Map Unit Properties Table: Hagerman Fossil Beds National Monument

Units listed in gray rows are not exposed within Hagerman Fossil Beds National Monument.

Age	Unit Name[1] (Symbol)	Features and Description	Erosion Resistance	Suitability for Development	Hazards	Paleontological Resources	Cultural Resources	Mineral Occurrence	Habitat	Recreation	Geologic Significance
QUATERNARY (Holocene)	Stream alluvium (Qal)	Unconsolidated silt, sand, and gravel of channel bars, islands, and shorelines. Typically 0.3 to 3 m (1 to 10 ft) thick. Limited exposure in the monument along the Snake River in section 21, Township 7 South, Range 13 East (sec. 21, T7S, R13E).	Low	Low. Limited exposure and within flood plain.	Flooding; bank erosion.	None	Unknown	Sand and gravel	Riparian zone vegetation and localized wetlands.	Hunting [to 15 m (50 ft) above river] and fishing zone.	None
	Landslide debris (Qls)	Unconsolidated landslide debris. Slumps, slides, and debris flows originating in the Glenns Ferry Formation are composed of unsorted and unstratified silt and clay. Exposed in the northern part of the monument & along the Snake River in sec. 21, T7S, R13E.	Low to variable	Low. Unstable slopes; some landslides remain active.	Active landslides impact fossil resources and visitor safety.	None	Unknown	None	Sparsely vegetated.	Hunting [to 15 m (50 ft) above river] and fishing zone.	Geologic hazard that impacts fossil preservation.
QUATERNARY (Upper Pleistocene)	Older alluvium (Qoa)	Pebble and cobble gravel in terraces 15 to 30 m (25 to 100 ft) above present Snake River. In tributary valleys, consists of fine-grained stratified deposits in terraces 1.5 to 3 m (5 to 10 ft) above flood plains. Supports moderately developed calcareous soil.	Low, especially on steeper slopes	Limited exposures along Snake River in sections 16 and 21, T7S, R13E.	None documented	None	Unknown	Sand and gravel	Riparian zone vegetation and localized wetlands.		None
REGIONAL UNCONFORMITY											
QUATERNARY (Middle Pleistocene)	SNAKE RIVER GROUP: Crowsnest Gravel (Qcg)	Stratified sand and pebble gravel that overlies Yahoo Clay. At location along Crows Nest Road (southeast of the monument) overlies well-bedded clay, silt, and rippled sand. Gravel clasts composed of felsic volcanic rocks, quartzite, and chert. Thickness about 1.8 m (6 ft). Original thickness and extent unknown owing to erosion by Bonneville Flood.	Not exposed in the monument.	Not exposed in the monument.	Not exposed in the monument.	Not exposed in the monument.	Not exposed in the monument.	Not exposed in the monument.	Not exposed in the monument.	Not exposed in the monument.	Unit may be channel deposits of ancestral Yahoo Creek that were deposited on Yahoo Clay as McKinney Lake drained.
	SNAKE RIVER GROUP: Yahoo Clay (Qbs)	*Originally mapped as Bruneau Formation, "sedimentary material" (Qbs) by Malde and Powers 1972. Mapped as "Qy" in Othberg and others (2005).* Pinkish white to light yellowish brown clay and silt. Laminated to thin-bedded. Conchoidal fracture when dry. Common partings along bedding and vertical jointing produce small blocks when exposed. Malde (1982) described the type locality near the mouth of Yahoo Creek (south of the monument), the lava-dam origin, and the distribution of the clay in the Snake River canyon from near Bliss, Idaho, to the Melon Valley. Stratigraphic evidence demonstrates that the Yahoo Clay is younger than the basalt of Notch Butte, but older than the Bonneville Flood. Scoured by the maximum stage of the Bonneville Flood. Flood features include streamlined topography and a relict cataract and plunge pool 0.8 km (0.5 mi) east of Hagerman.	Low. Landslide potential. Yahoo Clay weathers to form "popcorn" texture on the surface due to shrink and swell properties of clay.	Low. Isolated and areally restricted exposures along lower slopes. Road in the southern part of the monument crosses Yahoo Clay.	Swelling clay that expands when wet and shrinks upon drying may destabilize slopes.	Mollusk fossils from Yahoo Clay west of Hagerman (Malde 1982): *Fossaria dalli*, *Lymnaea caperata*, *Gyraulus circumstriatus*, *Pupilla muscorum*, *Vertigo ovate*, *Vallonia gracilicosta*, *Succinea?*, *Discus cronkhitei*. Pollen grains: *Picea, Pinus*, *Populus*, *Abies*, Cyperaceae, Gramineae, Compositae, unidentified dicots and spores.	Artifacts of prehistoric and historic American Indian cultures; visible sections of the Oregon Trail; remnants of early 20th century ranching; artifacts of early paleo excavation sites.	None	Sagebrush steppe plant communities (native) compete with non-native plant species.	Snake River Overlook has parking, hiking trail, wheelchair accessibility; unit contains a portion of the Oregon Trail.	Clay attributed to McKinney Lake, a temporary lake formed by damming of the Snake River by basalt of McKinney Butte.
REGIONAL UNCONFORMITY											
QUATERNARY (Lower Pleistocene)	IDAHO GROUP: Tuana Gravel (Qt)	Pebble and cobble gravel interbedded with layers of massive brown to gray sand and silt; well-bedded and sorted; forms surface of the Bruneau Plateau; exposures along Tuana Gulch and Salmon Falls Creek (west of monument) are composed mostly of silicic volcanic debris that covers an erosion surface of 180 to 240 m (600 to 800 ft) above the Snake River. Capped by a massive caliche layer, or duripan, several feet thick. Top is eroded. About 61 m (200 ft) thick at Indian Butte, 16 km (10 mi) southwest of Hagerman. Age is poorly constrained.	Well-cemented caliche layer forms a cap rock resistant to weathering.	Unit is developed on the Bruneau plateau with roads, some buildings, pipelines, and abandoned canals. Before sale to the state in 2005 plateau was private irrigated cropland.	Undercutting the caliche layer may lead to caprock collapse and landslides.	A few fossil vertebrates, including camel material, are in the monument's collections.	Paleo-Indian artifacts; visible sections of the Oregon Trail.	Gravel	Sagebrush steppe plant communities (native) compete with non-native plant species.	Oregon Trail Overlook has parking, hiking trail, horseback riding, wheelchair accessibility; unit contains a portion of the Oregon Trail.	Clast imbrication and gravel lithologies suggest deposition by an ancestral Salmon Falls Creek (Othberg et al. 2005).
EROSIONAL CONTACT BETWEEN TUANA GRAVEL and GLENNS FERRY FORMATION											

