Map Unit Properties Table: Little Bighorn Battlefield National Monument

Colored rows indicate units mapped within Little Bighorn Battlefield National Monument. Colors in Map Unit column correspond to colors on the overview graphic.

Age	Map Unit (Symbol)	Geologic Description	Geologic Issues	Geologic Features and Processes	Geologic History and Park Connections
QUATERNARY (Holocene)	**Alluvium (Qal)**	Well to poorly stratified, dominantly clast supported, and moderately well sorted gravel, sand, silt, and clay along active channels of rivers, streams, and tributaries. Includes alluvial terrace deposits less than 1.8 m (6 ft) above river or stream. Thickness as much as 10 m (35 ft).	Channel migration and erosion. Flooding potential. Anthropogenic disturbances—Channel relocation, riprap, channel clearing, diking, bridge abutments, and diversion.	Makes up steep riverbanks. Mineral resources—Sand, gravel, clay, and placer gold.	Impaired troop movements during the battle.
QUATERNARY (Holocene and Pleistocene)	**Landslide deposits (Qls)**	Rock and soil that moved down slope in discrete units through mass-wasting processes that resulted in irregular or hummocky surfaces. Thickness 30 m (100 ft) to 46 m (150 ft).	Potential impacts to infrastructure and human safety.	Potentially unstable deposit prone to future gravity-driven movement.	Mass wasting indicates slope instability sometime during the Holocene (the past 11,700 years).
QUATERNARY (Pleistocene)	**Alluvial terrace deposits (Qat)**	Gravel, sand, silt, and clay underlying alluvial terrace surfaces adjacent to and higher in elevation than modern streams and rivers. Poorly to moderately well stratified and sorted with planar and trough cross bedding. At least eight, distinct terrace levels occur along Little Big Horn River, ranging from 3 m (10 ft) to 170 m (560 ft) above the river. Gravel composed of rounded to subrounded clasts of limestone and dolomite, andesite and other mafic volcanic rocks, as well as quartzite, granitic rocks, sandstone, and chert. Thickness 5 m (16 ft) to 15 m (49 ft).	Flooding potential. Erosion potential.	Principal aquifer along the Little Bighorn River. Fossils—Known to contain Pleistocene fossils regionally (e.g., musk ox; see Reheis 1987). Mineral resources—Sand, gravel, and placer gold.	Location of Indian encampment during the battle. Records past floodplain surfaces. Formed during the Pleistocene. Lowest terrace deposit is approximately 20,000 years old; highest is 1.4 million years old (Agard 1989). The wide variety of clasts within the gravels attest to the wide variety of geologic units eroded by the ancient Little Bighorn River.
TERTIARY (Paleocene)	**Tullock Member of Fort Union Formation (Tft)**	Yellowish-gray, fine- to medium-grained trough cross-bedded, plane-bedded, or massive sandstone. Interbedded with brownish-gray or dark-gray carbonaceous shale (much less abundant than the sandstone). Sandstone beds thinner, more tabular, and persistent than those in underlying Lance Formation. Thickness 70 m (230 ft) to 120 m (395 ft).	Shale may cause slippage. Usually forms steep escarpments. Energy development (unit is source of coal).	Fossils—Freshwater shells, ceratopsian supraorbital bone fragment, and plant fossils (Rogers and Lee 1923). Mineral resources—Coal. Water resources—Aquifer.	Originally deposited in lakes and rivers in a large basin formed during the rise of the Rocky Mountains. The major coal beds of the Fort Union Formation, particularly in Wyoming, are deposits of organic material buried in forests within the basin.
UPPER CRETACEOUS	**Lance Formation (Kl)**	Light brownish-gray, fine-grained, cross-bedded, lenticular-bedded, or massive sandstone. Interbedded with light olive-gray to greenish-gray shale, less abundant than the sandstone. Contains calcite-cemented concretionary sandstone lenses. Sandstone beds thicker and more lenticular than those in overlying Tullock Member. In many areas contains very light-gray, fine- to medium-grained sandstone interbedded with coal in the lower part, with some associated clinker. Thickness 140 m (460 ft) to 160 m (525 ft).	Shale may cause slippage. Energy development (unit is source of coal).	Fossils—Abundant marine fauna (Thom and Dobbin 1924). Shells and leaves (Stone and Calvert 1910). Ceratopsian fossils (Calvert 1912). Marine fossils, plants, and bones of reptiles (turtles and dinosaurs), brackish-water oysters (Lloyd and Hares 1915). Freshwater snails (Rogers and Lee 1923). Extensive vertebrate fauna (amphibians, reptiles, mammals, and fish), gastropods, and pelecypods (Breithaupt 1982). Mineral resources—Coal and gypsum. Water resources—Fairly good source of water (Thom et al. 1935).	Originally deposited in Cretaceous Interior Seaway, a shallow sea connecting ancient Gulf of Mexico to ancient Arctic Ocean. Brackish-water fossils suggest shallower marine environments, likely near a shoreline. Potential source of local building stone.
	Fox Hills Formation (Kfh)	Brownish-gray siltstone and fine-grained cross-bedded or hummocky-bedded poorly resistant sandstone interbedded with dark gray shale. Thickness 30 m (100 ft).	Shale may cause slippage. Forms ledges and cliffs (Shroba and Carrara 1996). Bentonite may cause shrink-swell.	Fossils—Rounded concretions with fossils (Brown 1917). Brackish-water pelecypods (Scott 1963). Foraminifera (Van Horn 1957). Flora and burrows, usually *Ophiomorpha* (Rigby and Rigby 1990). Oyster shells and trace fossils (Roehler 1993). Mineral resources—Bentonite (Obradovich and Cobban 1975).	Originally deposited in Cretaceous Interior Seaway, a shallow sea connecting ancient Gulf of Mexico to ancient Arctic Ocean.

