Map Unit Properties Table: Great Basin National Park

Gray-shaded rows indicate units not mapped within Great Basin National Park.

Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
QUATERNARY (Holocene and Pleistocene)	Talus (Qt)	Rock fragments, usually coarse and angular, lying at the base of a cliff or steep slope from which they have been derived.	**Geomorphic Features** Talus deposits.	**Geohazards** Continued falling of talus blocks or movement of piles at base of cliffs.	**Ice Sculpture and Cave Carving** Mass-wasting (slope movement) processes generate modern talus deposits at the base of cliffs.
	Alluvium (Qa)	Generally unconsolidated sand and pebbles deposited within modern drainage systems.	**Geomorphic Features** Alluvial fans, fluvial deposits, and bolsons.	**Geohazards** Floods and debris flows may impact campgrounds in narrow canyons.	**Ice Sculpture and Cave Carving** Alluvial deposits accumulate as a result of fluvial (river) processes.
	Lacustrine gravels (Qlg)	Unconsolidated pebbles deposited in lakes.	**Geomorphic Features** May be distributed in playas and bolsons, outside of the park.	None documented.	**Ice Sculpture and Cave Carving** Coarse sand and pebbles accumulate at the mouth of modern rivers that empty into lakes.
	Landslide deposits (Ql)	Chaotic mass of blocks of various sizes deposited on modern slopes.	**Geomorphic Features** Avalanche chutes.	**Geohazards** Avalanches in the backcountry. Minor safety issue.	**Ice Sculpture and Cave Carving** Mass-wasting (slope movement) processes generate modern landslides.
	Glacial deposits (Qg)	Primarily ground moraine deposited during two glacial stages. Younger morainal surfaces are hummocky, whereas older morainal surfaces have a more subdued topography.	**Glacial Features** Lateral, terminal, and ground moraines	None documented.	**Ice Sculpture and Cave Carving** Deposition of glacial debris, some of which may be 26,000 years old.
	Older alluvium (Qoa)	Unconsolidated material older than **Qa**. The unit forms a relatively horizontal surface over tilted older rocks. Modern drainage systems have incised into **Qoa**.	**Geomorphic Features** Alluvial fans, bolsons, playas.	**Geohazards** Flood debris flows may be issues where modern streams are cutting through **Qoa**.	**Ice Sculpture and Cave Carving** Clast types and morphology of these deposits indicate they are derived from the major present-day drainage systems developed in flanking mountain ranges.
	Conglomerate (QTc)	Conglomerate consisting of rounded, poorly sorted clasts from all of the Paleozoic units from the **PNe** to **Op**, as well as clasts from the **Tnr**. Best exposed in the hilly region and road leading to Decathon Canyon. Thickness is 153–183 m (505–604 ft).	**Geomorphic Features** Conglomerates result from erosion and subsequent deposition in higher energy fluvial settings. Contains abundant clasts of the Needles Range Formation (**Tnr**).	None documented.	**Extensional Tectonics and the Metamorphic Core Complex** **QTc** predates **Qoa** and appears to be in fault contact with much older Paleozoic bedrock units.
PALEOGENE and NEOGENE (Tertiary)	Conglomerate (Tc, Tcmb)	The unit contains rounded, poorly sorted clasts greater than 2 mm (0.08 in) in diameter. **Tcmb** is a marker bed.	**Geomorphic Features** Conglomerates result from erosion and subsequent deposition in higher energy fluvial settings.	None documented. Limited extent. Only exposed along the southern border of the park.	**Extensional Tectonics and the Metamorphic Core Complex** Fluvial transportation of rocks eroded from uplifted horsts caused by Basin-and-Range extension produces rounded and subrounded clasts in the conglomerate.
	Needles Range Formation (Tnr)	Pink to red ashflow tuffs interlayered with two conglomerate beds. The best exposures are in the southern part of Johns Wash where it conformably overlies **Toc**. An incomplete section is approximately 110 m (360 ft) thick.	**Igneous Rocks** Tertiary volcanics. Surge layers of ashflow tuff. Imbricated pebbles in the conglomerate intervals indicate south-directed paleocurrents.	None documented.	**Extensional Tectonics and the Metamorphic Core Complex** Volcanic tuff from the Indian Peak caldera complex was deposited 33–27 million years ago.
	Lacustrine deposits (Tl)	Lake deposits consisting of fine to very fine silt and clay particles.	None documented.		**Extensional Tectonics and the Metamorphic Core Complex** Volcanic lava flows, conglomerate, and lacustrine sediments were deposited.
	Latite flows (Tlf)	Volcanic rock with phenocrysts of feldspar and almost no quartz.	**Igneous Rocks** Tertiary volcanics.		
