Map Unit Properties Table: Gila Cliff Dwellings National Monument (Ratté and Gaskill 1975; scale 1:62,500)

Colored units are mapped within Gila Cliff Dwellings National Monument. Bold text refers to report sections.

Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
QUATERNARY (Holocene)	Valley alluvium and terrace gravels (Qag)	No additional description besides unit name provided by Ratté and Gaskill (1975). However, alluvium is generally unconsolidated sand and pebbles deposited within modern drainage systems. Terrace gravels are larger clasts from previous floodplains.	**Terraces and Valley Incision**—terrace levels show where the Gila River paused in its downcutting and indicate that incision was not steady. **Paleontological Resources**—terrace gravels may contain Quaternary fossils. **Geological Features with Cultural Significance**—terraces provided adequate soil development, extent, and drainage for prehistoric farming in an area of mostly narrow, steep-sided canyons.	**Fluvial Features and Processes**—alluvium lines the Gila River and its tributaries. **Qag** indicates areas of potential flooding. T J unit is located on terraces above the present floodplain. **Post-Wildfire Sedimentation and Debris Flows**—stream valleys are likely locations for post-wildfire sedimentation and debris flows. **Seismic Activity**—earthquakes have not been significant enough to cause offset in Quaternary deposits (e.g., terrace gravels). **Climate Change**—flooding frequency and magnitude may change as climate changes.	**Valley Incision and Development of Cliff Dweller Canyon**—**Qag** deposits correspond to incision and development of Cliff Dweller Canyon.
QUATERNARY (Pleistocene)	Landslide deposits (Qls)	Deposits may be older or younger than Pleistocene; no additional description provided by Ratté and Gaskill (1975). However, landslide deposits typically are composed of clasts of various sizes that traveled downslope.	None reported.	Ratté and Gaskill (1975) mapped landslide deposits (**Qls**) in the Gila Wilderness, but none in Gila Cliff Dwellings National Monument.	None reported.
QUATERNARY and TERTIARY* (Holocene?–Miocene?)	Meerschaum vein (QTv)	Exact composition and age of vein is uncertain; no additional description provided by Ratté and Gaskill (1975). ***Note***: Displayed as a linear feature in the GRI data set.		None reported.	
QUATERNARY and TERTIARY (Holocene. Pleistocene, Pliocene, and Miocene)	Sedimentary rocks (QTs)	Mainly Gila Conglomerate of Pliocene and Pleistocene age, and possibly older. Also includes pediment gravels, colluvium, and valley alluvium, and terrace gravels where they are not mapped separately. Gila Conglomerate may include some volcaniclastic deposits of Oligocene age.	**Mogollon–Datil Volcanic Field**—Gila Conglomerate serves as upper boundary of the T4 volcanic unit. The contact between Bearwallow Mountain Andesite (part of **Tya**) and Gila Conglomerate is exposed in Gila Cliff Dwellings National Monument. **Gila Hot Springs Graben**—Gila Conglomerate is basin fill in graben. **Paleontological Resources**—Gila Conglomerate has the potential to yield fossils. **Geological Features with Cultural Significance**—caves in Gila Conglomerate invited human use. Gila Conglomerate was used as building stone in cliff dwellings. Lithic resources occur in Gila Conglomerate, including small nodules of chert, agate, and chalcedony that fill fissures in the unit.	**Fluvial Features and Processes**—Gila Conglomerate is the reservoir/source of the spring and creek in Cliff Dweller Canyon. **Cave Features and Processes**—caves and other openings are characteristic features of Gila Conglomerate. The caves in Cliff Dweller Canyon formed in Gila Conglomerate. **Rockfall Hazards**—rockfall from cliff faces is an ongoing management concern. **Spalling**—flakes, slabs, and blocks of rock break away from rock faces in caves, causing loss of pictographs and damage to structures. **Seismic Activity**—earthquakes of magnitude 5.5 or greater may cause rockfall from cliffs of Gila Conglomerate. **Geothermal Development**—Gila Conglomerate confines Bloodgood Canyon Rhyolite Tuff (**Tbc**) that serves as a geothermal reservoir.	**Basin and Range Faulting and Basin Filling**—concurrent with Basin and Range faulting. Streams transported sediments shed from surrounding volcanoes into Gila Hot Springs graben, which developed as a result of Basin and Range faulting. **Valley Incision and Development of Cliff Dweller Canyon**—Gila River and its tributaries incised Gila Conglomerate. **Development of Caves in Cliff Dweller Canyon**—stream action and groundwater sapping formed caves in Gila Conglomerate.