Age	Unit Name[1] (Symbol)	Features and Description	Erosion Resistance	Suitability for Development	Hazards	Paleontological Resources	Cultural Resources	Mineral Occurrence	Habitat	Recreation	Geologic Significance
NEOGENE (Pliocene)	Glenns Ferry Formation (QTg, QTgs, QTgc)	Basin fill of poorly consolidated detrital material and minor lava flows of basalt. Includes most of the Hagerman Lake Beds of former usage (Stearns et al. 1938). Sequence of bedding interrupted by numerous minor unconformities as a consequence of contemporaneous faulting and basin subsidence. Beds usually dip 3° or less and extend over many square miles, but some local angular discordances are as large 10°. About 610 m (2,000 ft) are exposed in the Glenns Ferry – Hagerman region. Although mapped as Quaternary-Tertiary by Malde and Powers (1972), the unit is entirely Pliocene in age (Greg McDonald, NPS senior curator for natural history, written communication, October 27, 2008; McDonald et al. 1996). The International Commission on Stratigraphy has replaced the term "Tertiary" with "Paleogene" and "Neogene." ***QTg***: Glenns Ferry Formation. Poorly consolidated, bedded lake & stream deposits characterized by abrupt lateral changes in lithofacies between neighboring sequences several hundred feet thick. In Hagerman Valley, consists of primarily floodplain deposits composed of calcareous olive-colored silt, dark clay, sand (locally cemented), and fine-pebble gravel. Different lithofacies include: (1) silt in massive layers marked with faint banding; (2) sand in evenly layered thick beds cemented locally to flaggy sandstone; (3) dark, thinly bedded clay, olive silt, and carbonaceous shale; (4) ripple-marked sand and silt; (5) granitic sand and fine pebble gravel; and (6) quartzitic cobble gravel. Age considered to be approximately 4 to 3 million years (McDonald et al. 1996; Greg McDonald, written communication, October 27, 2008), 3.4 to 3.8 million years (Othberg et al. 2005), or 3.7 to 3.3 million years (Hutchison 1987; Dennison-Budak 2008). ***QTgs***: Basalt of Shoestring Road. Gray to sooty brown, medium-grained basalt with common to abundant plagioclase laths as long as 1 cm (0.4 in) and weathered olivine crystals. Forms a thin layer 9 to 15 m (30 to 50 ft) thick within the Glenns Ferry sediments on the west side of the Snake River that extends northward from the Hagerman Horse Quarry. Locally, the basalt flow thins, pinches out, or is replaced by layered volcaniclastic deposits. Source is a vent 5 km (3 mi) south of Bliss. At the mouth of Tuana Gulch (northwest of the monument), the unit is about 30 m (100 ft) thick. ***QTgc***: Clover Creek lava flow. Fine-grained, plagioclase–olivine basalt. Source unknown. Minor exposure mapped by Malde and Powers (1972) near the west bank of the Snake River in sections 21 and 28, T7S, R13E. Exposure is not mapped by Othberg and others (2005). Thickness exceeds 30 m (100 ft) near mouth of Clover Creek, north of the monument.	Low. Poorly consolidated and prone to landsliding.	Low due to steep slopes, perched aquifers, and unconsolidated sediment ***QTg***: Primary unit exposed in the slopes of the monument; ***QTgs***: Limited exposure. Thin band exposed within ***QTg*** in northern part of the monument. ***QTgc***: Limited to narrow band along the Snake River in sections 21 and 28, T7S, R13E. Mostly covered by ***Qls***.	