	Older conglomerate (Toc)	Flat-lying conglomerate of pebbles and occasional cobbles. The best exposures are in the Johns Wash and Murphy Wash areas, south of the park.	**Geomorphic Features** Conglomerates result from erosion and subsequent deposition in higher energy fluvial settings. No imbrications, suggesting that the pebbles were not aligned by flowing water.		
	Rhyodacite flows and subvolcanic intrusive rocks (Trdi)	Volcanic flows with a composition intermediate between rhyolite and dacite. A subvolcanic intrusive rock is an igneous body that formed at a shallow depth.	**Igneous Rocks** Tertiary volcanics.	None documented.	**Extensional Tectonics and the Metamorphic Core Complex** Volcanic lava flows, conglomerate, and lacustrine sediments were deposited.
	Muscovite-bearing rhyolite porpyhyry dikes and sills (Tmp)	Dikes and sills are narrow igneous intrusions that either cut across (dike) or are parallel to (sill) bedding planes or other geologic structures. Rhyolite composition with phenocrysts of muscovite.	**Igneous Rocks** Tertiary granite with phenocrysts of biotite and muscovite. **Geomorphic Features** Pediments are forming on **Tgr**.	**Geohazards** Granites produce very erosive, unconsolidated grus that may become highly mobile during heavy rainstorms, especially following fires. Potential for rockfall along Baker Creek, Kious Basin, Young Canyon, and Rudolph's Canyon on the eastern edge of the park.	**Extensional Tectonics and the Metamorphic Core Complex** Subduction continued to produce granitic magma and the emplacement or Tertiary plutons in the Snake Range region approximately 35 million years ago.
	Granite (Tgr)	Granite is an igneous intrusive rock composed primarily of quartz and feldspar. This unit also contains abundant biotite.			

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Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
CRETACEOUS	Granite (Kgr)	This granite is the westward edge of the Pole Canyon pluton and is characterized by two types of micas: (1) large, euhedral muscovite phenocrysts up to 2 cm (0.8 in) in diameter, and (2) tiny biotite inclusions within the larger muscovite phenocrysts.	**Igneous Rocks** Cretaceous Pole Canyon pluton. Part of a north-south oriented band of similarly-aged granites in eastern Nevada. **Geomorphic Features** Prediments are forming on **Kgr**.	**Geohazards** Granites produce very erosive, unconsolidated grus that may become highly mobile during heavy rainstorms, especially following fires. Potential for rockfall in the Pole Canyon area.	**Extensional Tectonics and the Metamorphic Core Complex** Tertiary extension exposed **Kgr** beneath the Snake Range décollement. **Volcanoes and an Ancient Seaway** Plate convergence along the active tectonic margin of western North America generated (and continues to generate) magma that was emplaced as granitic plutons approximately 80 million years ago.
JURASSIC	Granite (Jg)	This elongated igneous intrusion in the center of the park is known as the Snake Creek/Williams Canyon pluton. Composition varies from a biotite-tonalite (63% quartz) in the east to a biotite-granite (76% quartz) in the west. The contact with the surrounding Precambrian and Paleozoic units is sharp and includes contact metamorphic minerals. Contains granodiorite and aplite dikes.	**Igneous Rocks** Jurassic Snake Creek/Williams Canyon pluton. Underlies "Granite Basin." Accessory minerals include biotite, epidote, titanite, magnetite, and allanite in the eastern portion of the pluton; garnet, ilmenite, and monazite in the central and western portions; apatite and zircon are ubiquitous throughout. Contact metamorphic minerals include muscovite, chlorite, epidote, garnet, diopsite, staurolite, and actinolite. **Periglacial Features** Stone polygons and circles in Johnson Pass. **Geomorphic Features** Pediments are forming on **Jg**.	**Geohazards** Granites produce very erosive, unconsolidated grus that may become highly mobile during heavy rainstorms, especially following fires. Potential for rockfall in the backcountry along the ridgelines extending east and south from Pyramid Peak.	**Extensional Tectonics and the Metamorphic Core Complex** Tertiary extension exposed **Jg** beneath the Snake Range décollement. **Volcanoes and an Ancient Seaway** Plate convergence along the active tectonic margin of western North America generated (and continues to generate) magma that was emplaced as granitic plutons approximately 160 million years ago.