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Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
TERTIARY (Pliocene)	Alkali olivine basalt flows (Tb)	Flows occur on top of the Gila Conglomerate in the southeastern corner of map area but probably correlate with 6-million-year-old basalt that is interlayered just beneath the top of the Gila Conglomerate in the Mimbres River valley about 16 km (10 mi) east.	**Mogollon–Datil Volcanic Field**—represents minor volcanism in the volcanic field related to development of the Rio Grande rift.	None reported.	**Basin and Range Faulting and Basin Filling**—postdates Oligocene "peak" of volcanic activity. Associated with Basin and Range extension.
TERTIARY (Miocene and Miocene?)	Younger andesitic and latitic lava flows (Tya)	Includes the Bearwallow Mountain Formation and Wall Lake Latite of Elston et al. (1968), Double Springs Andesite of Elston et al. (1970), and Mogollon and Last Chance andesites of the Mogollon mining district (Ferguson 1927).	**Mogollon–Datil Volcanic Field**—unit includes Bearwallow Mountain Andesite (**Tba**) and andesitic to dacitic lava flows of the Middle Fork Gila River (**Tmd**) of Ratté and Gaskill (2013). The contact between Bearwallow Mountain Andesite (part of **Tya**) and Gila Conglomerate is exposed in Gila Cliff Dwellings National Monument. **Geological Features with Cultural Significance**—andesite is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at the monument.	**Fluvial Features and Processes**—water in Cliff Dweller creek issues from the contact between the Gila Conglomerate and underlying volcanic rocks, which depending on local stratigraphy may be younger andesitic and latitic lava flows (**Tya**), in particular Bearwallow Mountain Andesite. **Geothermal Resources**—pervious zones in Bearwallow Mountain Andesite are geothermal reservoirs.	**Volcanic Activity**—extruded after the formation of the Gila Cliff Dwellings and Bursum calderas.
TERTIARY (Miocene and Miocene?)	Rhyolitic pyroclastic and volcaniclastic rocks (Tps)	Interlayered with the younger andesitic and latitic lava flows (**Tya**). Rocks probably correlate with younger rhyolite flows and domes (**Try**); and rhyolites of Indian Creek (**Tri**), Beaver Creek (**Trb**), and Rocky Canyon (**Trr**). Some flows are of uncertain (Miocene?) age.	Erupted in **Mogollon–Datil volcanic field**. **Geological Features with Cultural Significance**—rhyolite is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.	None reported.	**Volcanic Activity**—postdates peak of volcanism during Oligocene Epoch.
TERTIARY (Miocene)	Rhyolite flows of Indian Creek (Tri)	Rhyolite lava flows with hollow, bubblelike structures composed of concentric minerals. Occur just north of the Gila Cliff Dwellings caldera, and probably accumulated around a local vent.			
	Rhyolite flows of Beaver Creek (Trb)	Tin-bearing flow-banded rhyolite with hollow, bubblelike structures composed of concentric minerals in northeastern part of Ratté and Gaskill (1975) map area.			
	Rhyolite flows of Rocky Canyon (Trr)	Rhyolite with hollow, bubble-like structures composed of concentric minerals present in eastern part of Ratté and Gaskill (1975) map area; may be the same as rhyolite of Beaver Creek (**Trb**) and other rhyolite lavas in vicinity of the Taylor Creek tin district northeast of Wall Lake.			
TERTIARY (Miocene and Oligocene)	Dikes of intermediate or mafic composition (Tad)	No additional description besides unit name provided by Ratté and Gaskill (1975).	Occur in **Mogollon–Datil volcanic field**.		
TERTIARY (Miocene? and/or Oligocene?)	Rhyolite dikes (Tr)	Felsitic to porphyritic rhyolitic dikes a meter to a few meters thick. Most are probably the same age as **Try**, but some may be as old **Trd**.			

