contains about 3 percent of 0.5-0.8 mm olivine, 1 percent of 0.1-1 mm plagioclase with opaque inclusions, and 10 percent of 0.1-1 mm plagioclase with olivine inclusions; overlies units bwp, bcr, bbr, and bsv; as flow surface preserved locally; magnetic polarity normal; thickness about 3 to 7 metres.
- sw SEDIMENTARY ROCKS OF THE WHITE HILLS. Includes interbedded conglomerate, sandstone, siltstone, silty claystone, and tuff, apparently grades laterally into tuffaceous sandstone, and siltstone; tuffaceous sandstone, coarse-grained arkose, and tuff are predominant on the high slopes of Haines Ridge and Tethering with finer grained rocks and lacustrine beds to the north and west; north and east of Coso Hot Springs, arkose and tuff are locally overlain by a thin layer of Pleistocene or early Pliocene, but highest exposed beds are younger than Coso Flow (see note on Haines Ridge, 1975).
- rhc RHYOLITE SOUTH OF HAINES SPRINGS. Dome or plug of flow banded, porphyritic rhyolite; contains about 1 percent quartz up to 1.5 mm and 1 percent feldspar up to 1 mm in a matrix of gray devitrified rhyolite or green hydrated and perlitic glass; bounded by normal fault on east; exposed thickness about 50 metres; age uncertain.
- dy dy YOUNGER DACITE EAST OF COSO VALLEY. Small pyroclastic deposit (dy) and thick flow (dy) of flow banded dacite; contains less than 1 percent of 0.2-2 mm quartz, 10 percent of 0.1-1 mm plagioclase, less than 1 percent of 0.1-0.2 mm brown amphibole, now mostly replaced by iron oxide, less than 1 percent of 0.1-0.5 mm orthopyroxene, rare 0.1-0.1 mm clinopyroxene, and rare 0.2 mm hornblende; contains 1 percent of 0.1-0.2 mm orthopyroxene, commonly with cores of up to 1 mm forsterite; olivine in a granular groundmass of orthopyroxene, feldspar and microcline in devitrified glass; overlies units onf and and is overlain by unit c; thickness 10 to at least 60 metres.
- anp anp ANDESITE NORTHWEST OF PETROGLYPH CANYON. Flow (anp) and associated pyroclastic deposit (anp) of porphyritic basaltic andesite; near vent area contains about 2 percent of 0.1 to 0.6 mm olivine, 2 percent of 0.1 to 0.6 mm clinopyroxene, 10 percent of 0.1 to 0.6 mm plagioclase, and rare 1 to 1.5 mm rounded quartz in a fine-grained matrix of clinopyroxene, orthopyroxene and plagioclase; thickness ranges from about 5 to 20 metres; phenocryst content and thickness decrease away from vent area; overlies units c, p, and onf; magnetic polarity normal.
- dh DACITE OF HAINES RIDGE. Flow of porphyritic dacite; contains rare 0.2 mm zircon, rare 0.1 mm apatite, rare 0.1-0.2 mm orthopyroxene, rare amphibole rare larger crystals; rare 0.1 mm clinopyroxene, 10 percent of 0.1-0.2 mm brown amphibole, 3 percent of 0.1-1 mm brown biotite with opaque and feldspar inclusions, 3 percent of 0.1-1 mm greenish brown amphibole with opaque, feldspar and biotite inclusions, and 10 percent of 0.1-0.5 mm plagioclase with inclusions of rock tuff; phenocrysts in a glassy groundmass now largely composed of feldspar and other microcline; overlies unit c; highly flow banded, columnar jointed where ponded; K/Ar age 2 m.y. (Evernden and others, 1964); average thickness about 25 metres; ponded to at least 200 metres south of Haines Reservoir.
- c COSO FORMATION (Late Pliocene or early Pleistocene). Includes conglomerate of Mesozoic basement rocks, arkose sandstone, tuffaceous sandstone and siltstone, tuffaceous sandstone, and siltstone; tuffaceous sandstone, coarse-grained arkose, and tuff are predominant on the high slopes of Haines Ridge and Tethering with finer grained rocks and lacustrine beds to the north and west; north and east of Coso Hot Springs, arkose and tuff are locally overlain by a thin layer of Pleistocene or early Pliocene, but highest exposed beds are younger than Coso Flow (see note on Haines Ridge, 1975); overlies units b and onf and is overlain by units c, p, dy, anp, and bp.
- onf OLDER MAFIC LAVAS. Predominantly flow 3 to 10 metres thick (onf) and eroded cinder cones (onf) of porphyritic vesicular basalt to basaltic andesite; phenocrysts include olivine up to 1.5 mm, plagioclase up to 4 mm, and clinopyroxene up to 2 mm, generally in an aphanitic to cryptocrystic groundmass; anorthoclase and quartz common in some flows; unit also includes minor hornblende-dacite flow as much as 30 metres thick exposed in Black Canyon and northeast of Wells Valley; maximum thickness of section not known; includes both normal and reversed magnetic polarities; K/Ar age of flow at northeast edge of lower section is 3.24 ± 0.10 m.y. (Lanphere and others, 1975); overlies units c, p, dy, anp, and bp.
- b UNDIFFERENTIATED BASEMENT ROCKS (Mesozoic). Principally granitic intrusive rocks of Mesozoic age; model compositions range from granite to quartz diorite to quartz feldspar diorite and gabbro; textures range from medium to coarse grained to porphyritic with K-feldspar crystals up to 1.5 cm; mafic inclusions common, especially in south part of map area. Mesozoic (1) dikes of silicic and intermediate to mafic compositions abundant locally.

- EXPLANATION OF SYMBOLS
- Contact, dashed where uncertain and dotted where concealed.
- Fault, dashed where uncertain and dotted where concealed or inferred; bar and ball on down-thrown side.
- Topographic crest of rim of pyroclastic debris that partly surrounds some rhyolite domes.
- Cinder cones, dotted where concealed.
- Strike and dip of stratified rocks.
- Strike and dip of flow foliation in unit dh.
- Steeply dipping dike.

Note: In addition to being broken by the mapped faults, the Mesozoic basement rocks (b) that underlie that part of the field of rhyolite domes (r) south of Coso Peak are shattered to pieces generally less than one metre in diameter, and are locally hydrothermally altered, especially immediately west of Coso Basin and south and west of Coso Hot Springs.

REFERENCES

Evernden, J. F., Savage, D. E., Curtis, G. R., and James, G. T., 1964, Potassium-argon dates and the Cenozoic mammalian chronology of North America. *Am. Jour. Sci.*, v. 262, p. 161-191.

Lanphere, M. A., Dalrymple, G. B., and Smith, R. L., 1975, K-Argon ages of Pleistocene-rhyolite volcanics in the Coso Mountains, California. *Geology*, v. 3, p. 339-341.



This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey standards and nomenclature.

PRELIMINARY GEOLOGIC MAP OF THE COSO RHYOLITE DOMES AND ADJACENT AREAS, INYO COUNTY, CALIFORNIA

By
Wendell A. Duffield and Charles R. Bacon
1976