PENNSYLVANIAN (Early and Middle)	Ely Limestone (PNe)	Gray, medium- to coarse-grained, fossiliferous limestone characterized by alternating thin-bedded limestone ledges and gentle slopes of platy, medium-gray to tannish-gray silty limestone. Incomplete sections are exposed south of the park in the Murphy Wash and Johns Wash area. The estimated total unit thickness is 550–720 m (1,800–2,400 ft).	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** Invertebrate fossils include foraminifera, brachiopods, crinoids, and string corals (*Chaeletes*). **Rock Art and Projectile Points** Potential source of chert for projectile points.	None documented.	**Extensional Tectonics and the Metamorphic Core Complex** Formed part of the upper plate above the Snake Range décollement. **The End of an Era and the Emergence of Pangaea** Pangaea formed. Collision produces the Sonoma Orogeny along the western margin of North America. Sea level rises and marine environments transgress over the continent.
MISSISSIPPIAN (Middle and Late)	Chainman Shale (Mc)	Primarily dark gray to pale yellow-brown shale and siltstone with occasional thin quartz sand beds. Forms slopes between the more resistant limestones in **PNe** and **Mj**. In general, only the sandstone beds are exposed. The best exposures are south of the park in the Murphy Wash and Johns Wash area. Estimated to be 305–610 m (1,000–2,000 ft) thick. Brownish-red displaced rock fragments of **Mc** occur in Great Basin National Park.	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** Invertebrate fossils include brachiopods, conodonts, and crinoids.		**Extensional Tectonics and the Metamorphic Core Complex** Formed part of the upper plate above the Snake Range décollement. **The Antler Orogeny and an Active Tectonic Margin** **Mc** was deposited in deltaic systems, alluvial fans, and fluvial systems that formed as the Antler Orogeny ended, sea level fell, and sediment filled the trough landward of the Roberts Mountains Thrust.
MISSISSIPIAN (Early)	Joana Limestone (Mj)	Gray, cliff-forming, massive bedded, fossiliferous limestone. Locally, nodules and stringers of chert are abundant. Exposed south of the park in the Murphy Wash and Johns Wash area. Partial thickness of 100 m (330 ft).	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** Marine invertebrates (crinoid stems, coral, and brachiopods). **Rock Art and Projectile Points** Potential source of chert for projectile points.		**Extensional Tectonics and the Metamorphic Core Complex** Part of the upper plate above the Snake Range décollement. **The Antler Orogeny and an Active Tectonic Margin** Deposited on a carbonate platform that developed east of a deep trough forming in front of the west-to-east advancing Roberts Mountains Thrust.

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Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
DEVONIAN (Late) – MISSISSIPIAN (Early	Pilot Shale (MDp)	Gray to yellow, very poorly-exposed, slope-forming, calcareous shale with thin limestone interbeds and occasional chert stringers. Primarily found as displaced fragments. Occurs near the spring on the east side of Johns Wash where it intersects Murphy Wash. Estimated thickness is 91–244 m (300–800 ft).	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks.	None documented.	**Extensional Tectonics and the Metamorphic Core Complex** Part of the upper plate above the Snake Range décollement. **The Antler Orogeny and an Active Tectonic Margin** Deposited in a basin that formed landward of the Roberts Mountains Thrust.
DEVONIAN (Late)	Guilmette Formation (Dg)	Dark bluish-gray, massive, slope- to cliff-forming limestone that becomes progressively more well-bedded and more shaly up-section. Partial sections are exposed in the southeastern corner of the park where **Dg** is estimated to be 760 m (2,500 ft) thick.	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** Contains a stromatolite boundstone up to 2 m (7 ft) thick. Also has brachiopods, crinoids, gastropods, and stromatoporoids.	**Cave Preservation and Protection** May contain caves in the southeastern backcountry of the park. **Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park.	**Extensional Tectonics and the Metamorphic Core Complex** Formed part of the upper plate above the Snake Range décollement. **The Antler Orogeny and an Active Tectonic Margin** Deposited on a carbonate platform that developed as sea level continued to rise due to the Antler Orogeny.
DEVONIAN (Middle)	Simonson Dolomite (Ds)	A light to dark-brown, thin- to medium-bedded, laminated, microcrystalline to coarsely crystalline, ledgy slope-forming dolomite exposed in the southern part of the park and south of the park, east of Johns Wash. In fault-contact with **Dg**. Estimated thickness is 175 m (575 ft).	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** Gastropods, tabulate corals, crinoids, brachiopods, stromatoporoids.	**Geohazards** None documented, but may form unstable slopes in the southern backcountry of the park. **Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park.	**Extensional Tectonics and the Metamorphic Core Complex** Formed part of the upper plate above the Snake Range décollement. **The Antler Orogeny and an Active Tectonic Margin** The initial influence of the Antler Orogeny was felt in east-central Nevada. Sea level rose rapidly, creating well-oxygenated marine environments for invertebrates.