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Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
TERTIARY (Miocene?)	Rhyolitic pyroclastic and volcaniclastic rocks (Tpy)	Interlayered with the younger rhyolite flows and domes (**Try**); mainly within the Bursum caldera.	Occur in **Mogollon–Datil volcanic field**, mainly within Bursum caldera.	None reported.	**Volcanic Activity**—postdates peak of volcanism during Oligocene Epoch.
	Younger rhyolite flows and domes (Try)	Mainly lava flows and domes of flow-banded rhyolite confined largely within the Bursum caldera. These rhyolites are all defined as lava flows that postdate resurgence of the Bursum caldera. Structural relationships both extrusive and intrusive.	Erupted in **Mogollon–Datil volcanic field**. Confined largely within Bursum caldera. **Geological Features with Cultural Significance**—rhyolite is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.		
	Bedded volcaniclastic deposits (Tmf)	No additional description besides unit name provided by Ratté and Gaskill (1975).	Erupted in **Mogollon–Datil volcanic field**. Consists of rocks that locally fill the moat between the Bursum caldera wall and its interior resurgent dome.		
	Breccia of Bloodgood Canyon Rhyolite Tuff (Tcb)	Local monolithologic breccia deposits of Bloodgood Canyon Rhyolite Tuff.	**Mogollon–Datil Volcanic Field**—probably formed by debris avalanches off the interior walls of the Bursum caldera; represent a marginal caldera-fill deposit.		**Volcanic Activity**—associated with Oligocene volcanism.
	Mineral Creek Andesite (Tmc)	Andesitic lava flows and flow breccia.	**Mogollon–Datil Volcanic Field**—occurs in Bursum caldera along Whitewater Creek and elsewhere.		
TERTIARY (Miocene? and Oligocene?)	Tuff of Apache Spring (Tas)	Densely welded phenocryst-rich ash-flow tuff. Contains abundant quartz, sanidine, plagioclase, and biotite phenocrysts; accessory sphene common. May include some rhyolite of Sacaton Mountain (**Ts**), especially in upper Spider and Spruce creeks.	**Mogollon–Datil Volcanic Field**—identified within the Bursum caldera; not recognized outside the caldera in the Ratté and Gaskill (1975) map area. **Geological Features with Cultural Significance**—welded tuff is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.		**Volcanic Activity**—erupted from Bursum caldera between 29 million and 25.9 million years ago.
	Bloodgood Canyon Rhyolite Tuff of Elston (1968) (Tbc)	Mainly phenocryst-rich densely welded ash-flow tuff containing abundant quartz and sanidine phenocrysts and sparse biotite and honey-yellow sphene.	**Mogollon–Datil Volcanic Field**—Bursum caldera is source. Fills the Gila Cliff Dwellings caldera and forms outflow sheet along Gila River canyon south and southeast of the caldera. **Geological Features with Cultural Significance**—rhyolite is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.	**Fluvial Features and Processes**—water in Cliff Dweller creek issues from the contact between the Gila Conglomerate and underlying volcanic rocks, which depending on local stratigraphy may be Bloodgood Canyon Rhyolite Tuff (**Tbc**). **Geothermal Resources**—pervious zones in Bloodgood Canyon Rhyolite Tuff are geothermal reservoirs.	**Volcanic Activity**—erupted from Bursum caldera between 26.2 million and 25.3 million years ago.
TERTIARY (Oligocene?)	Volcaniclastic sedimentary rocks (Tvs)	Fluvial volcaniclastic beds consisting of rock fragments derived largely from latitic lava flows in the western wall of the Gila Cliff Dwellings caldera. Located beneath the Bloodgood Canyon Rhyolite Tuff (**Tbc**) at the head of Little Creek.	**Mogollon–Datil Volcanic Field**—derived from the wall of Gila Cliff Dwellings caldera.	None reported.	**Volcanic Activity**—correspond in time with Oligocene volcanism

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Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
TERTIARY (Oligocene?)	Rhyolite of the Diablo Range (Trd)	Mainly flow-banded rhyolite in lava flows and domes in the Diablo Range southwest of the Gila Cliff Dwellings caldera. Quartz and sanidine phenocrysts commonly are large and conspicuous. Locally occurs in sill-like rhyolite breccia bodies, as on the southern slope of Watson Mountain west of the canyon of the Gila River. Unit may be petrographically indistinguishable from **Try** in some places. Defined by stratigraphic position beneath Bloodgood Canyon Rhyolite Tuff (**Tbc**). Includes pyroclastic or volcaniclastic facies (**Tpd**) and welded tuff facies (**Trw**), which has virtually identical mineralogy to **Tbc,** thus correlation is uncertain.	Erupted in **Mogollon–Datil volcanic field**. **Geological Features with Cultural Significance**—rhyolite is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.	None reported.	**Volcanic Activity**—erupted between 27.6 million and 26.2 million years ago.
	Andesitic flows and breccias of Murtocks Hole (Tmh)	Separates the younger Bloodgood Canyon Rhyolite Tuff (**Tbc**) from the older tuff of Shelley Peak (**Tsp**) mainly along and south of the Gila River canyon in southern part of Ratté and Gaskill (1975) map area. **Tmhst** is thin discontinuous tuff layer with small sanidine phenocrysts within **Tmh**.	Erupted in **Mogollon–Datil volcanic field**.		**Volcanic Activity**—associated with Oligocene volcanism.
TERTIARY (Miocene? and/or Oligocene?)	Tertiary volcanic rocks (Tvu)	Mapped in areas of complex geology, mainly along the southwestern flank of the Mogollon Mountains.	Erupted in **Mogollon–Datil Volcanic Field.**		**Volcanic Activity**—rocks probably are mainly pre-Bursum caldera but may include some post-caldera rocks.
TERTIARY (Oligocene?)	Tuff of Shelley Peak (Tsp)	Compositionally zoned ash-flow tuff. Contains abundant biotite and plagioclase phenocrysts and sparse green pyroxene crystals in most outcrops. Sanidine phenocrysts occur locally in lower part of tuff. 180–200 m (600–700 ft) thick on Shelley Peak.	**Mogollon–Datil Volcanic Field**—uncertain but possible source is Gila Cliff Dwellings caldera. **Geological Features with Cultural Significance**—welded tuff is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.		**Volcanic Activity**—associated with Oligocene volcanism.
	Tuff of Davis Canyon (Tdc)	Phenocryst-poor partially welded ash-flow tuff containing conspicuous banded pumice and small quartz and sanidine phenocrysts.	**Mogollon–Datil Volcanic Field**—uncertain but possible source is Gila Cliff Dwellings caldera. Interlayered with latitic and andesitic lava flows that are tentatively correlated with the lava flows of Gila Flat (**Tgf**). **Geological Features with Cultural Significance**—welded tuff is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.		
	Tuff of Fall Canyon (Tfc)	Partially to densely welded ash-flow tuff containing about 20% quartz, sanidine, and plagioclase phenocrysts; sparse biotite and other mafic crystals.	**Mogollon–Datil Volcanic Field**—interlayered with latitic and andesitic lava flows that are tentatively correlated with the lava flows of Gila Flat (**Tgf**). **Geological Features with Cultural Significance**—welded tuff is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.		

