

SYSTEM	SERIES	GROUP, FORMATION, AND MEMBER	THICKNESS (feet)	SECTION	DESCRIPTION OF ROCKS	
QUATERNARY		Alluvium	0-20		Silt, sand, and gravel in flood plains along streams.	
		Landslide debris	0-40		Masses of displaced bedrock on the dip slope of the Elk Mountains.	
TERTIARY(?)		High-level gravel	0-40		Pebbles and cobbles of limestone, sandstone, and quartz in elevated terraces and amorphous deposits.	
CRETACEOUS	Upper Cretaceous	Carlile Shale			Covered	
			53		Shale, dark gray; weathers brown with thin beds of limestone near the top. Poorly exposed in grass-covered flats in the southwestern part of the quadrangle. The Sage Breaks Member.	
			77		Sandstone, brown, fine-grained, firmly cemented; many thin shale partings near base. Seleniferous in lower part. Forms a low hogback in the southwestern part of the quadrangle. The Turner Sandy Member.	
		90		Shale, brown to dark-gray, silty; contains thin beds of bentonite and limestone near the top. Underlies a low swale between the overlying sandstone and the underlying Greenhorn Formation.		
		Greenhorn Formation	Upper unit	70		Thin-bedded limestone and dark-gray, calcareous shale interbedded with thin beds of calcareous light-gray sandstone and siltstone. Fossiliferous. Forms a low hogback.
			Lower unit	183		Limestone concretions Shale, brown soft, calcareous, fissile, fossiliferous; septarian limestone abundant in the upper part. Several thin beds of impure bentonite in lower part. Bentonite
		Belle Fourche Shale	417			Shale, black, fissile, fossiliferous; contains many thin beds of impure bentonite. Shale weathers black. Dark brown oxides of iron are concentrated in zones that have regional continuity. The middle part of the formation is poorly exposed in grass-covered flats in the southwestern part of the quadrangle, but the upper and lower parts are well exposed at many places along the Black Hills monocline.
						Siderite concretions
						Iron oxides
						Bentonite
	Bentonite					
	Lower Cretaceous	Mowry Shale	130		Shale, dark gray, siliceous, silty, hard, fossiliferous; many thin beds of bentonite, siltstone, and laminated sandstone. Forms low rounded discontinuous ridges in the southwestern part of the quadrangle. Bentonite	
					Bentonite	
		Newcastle Sandstone	0-86		Sandstone, light-brown to light-gray, fine-grained, lenticular, strongly cross-stratified, carbonaceous. Forms the rimrock in Whoopup and Rock canyons.	
		Skull Creek Shale	200-250		Shale, black, fissile, soft. Secondary minerals that are abundant locally, particularly in the upper part, include crystals of selenite, concretions and cone-in-cone structures of siderite, septarian calcite, marcasite, pyrite, and jarosite. Best exposures of the formation are in Whoopup and Rock canyons.	
Inyan Kara Group		Fall River Formation	140-160		Upper part composed of carbonaceous siltstone and mudstone with thin beds of fine-grained sandstone. Middle part: thin- to thick-bedded sandstone. Lower part composed of carbonaceous siltstone and beds of laminated siltstone and sandstone. Crops out along the western foot of the Elk Mountains and on the Whoopup anticline.	
		Lakota Formation	Fuson Member	30-370		A succession of mudstone, varicolored claystone, and thin sandstone in the upper part overlies a thick bedded cliff-forming granule sandstone in the lower part. Best exposures are in the canyon of Whoopup Creek and in canyons cut into the dip slope of the Elk Mountains.
			Chilson Member	0-200+		Sandstone, light-brown to light-gray, fine- to medium-grained, thick-bedded; overlies a dark-red to black carbonaceous siltstone. Sandstone is exposed only in the canyon of Whoopup Creek.
JURASSIC	Sundance Formation	Morrison Formation	0-80		Claystone, light-gray to light-green; contains thin beds of marlstone. Exposed along the east scarp and in the deeper canyons on the dip slope of the Elk Mountains.	
		Redwater Shale Member	70-180		Siltstone, light-gray to light-green, clayey, calcareous, friable; contains thin beds of glauconitic sandstone. Forms a steep covered slope along the east scarp of the Elk Mountains.	
		Lak Member	70		Siltstone, light-red, calcareous, well-cemented, weakly fissile. Exposed only along the east scarp of the Elk Mountains.	
		Hulett Sandstone Member	60		Sandstone, light-brown, fine-grained, thin-bedded, calcareous, glauconitic; becomes silty in upper part. Ledge-forming along the east scarp of the Elk Mountains.	
		Stockade Beaver Shale Member	63		Siltstone, light-gray, clayey, calcareous; contains thin beds of light gray fine-grained glauconitic sandstone. Crops out along the east scarp of the Elk Mountains.	
		Gypsum Spring Formation	2-10		Thick-bedded gypsum and thin-bedded calcareous sandstone.	
	TRIASSIC	Spearfish Formation	Upper siltstone unit	257		Siltstone, red, thick-bedded, friable; becomes sandy near top. Underlies grass-covered flats in the Red Valley and forms cliffs at the foot of the scarp along the east side of the Elk Mountains.
Middle unit			222		Siltstone, red, thick-bedded, friable; contains many thin to thick beds of rock gypsum. A bed of purple gypsum 25 feet thick at the base of this unit and a bed of white gypsum 18 feet thick and 45 feet above the purple gypsum crop out conspicuously in erosion gullies in the Red Valley.	
PERMIAN	Spearfish Formation	Lower siltstone unit	50-80		Siltstone, red, thick-bedded, friable; contains many veinlets of satin spar. Underlies grass-covered flats in the Red Valley.	
		Minnekahta Limestone	40		Limestone, light-gray, thin- to thick-bedded, weathers pink. Crops out in the northeast part of the quadrangle.	
		Opeche Formation	75		Siltstone, red, sandy; upper part is a purple shale. Underlies covered slopes in Ferguson and Gillette canyons.	
		Minnelusa Formation	40+		Covered	

COLUMNAR SECTION OF SEDIMENTARY ROCKS IN THE
CLIFTON QUADRANGLE, WYOMING AND SOUTH DAKOTA