DEVONIAN (Early)	Sevy Dolomite (Dse)	White-weathering, light-gray, thin- to medium-bedded, very fine-grained, generally well-laminated dolomite that forms ledges and slopes. Lighter in color than **Ds** and **OSfl**. Noted for quartz sand beds near the top of the unit. Fossils rare, commonly nonfossiliferous. Sand beds are up to 0.5 m (1.7 ft) thick. Gradual contact with both **Ds** and **OSfl**. Exposed in the southeastern corner of the park where estimated thickness is 213–244 m (703–805 ft).	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** Rare acanthodian fish spines and stromatolites.	**Geohazards** None documented, but may form unstable slopes in the southern backcountry of the park. **Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park.	**Extensional Tectonics and the Metamorphic Core Complex** Formed part of the upper plate above the Snake Range décollement. **From Global Warming to Global Glaciation** Relative sea level fell, and **Dse** dolomites formed in shallow marine, subtidal to peritidal environments.
ORDOVICIAN (Late) – SILURIAN	Fish Haven and Laketown Dolomites Undifferentiated (OSfl)	Dark brown to light gray, resistant, ledge- and cliff-forming, fossiliferous (coral-rich) dolomites exposed in the southernmost part of the park. Dark brown layers contain diagnostic corals and very large brachiopods 10–13 cm (4–5 in) in diameter. Locally contains abundant chert. Thickness is 230–433 m (760–1,400 ft).	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** Branching coral, rugose corals (horn corals), *Halysites* (chain coral), crinoid stems, brachiopods, and stromatolites. **Rock Art and Projectile Points** Potential source of chert for projectile points.	**Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park.	**Extensional Tectonics and the Metamorphic Core Complex** Formed part of the upper plate above the Snake Range décollement. **From Global Warming to Global Glaciation** After global warming caused a sea-level rise and **Oe** was deposited on **Op** karst topography, glaciation caused sea-level to fall, and channels incised the surface of **Oe**. Following glaciation, sea-level rose again and **OSlf** was deposited on a new carbonate platform.

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Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
ORDOVICIAN (Middle–Late)	Eureka Quartzite (Oe)	White, cliff-forming, thick-bedded orthoquartzite exposed in the southernmost part of the park. The quartzite is composed of well-rounded, well-sorted, fine to medium-grained quartz. Forms a distinctive stratigraphic marker throughout the Great Basin between yellow-weathering, slope-forming **Opl** and dark colored **OSfl** dolomites. Approximately 100 m (330 ft) thick.	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** No body fossils. Vertical burrows in some exposures.	**Geohazards** None documented, but potential for rockfall in the backcountry in the southern part of the park.	**Extensional Tectonics and the Metamorphic Core Complex** Formed part of the upper plate above the Snake Range décollement. **From Global Warming to Global Glaciation** Deposited on **Op** karst surface during a major sea-level rise.
ORDOVICIAN Early and Middle)	Pogonip Group (undifferentiated: Op) – Lehman Formation (Opl)	Medium-gray, slope- to ledge-forming, well-bedded, fine- to medium-grained, fossiliferous limestone and silty limestone exposed in the southern part of the park. Bioturbation gives a mottled appearance. Thickness is 100–300 m (330–1,000 ft).	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** Some 2–10 cm (0.8–4 in) beds of **Opl** contain abundant gastropods, cephalopods, trilobites, and ostracods. The upper part of the unit in places contains a coral bioherm of *Eofletcheria* and *Foerstephyllum* up to 0.5 m (1.6 ft) thick. **Opk** contains ostracods, trilobite spines, gastropods, cephalopods, brachiopods, and the unusual algae bodies, *Receptaculites* and *Calathium*. Beds of **Opj** are 2–4 cm (0.8–2 in) thick and contain gastropods, ostracods, cystid echinoderms, cephalopods, sponges, *Calathiu*, and trilobite debris. Burrowing (bioturbation) is common in **Opl** and **Opk.** Burrows are the only paleontological feature in **Opw**, and range in width from 0.5 cm (0.2 in) to 1.5 cm (0.6 in).	**Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park.	**Extensional Tectonics and the Metamorphic Core Complex** Formed part of the upper plate above the Snake Range décollement. **A Passive Margin and Paleokarst** Deposited in warm, well-oxygenated seawater on a carbonate shelf that expanded into western Utah with the rise of relative sea level. The passive tectonic margin was beginning to change into an active tectonic margin. Episodic fluctuations of sea level resulted in the development of a paleokarst topography on the **Op**.
	Kanosh Shale (Opk)	Yellowish-brown to olive gray, non-resistant, slope-forming, fissile shale with brown-weathering, resistant beds of highly fossiliferous gray limestone. Rare exposures in the southern part of the park. Estimated thickness of 110 m (360 ft) on the southern end of Highland Ridge. Section is faulted and folded.			