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Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
TERTIARY (Oligocene?)	Volcanic complex of Brock Canyon (Tvb)	Mainly fresh to intensely altered latitic and andesitic lava flows, flow breccia, and minor volcaniclastic and pyroclastic materials. Some rocks may be intrusive.	Erupted in **Mogollon–Datil volcanic field**.	None reported; however, association with mining in the Gila area may be of interest to monument managers. The volcanic complex is host to quartz-fluorite veins of Gila fluorspar district, which probably are younger than the hydrothermally altered and mineralized rocks along Brock and Brushy canyons and adjoining areas straddling the Gila River.	**Volcanic Activity**—erupted between 30 million and 34 million years ago.
	Latitic and andesitic lava flows of Gila Flat (Tgf)	No additional description besides unit name provided by Ratté and Gaskill (1975).		None reported.	**Volcanic Activity**—erupted between 29.6 million and 29.1 million years ago.
	Rhyolitic dikes and sills (Tvi)	No additional description besides unit name provided by Ratté and Gaskill (1975).			**Volcanic Activity**—erupted approximately 29.7 million years ago.
	Andesitic flows and breccias, pyroclastic and volcaniclastic rocks, and associated small volcanic rocks (Tva)	Includes all hydrothermally altered rocks in the Copperas Creek and Alum Mountain areas.	Erupted in **Mogollon–Datil volcanic field**. **Geological Features with Cultural Significance**—andesite is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.	**Geothermal Development**—altered areas are evidence of past or present geothermal activity.	**Volcanic Activity**—associated with Oligocene volcanism.
	Ash-flow tuffs of Rocky Canyon (Trc)	Includes at least two ash-flow tuff sheets that may correlate with the Caballo Blanco Tuff and Kneeling Nun Tuff.	Erupted in **Mogollon–Datil volcanic field**. **Geological Features with Cultural Significance**—welded tuff is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.	None reported.	
	Sedimentary rocks (Trs)	Sediments mapped locally between the sheets of ash-flow tuffs of Rocky Canyon (**Trc**).	Associated with the **Mogollon–Datil volcanic field**.		**Volcanic Activity**—corresponds in time with Oligocene volcanism.
TERTIARY (Oligocene? or older)	Andesitic flows and breccias of Turkey Cienega Canyon (Ttc)	No additional description besides name provided by Ratté and Gaskill (1975). Present only in southeastern corner of mapped area.	Erupted in **Mogollon–Datil volcanic field**. **Geological Features with Cultural Significance**—andesite is quite workable and well-suited for manufacturing cutting and piercing tools and provided raw material for artifacts found at Gila Cliff Dwellings National Monument.		**Volcanic Activity**—associated with Oligocene volcanism.
UPPER PENNSYLVANIAN	Syrena Formation (PNs)	Limestone and some clay-rich beds. Present only in southeastern corner of Ratté and Gaskill (1975) map area between Terry Canyon and Turkey Cienega Canyon.	None reported.		Deposited approximately 300 million years ago at the time of the supercontinent Pangaea in marine waters. Much older than Cenozoic Era volcanic and sedimentary rocks exposed in Gila Cliff Dwellings National Monument.

***Tertiary is no longer a formal geologic period, but the term is still in common use, and was used by Ratté and Gaskill (1975) and is used in this report. Tertiary covers the Paleogene and Neogene (approximately 66.0 million–2.6 million years ago).**