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UPPER CRETACEOUS	**Bearpaw Formation (Kb)**	Dark-gray fissile shale interbedded with thin, brownish-gray siltstone and fine-grained sandstone beds. Contains numerous brown-weathering calcareous concretions throughout, and numerous bentonite beds in the middle, one of which is 6 m (20 ft) thick. Thickness as much as 262 m (860 ft).	Shale may cause slippage. Bentonite may cause shrink-swell.	Fossils—Nearly complete plesiosaur (marine reptile) *Dolichorhynchops osborni* collected within the national monument, now on display at the Smithsonian Institution. Calcareous concretions with marine fauna, including fossil lobsters, crabs, and mollusks. Dinosaur fossils elsewhere. Mineral resources—Bentonite and coal.	One of two Cretaceous formations within the national monument; underlies broad flats. Originally deposited in Cretaceous Interior Seaway, a shallow sea connecting ancient Gulf of Mexico to ancient Arctic Ocean.
	Judith River Formation (Kjr)	Yellowish-gray to brownish-gray and olive-green, fine- to medium-grained cross-bedded sandstone interbedded with lesser amounts of yellowish-gray silty shale. Thickness 70 m (230 ft) to 79 m (260 ft).	Shale may cause slippage.	Fossils—Bony fish and shark remains. Marine reptile bones. Dinosaur, soft-shelled turtle, and mammalian fossils. Plant debris and wood fragments. Freshwater clams, gastropods, and shell debris. Invertebrate fossils. Mineral resources—Coal, which is part of the "great lignite group" (Hayden 1869). Water resources—Important aquifer.	One of two Cretaceous formations within the national monument; underlies ridges. Originally deposited in Cretaceous Interior Seaway, a shallow sea connecting ancient Gulf of Mexico to ancient Arctic Ocean.
	Upper Member of Judith River Formation (Kju)	Greenish-gray to brownish-gray sandy shale and shale interbedded with some thin, brown sandstone beds. Thickness 60 m (200 ft) to 136 m (445 ft).	Shale may cause slippage.	See Judith River Formation (Kjr).	Originally deposited in Cretaceous Interior Seaway, a shallow sea connecting ancient Gulf of Mexico to ancient Arctic Ocean.
	Parkman Member of Judith River Formation (Kjp)	Yellowish-gray to brownish-gray and olive-green, fine- to medium-grained cross-bedded sandstone interbedded with yellowish-gray silty shale, less abundant than the sandstone. Thickness 78 m (255 ft).	Shale may cause slippage. Energy development (unit is source of coal).	Fossils—Marine organisms (Darton 1906). Fossiliferous (turtles, crocodiles, and ammonites) (Wegemann 1911). Fossil pollen (Nichols 1994). Mineral resources—Thin coal seams. Oil and gas potential. Water resources–Fairly good source of water (Thom et al. 1935).	Originally deposited in Cretaceous Interior Seaway, a shallow sea connecting ancient Gulf of Mexico to ancient Arctic Ocean.
	Claggett Formation (Kcl)	Brownish-gray and dark-gray fissile or bentonitic shale. Contains distinctive yellowish-tan or orange septarian concretions, many of which contain fossils. Thickness 120 m (395 ft).	Shale may cause slippage. Bentonite may cause shrink-swell.	Fossils—Fossiliferous septarian concretions. Mineral resources—Bentonite.	Originally deposited in Cretaceous Interior Seaway, a shallow sea connecting ancient Gulf of Mexico to ancient Arctic Ocean.
	Gammon Formation (Kga)	Yellowish-brown calcareous siltstone interbedded with yellowish-brown weathering, brownish-gray, calcareous silty shale. Contains several yellowish-brown fine-grained sandstone beds. Contains a zone of reddish-orange ferruginous concretions in sandy shale. Thickness 99 m (325 ft) to 261 m (855 ft).	Shale may cause slippage. Bentonite is nonswelling (Gill et al. 1966).	Fossils—Fossiliferous (Robinson et al. 1959). Mollusks (Merewether 1996). Mineral resources—Ferruginous concretions (Rubey 1931). Bentonite (Knechtel and Patterson 1955).	Originally deposited in Cretaceous Interior Seaway, a shallow sea connecting ancient Gulf of Mexico to ancient Arctic Ocean.