	Juab Limestone (Opj)	Medium-to-dark gray, ledge forming, well-bedded, fine- to coarse-grained, fossiliferous limestone with silty partings. Exposed in the southwestern corner of the park. Approximately 230 m (760 ft) thick.			
	Wahwah Limestone (Opw)	Medium gray, slope- to ledge-forming, well-bedded, fine- to medium-grained limestone and shaley to silty limestone. Limestone beds range from 2 cm (0.8 in) to 30 cm (12 in) thick. Distinguished from **Opf** by higher limestone content, more resistant nature, and no flat pebble conglomerate. Approximately 90 m (300 ft) thick.			
	Fillmore Limestone (Opf)	Light gray, well-bedded, fine-grained, slope- to ledge-forming limestone and shaley limestone with abundant flat pebble conglomerate throughout. Silty olive-gray layers weather to a distinct pale orange to yellowish-orange color. Coloration and break in slope separates **Opf** from **OCn**. Shale separates 6 m (20 ft) intervals of limestone beds. At the southern end of Highland Ridge, a complete section is 380 m (1,300 ft) thick.			
	House Limestone (Oph)	The House Limestone is not included as a member of the Pogonnip Group on the OF93 publication.			
CAMBRIAN (Late) – ORDOVICIAN (Early)	Notch Peak Limestone (OCn)	Resistant, medium-gray to dark gray, fine-grained, cliff-forming limestone containing chert nodules and stringers subparallel to bedding. Chert nodules, which are more common in the lower part, are 2.5–7.5 cm (1–3 in) thick. Higher in the section, thin layers of tan or pink siltstone are interbedded with thin limestone beds. Exposed along the eastern border and southern part of the park. A partial section measured 770 m (2,500 ft) thick.	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** Gastropods, trilobite debris, articulate and inarticulate brachiopods, and stromatolites. **Periglacial Features** Stone polygons and circles. **Lexington Arch** Developed in **OCn**, the arch may be the only limestone arch in the Southwest. **Rock Art and Projectile Points** Potential source of chert for projectile points.	**Cave Preservation and Protection** May contain caves in the backcountry of the park. **Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park.	**Extensional Tectonics and the Metamorphic Core Complex** Formed part of the upper plate above the Snake Range décollement. **A Passive Margin and Paleokarst** Deposited in warm, well-oxygenated, equatorial seawater on the passive tectonic margin of western North America.

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Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
CAMBRIAN (Late)	Corset Spring Shale (Ccs)	Light olive-gray to brown, fissile shale with thin lenses and nodules of limestone. Forms gentle slopes south of the park. The unit forms a bench above the underlying **Cjw**. Complete section is 26 m (86 ft) thick.	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. **Paleontological Resources** Trilobites and tiny inarticulate brachiopods.	**Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park.	**Extensional Tectonics and the Metamorphic Core Complex** Formed part of the upper plate above the Snake Range décollement. **A Passive Margin and Paleokarst** Deposited in warm, well-oxygenated, equatorial seawater on the passive tectonic margin of western North America.
CAMBRIAN (Late)	Johns Wash Limestone (Cjw)	Medium- to light-gray, medium- to coarse-grained, massive to thin-bedded, ledge to cliff-forming limestone. More resistant then underlying **Clp** and overlying **Ccs**. Exposed in the southeastern corner of the park, in Johns Wash, and in relation to the Gateway Fault. Complete thickness is 86 m (284 ft).	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. Contains cross-bedded oolitic limestone beds 0.5–1 m (1.7–3.3 ft) thick and fenestral fabric. **Paleontological Resources** Trilobites are reported immediately outside the park.	**Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park.	
CAMBRIAN (Middle–Late)	Lincoln Peak Formation (Clp)	Light to medium bluish-gray, fine-grained, thin-bedded limestone with silty partings, silty limestone, or calcareous siltstone, each interbedded with shale. Non-resistant and weathers to gentle brownish-orange colored slopes covered by dense vegetation. Best exposures are along the east side of Lincoln Peak where a partial section was measured to be 630 m (2,080 ft) thick. **Clpmb**: conglomerate marker bed.	**Metamorphic Core Complex and the Southern Snake Range Décollement** Upper plate sedimentary rocks. Beds are 3–30 cm (1.2–12 in) thick. Unit contains rare beds of chert or trilobite hash. Where limestone beds are thickest, shale occurs as wavy interbeds and partings. **Paleontological Resources** Large trilobites and rare tiny agnostid trilobites.	**Geohazards** Potential for rockfall in the backcountry from steep slopes of Lincoln Peak. **Cave Preservation and Protection** May contain caves in the backcountry of the park. **Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park.	