Landslides; radioactivity.	Over 550 sites in different horizons. Some of the significant fossils include:[2] <u>Mammals</u> *Equus simplicidens* (Hagerman Horse); 5 species of shrew – 4 in genus *Sorex*, 1 in *Paracryptotis*; 2 rabbits – *Hypolagus limnetus, H. gidleyi*; many varieties of squirrels, mice, rats, beavers, voles; 2 beavers – *Castor californicus, Dipoides*; 1 species of sloth – *Megalonyx leptostomus*; families in Order Carnivora – Canidae, Ursidae, Mustelidae, Felidae; significant carnivore species include *Sminthosinis bowleri* (Mustelidae), *Puma lacustris* (Felidae), *Canis lepophagus* (Canidae); other orders are Proboscidea (mastodont), Perissodactyla (odd-toed ungulates), Artiodactyla (even-toed ungulates; families in Artiodactyla – Tayassuidae (peccaries), Camelidae (camels), Cervidae (deer, caribou, moose), Antilocapridae (pronghorns). <u>Fish</u> Dominated by *Mylopharodon hagermanensis*; western catfish; 7 new species – *Ameiurus vespertinus* (catfish), *Archoplites taylori* (sunfish); *Signopharyngodon idahoensis*; *Ptychochilus oregonensis*. <u>Reptiles</u> Snake fossils: *Thamnophis* (garter snake); *Coluber* (racer); *Elpaphe pliocenica* and *E. vulpine* (rat snake); *Lampropeltis* (milk snake); Pond turtles: *Trachemys idahoensis; Clemmys owyheensis*. <u>Birds</u> *Colymbus* sp., *Pelecanus halieus, Phalacrocorax idahensis, Phalacrocorax auritus, Chen pressa, Gallinula choropus, Cygnus* sp., *Ouerquedula* sp., *Cygnus columbianus, Porzana lacustris, Bucephala* sp., *Phalacrocorax macer, Cygnus hibbardi, Anas platyrhychus, Olor hibbardi, Anser pressus, Nettion bunkeri, Olor columbianus, Ciconia maltha, Grus americana, Speotyto megalopenze, Asio brevipes, Pliolymbus baryosteus, Podiceps discors, Aechmorphorus elasson, Podilymbys majusculus, Rallus prenticei, Rallus lacustris, Rallus elegans-longirostris, Coturnicops avita, Gallinula* sp.	Artifacts of prehistoric and historic American Indian cultures; visible sections of the Oregon Trail; remnants of early 20th century ranching; artifacts of early paleo excavation sites.	Diatomite	Sagebrush steppe plant communities (native) compete with non-native plant species. Steep slopes contribute to plant diversity.	Oregon Trail Overlook has parking, hiking trail, horseback riding, wheelchair accessibility; unit contains a portion of the Oregon Trail; few developed trails in the monument.	World-renowned fossil site. Quantity, quality, and species diversity of fossil sites are globally significant in terms of fauna and flora evolution, Pliocene ecosystems, and Cenozoic climate change.

1: Except for the Yahoo Clay, units are from Malde, H. E. and H. A. Powers, 1972, *Geologic map of the Glenns Ferry- Hagerman area, west- central Snake River Plain, Idaho*, Scale 1:48,000, Miscellaneous Geologic Investigations Map I-696, Reston, VA: U.S. Geological Survey. Malde (1982) named the Yahoo Clay and revised the stratigraphy so that the previously mapped Bruneau Formation is replaced by the Yahoo Clay. The Bruneau Formation is not exposed in the monument.

2: McDonald and others (1996) contains a complete list of fossils identified from Hagerman Fossil Beds National Monument