CAMBRIAN (Middle)	Pole Canyon Limestone	Undifferen-tiated (Cpc)	As a whole, the Pole Canyon Limestone forms prominent gray and white cliffs. In general, subunits **Cpca**, **Cpcc**, and **Cpce** are darker than the other units and consist of medium-dark- to dark-gray, slope-forming limestones with abundant silty interbeds. Subunits **Cpcd** and **Cpcd** are mostly light-gray to white, cliff-forming limestones. A total thickness of 557 m (1,840 ft) was measured in Lincoln Canyon. **Cpcmb**: conglomerate marker bed.	**Cave Systems** and **Speleothems** Four distinctive groups of cave systems: Lehman Hills Caves, Baker Creek Caves, Snake Creek Caves, and Alpine Caves. Abundant speleothems including drapery, folia, stalactites, stalagmites, columns, anthodite, frostwork, shields, soda straws, helictites, rimstone, popcorn, and flowstone. **Metamorphic Core Complex and the Southern Snake Range Décollement** Lower plate sedimentary and metasedimentary rocks. **Paleontological Resources** Small *Girvinella* 5–10 mm (0.2–0.4 in) in diameter in **Cpce**. Burrowing (bioturbation) is common in **Cpcc**, Trilobites occur in **Cpcc** and **Cpce**.	**Cave Preservation and Protection** Visitor use, cave infrastructure, air and water quality, invasive species, surface habitat alteration, climate change, and droughts. **Lehman Cave Restoration Project** Removing trail material and electrical conduit from Talus Room, lint removal, and algae reduction. **Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park. **Preservation of Cultural Rock Art** Preservation of pictographs and petroglyphs.	**Ice Sculpture and Cave Carving** During the Pleistocene, wetter climate initiated the development of cave systems in **Cpc** units. Lehman Cave is at least 1 million years old. **Extensional Tectonics and the Metamorphic Core Complex** In the Tertiary, the Snake Range décollement cut up-section from the **Cpi** into the **Cpc**. **A Passive Margin and Paleokarst** Deposited on a carbonate platform that developed as relative sea level rose, drowning the ramp-like continental shelf.
		E Member (Cpce)	Consists of two types of limestone: 1) fine-grained, silty, slope-forming limestone, and 2) very fine to fine-grained, cliff-forming limestone. Lower 23–33 m (80–110 ft) of dark gray, slope-forming limestone is overlain by a massive, medium-gray, cliff-forming limestone with lenses of oolitic limestone, fenestral fabric, and rip-up clasts. The upper section is a poorly-exposed, dark gray, slope-forming limestone. Well-exposed on the south side of Swallow Canyon where it is 109 m (360 ft) thick.		
		D Member (Cpcd)	Gray, fine-grained, resistant, massive, cliff-forming limestone with some thin silt interbeds. Tiny flecks and blebs of lighter colored limestone are diagnostic of **Cpcd**. Lenses of oolitic limestone and fenestral fabric are common. Contact with **Cpce** is at a change in slope and no more light colored beds. Exposed on the east fork of Lincoln Canyon where it is 100 m (330 ft) thick.		
		C Member (Cpcc)	Dark gray, fine- to medium-grained limestone with 2–3 cm-(0.8–1.2 in-) thick dolomite lenses. Forms a slope between **Cpcd** and **Cpcb**. Contains abundant, very thin, bioturbated (mottled) red-pink silt interbeds. Fenestral fabric is common. **Cpcc** is 45 m (150 ft) thick on the north side of Swallow Canyon.		

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Age	Map Unit (Symbol)	Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
CAMBRIAN Middle)	Pole Canyon Limestone — B Member (Cpcb)	Gray, massive, resistant, cliff-forming limestone. Distinguished from **Cpca** by its light color. Lower 30–70 m (100–230 ft) consists of light gray, fine-grained limestone with stringers and blebs of silt sub-parallel to bedding. Upper 135–150 m (446–495 ft) consists of alternating medium-gray and light-gray limestone beds 1.5–17 m (5.0–56 ft) thick. Fine-grained darker beds commonly contain lighter colored limestone blebs strung out parallel to bedding. Extensive mottling from bioturbation. Fenestral fabric is common. Well-exposed east of the fork in Lincoln Canyon where the unit measures 200 m (660 ft) thick.	**Cave Systems** and **Speleothems** Four distinctive groups of cave systems: Lehman Hills Caves, Baker Creek Caves, Snake Creek Caves, and Alpine Caves. Abundant speleothems including drapery, folia, stalactites, stalagmites, columns, anthodite, frostwork, shields, soda straws, helictites, rimstone, popcorn, and flowstone. **Metamorphic Core Complex and the Southern Snake Range Décollement** Lower plate sedimentary and metasedimentary rocks. **Paleontological Resources** *Girvinella*, 1.25–2.5 cm (0.49–0.98 in) in diameter, is a diagnostic feature of **Cpca**. Burrowing (bioturbation) is common in **Cpcb** and **Cpca**.	**Cave Preservation and Protection** Visitor use, cave infrastructure, air and water quality, invasive species, surface habitat alteration, climate change, and droughts. **Lehman Cave Restoration Project** Removing trail material and electrical conduit from Talus Room, lint removal, and algae reduction. **Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park. **Preservation of Cultural Rock Art** Preservation of pictographs and petroglyphs.	**Ice Sculpture and Cave Carving** During the Pleistocene, wetter climate initiated the development of cave systems in **Cpc** units. Lehman Cave is at least 1 million years old. **Extensional Tectonics and the Metamorphic Core Complex** In the Tertiary, the Snake Range décollement cut up-section from the **Cpi** into the **Cpc**. **A Passive Margin and Paleokarst** Deposited on a carbonate platform that developed as relative sea level rose, drowning the ramp-like continental shelf.
	Pole Canyon Limestone — A Member (Cpca)	Dark gray, fine- to medium-grained, slope-forming and cliff-forming limestone and abundant tan or pink silty interbeds, which are mottled due to bioturbation. Fenestral fabric is common. A resistant, cliff-forming limestone greater than 7 m (23 ft) thick occurs in the middle of the unit. Cliff is overlain by yellowish-brown siltstone and calcareous quartzite. Exposed near the head of the north fork of Big Wash where it is 137 m (452 ft) thick.			
CAMBRIAN (Early)	Pioche shale (Cpi)	Dark siltstone, quartzose, sandy siltstone, and calcareous quartzite and greenish-gray to khaki-colored, thin-bedded shale. Abundant detrital mica. Transitional with the **CZpm** with dark-colored quartzite beds (**CZpm**) interlayered with olive-brown to rust-brown siltstone (**Cpi**). Upper contact with **Cpc** is well-exposed in snow avalanche chutes on the northeastern face of Mt. Washington where dark gray, orange-weathering siltstone layers (**Cpi**) are interbedded with gray limestone (**Cpc**). **Cpi** is not metamorphosed in the park except in the vicinity of **Jg** in the Snake Creek Drainage and on the ridgeline between Pyramid Peak and Mt. Washington. Thickness is 90–96 m (300–320 ft).	**Metamorphic Core Complex and the Southern Snake Range Décollement** Lower plate sedimentary and metasedimentary rocks. Abundant ripples and mudcracks. In the vicinity of **Jg**, the unit has been metamorphosed to biotite-, muscovite-, and andalusite-bearing psammite, schist, and calc-silicate (garnet, epidote, and diopside) bearing rocks. **Paleontological Resources** Burrows and grazing trace fossils from unknown organisms.	**Paleontological Resource Inventory, Monitoring, and Protection** The park's paleo-potential map identifies potential areas where Paleozoic marine invertebrates could occur. Inventory efforts are underway to better document fossils and potential management issues throughout the park.	**Extensional Tectonics and the Metamorphic Core Complex** In the Tertiary, these units became part of the Metamorphic Core Complex and the lower plate rocks below the Snake Range décollement. **A Passive Margin and Paleokarst** Deposited on a ramp-like continental shelf on a passive tectonic margin bordering the initial North American craton. **Cpi** formed an important lithologic transition between dominantly clastic Early Cambrian and older strata and the overlying Middle Cambrian carbonate section.
NEOPROTEROZOIC ERA – CAMBRIAN (Early)	Prospect Mountain Quartzite (CZpm)	White to gray, well-sorted, medium- to coarse-grained quartzite. Abundant cross-beds. Bedding is generally 0.3–1 m (1–3.3 ft) thick. **CZpm** forms the rugged, glaciated crest of the southern Snake Range north of Pyramid Peak to Wheeler Peak. It is well-exposed in steep glacial cirques, cirque walls, and cliffs. Cliffs and talus slopes of **CZpm** weather rust-brown, tan, or purple. The gradational upper contact with **Cpi** is best exposed on the ridge between Box and Dry Canyons north of Mt. Wheeler Mine. **CZpm** is distinguished from the underlying **Zm** by its general lack of pebble conglomerates and rare politic intervals, the abundance of cross-beds, and the more regular bedding and total thickness. Forms steep cliffs and talus slopes in the northern part of the park. The total thickness of the unit is estimated to be 1,520 m (5,020 ft).	**Metamorphic Core Complex and the Southern Snake Range Décollement** Lower plate sedimentary and metasedimentary rocks. Abundant cross-beds are defined by dark laminations. Occasional soft sediment slumping of cross-beds. **Rock Glaciers** Blocks of Prospect Mountain Quartzite comprise all the rock glaciers in Great Basin National Park. **Glacial Features** Cirques form below steep walls of **CZpm**. **Periglacial Features** Stone polygons and circles, garlands, and a protalus rampart. **Geomorphic Features** Pediments are forming on **CZpm**.	**Documenting Glacial Features** Baseline inventory and map of the rock glaciers, tarns, cirques, kettles, moraines, and other glacial features is needed in order to monitor changes due to climate change. **Geohazards** Potential rockfall from cliffs and steep slopes may impact hiking trails in the higher elevations of the park.	**Extensional Tectonics and the Metamorphic Core Complex** In the Tertiary, these units became part of the Metamorphic Core Complex and the lower plate rocks below the Snake Range décollement. **A Passive Margin and Paleokarst** Deposited on a ramp-like continental shelf that formed on a passive tectonic margin bordering the initial North American craton.

Gray-shaded rows indicate units not mapped within Great Basin National Park.

Age	Map Unit (Symbol)		Geologic Description	Geologic Features and Processes	Geologic Issues	Geologic History
NEOPROTEROZOIC ERA	McCoy Creek Group	Undifferen-tiated (Zm)	On the north-facing slopes leading up towards Wheeler Peak, the McCoy Creek Group forms an intact, gently dipping, apparently conformable section about 1100 m (3,630 ft) thick.	**Metamorphic Core Complex and the Southern Snake Range Décollement** Lower plate sedimentary and metasedimentary rocks. Abundant sedimentary structures in **Zmoa** include small-scale cross beds with a maximum height of 6 cm (2.4 in), ripple marks, fluid-escape structures, rip-up clasts and soft sediment folds and slumps. Rare graded bedding. Abundant metamorphic minerals in **Zmoa** include staurolite, muscovite and chlorite. Deformation of **Zmoa** produced two planar fabrics: an east-dipping fabric associated with **Jg**, and a younger, west-dipping fabric inferred to be Cretaceous in age. The younger fabric cuts the older planar fabric. **Geomorphic Features** Pediments are forming on McCoy Group deposits (**Zmoa**, **Zmq**).	None documented.	**Extensional Tectonics and the Metamorphic Core Complex** In the Tertiary, these units became part of the Metamorphic Core Complex and the lower plate rocks below the Snake Range décollement. **A Passive Margin and Paleokarst** Deposited on a ramp-like continental shelf that formed on a passive tectonic margin bordering the initial North American craton.
		Osceola Argillite (Zmoa)	Green to gray-blue, well-bedded to laminated slates and siltstone. Rare limestone interbeds occur near the base of the unit, and calcareous mudstone occurs throughout the sequence. Gradational contact with **CZpm** over approximately 10–15 m (33–50 ft) where cross-bedded pure quartz sand (**CZpm**) is interbedded with many thin argillaceous intervals (**Zmoa**). The metamorphic grade and the degree of deformation vary. Exposed in the northwestern corner of the park. Thickness in the park ranges from 190 to 200 m (630 to 660 ft).			
		Shingle Creek Shale (Zmsc)	This unit is exposed in the northwestern corner of the park, but it has limited areal extent. No detailed description given.			
		Quartzite (Zmq)	Well-bedded quartzite that forms cliffs, ledges, and slopes. Ledges and slopes increase near the top 20 m (66 ft) of the unit. It varies considerably in thickness and grain size from north to south. To the north, the unit is a thin conglomeratic quartzite, no more than 30 m (100 ft) thick, with clasts consisting mostly of rounded quartz pebbles 1–3 cm (0.4–1.2 in) in diameter. South of Willard Creek, the unit is mostly a well-bedded quartzite with few conglomerate beds in its upper part. Exposed in the northwestern corner of the park where incomplete sections are a maximum of 112 m (370 ft) thick.			

Digital map reference: Miller, E. L, and the Stanford Geological Survey. 2007. Geologic map of Great Basin National Park and environs, Southern Snake Range, Nevada. Stanford Geological Survey (scale 1:24,000). Stanford Geological Survey, Stanford, California, USA.

Reference for unit descriptions: Miller, E. L., and P. B. Gans. 1993. Geologic map of the Wheeler Peak and Minerva Canyon 7.5' Quadrangle, White Pine County, Nevada. Department of Geology, Stanford University, unpublished, OF93.