Geologic Map Unit Properties Table: Aniakchak National Monument and Preserve (see Plate 1)

Unit descriptions were derived primarily from Detterman et al. (1981, 1987), Detterman et al. (1996), and Wilson et al. (1999). Gray shaded map units are not mapped within Aniakchak National Monument and Preserve. Bold text refers to report sections.

Age	Map Unit (Symbol)	Description	Features and Processes	Resource Management Issues	History
QUATERNARY	Surficial deposits (**Qs**)	Undifferentiated, unconsolidated deposits. See Quaternary Geologic Map Unit Properties Table and Plate 2 for individual units.	See Quaternary Geologic Map Unit Properties Table.	See Quaternary Geologic Map Unit Properties Table.	See Quaternary Geologic Map Unit Properties Table.
QUATERNARY (Holocene and late Pleistocene)	Moraines and other glacial deposits (**Qm**)	Unconsolidated, poorly sorted, and nonstratified glacial drift forming moraines and kame topography. Glacial drift divided into glacial advances in Plate 2 and the Quaternary Geologic Map Unit Properties Table.	**Glaciers and Glaciations**—End, lateral, and ground moraines; glaciolacustrine deposits; knobs, kettles, and ice-contact deposits	**Geohazards**—Unconsolidated units are easily eroded and susceptible to landsliding when exposed on slopes or undercut by streams.	**Quaternary Volcanism and Glaciation**—The oldest glacial deposits are from the Mak Hill glaciation, which took place more than 44,000 years ago. Most glacier deposits are younger and part of the Brooks Lake glaciation, which occurred 10,000 years ago or earlier.
QUATERNARY (Holocene and late Pleistocene)	Pyroclastic and debris-flow deposits (**Qpd**)	Consolidated and unconsolidated, poorly sorted volcanic ash and debris flows. Consists of basaltic andesitic to rhyolitic pumice, ash, ash-flow tuffs, scoria bombs, and lithic fragments.	**Aniakchak II, The Caldera Forming Eruption**—Forms broad fields of loose materials in the caldera and along its flanks. Where dissected by rivers or streams, the welded ignimbrites can form steep cliffs.		**Quaternary Volcanism and Glaciation**—Most of the pyroclastic and debris flow materials were formed during the caldera forming eruption (Aniakchak II). The Aniakchak II eruption deposits in the caldera are overlain by the numerous eruptions from Half Cone and Vent Mountain, and locally by the 1931 eruption.
QUATERNARY	Younger volcanic rocks, undivided (**Qv**)	Dacite, andesite, and basalt lava flows, breccia, pyroclastic flows, and air-fall deposits.	**Pre-Caldera Eruption Features**—The caldera walls are formed of pre-Aniakchak II eruption volcanic rocks that are as yet undifferentiated.	None reported	**Quaternary Volcanism and Glaciation**—The caldera wall forming volcanic rocks are as old as 850,000 years.
TERTIARY	Older volcanic rocks, undivided (**Tvu**)	Andesite, dacite, and basalt flows, domes, and stocks.	**Tertiary Igneous Rocks**—Tertiary igneous rocks are part of a larger belt of similar age igneous rocks that span the length of the Alaska Peninsula and continue up to the Alaska Range		**Tertiary Sedimentary Rocks and Initiation of a New Volcanic Arc**—The Meshik Volcanics (**Tm**) and associated intrusive rocks represent volcanic activity along the Aleutian arc after the subduction zone moved.
TERTIARY (Pliocene and Miocene)	Younger Intrusive rocks (**Ti**)	Hypabyssal rhyolite porphyry, dacitic felsite, and hornblende andesite that form dikes, plugs, and stocks.	**Tertiary Igneous Rocks**—Dikes, plugs, and stocks.	**Mineral Extraction**—The Mike prospect (Mo, Cu), located 8 km (5 mi) northeast of the preserve boundary, is associated with rhyolitic porphyry dikes of this unit.	
TERTIARY (early Oligocene and late Eocene)	Older intrusive rocks (**Tiu**)	Primarily small stocks and plugs of diorite.	**Tertiary Igneous Rocks**—Small stocks and plugs	None reported	

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Age	Map Unit (Symbol)	Description	Features and Processes	Resource Management Issues	History
TERTIARY (early Oligocene and late Eocene)	Meshik Volcanics (**Tm**)	Leucobasaltic to dacitic flows, tuff, agglomerate, and lahar flows. Associated hypabyssal basalt and andesite plugs. Minor amounts of volcaniclastic sedimentary rocks.	**Tertiary Igneous Rocks**—Flows, tuff, plugs, and sedimentary rocks.	**Geohazards**—Poorly consolidated Tertiary units are associated with many large landslides (geologic map unit **Qls**; see Plate 2 and Quaternary Geologic Map Unit Properties Table).	**Tertiary Sedimentary Rocks and Initiation of a New Volcanic Arc**—The Meshik Volcanics (**Tm**) and associated intrusive rocks represent volcanic activity along the Aleutian arc after the subduction zone moved.
TERTIARY (middle Eocene to late Paleocene)	Tolstoi Formation (**Tt**)	Nonmarine and shallow marine sandstone, siltstone, and conglomerate.	**Tertiary Sedimentary Rocks of the Tolstoi Formation**— Abundant plant fossils, including petrified logs, and marine mollusks and dinoflagelates..	**Geohazards**—Poorly consolidated Tertiary units are associated with many large landslides (geologic map unit **Qls**; see Plate 2 and Quaternary Geologic Map Unit Properties Table). **Paleontological Resource Inventory, Monitoring, and Protection**—possible theft of petrified wood and plant fossils. A field-based paleontological resource survey can provide detailed, site-specific descriptions and resource management recommendations	**Tertiary Sedimentary Rocks and Initiation of a New Volcanic Arc**—Megaflora and marine invertebrate species indicate the unit was deposited when the climate was warmer than at present.
			Unconformity		
LATE CRETACEOUS	Hoodoo Formation (**Kh**)	Marine deep water siltstone and sandstone turbidites deposited along a marine shelf and slope in submarine fans.	**Upper Cretaceous Marine and Nonmarine Sedimentary Rocks**—*Inoceramus* and ammonite fossils.	**Paleontological Resource Inventory, Monitoring, and Protection**—Possible theft or vandalism of invertebrate fossils or dinosaur tracks. A field-based paleontological resource survey can provide detailed, site-specific descriptions and resource management recommendations	**Cretaceous Sedimentary Rocks and Unconformity**—**Kh** is a lateral marine facies deposited on a marine shelf and lower slope of a submarine fan; it is coeval with the Chignik Formation (**Kc**)
LATE CRETACEOUS	Chignik Formation (**Kc**)	Nonmarine and marine pebble-cobble conglomerate and coarse-grained sandstone that is interbedded with shale, coal, and siltstone. Deposited as a cyclic nearshore marine, tidal flat, and nonmarine flood plain and fluvial deposit	**Upper Cretaceous Marine and Nonmarine Sedimentary Rocks**—Hadrosaur tracks were first record of Cretaceous dinosaurs in western Alaska. Minor petrified wood in the nonmarine sections. *Inoceramus* and ammonite fossils in the marine portions of the unit.		**Cretaceous Sedimentary Rocks and Unconformity**—Lower contact of **Kc** is unconformable with lower units, representing a major erosion period followed by nonmarine deposition.
			Unconformity		
EARLY CRETACEOUS	Herendeen Formation (**Khe**)	Marine thin-bedded calcareous sandstone and siltstone.	**Upper Jurassic to Lower Cretaceous Marine Sedimentary Rocks**—Sandstone is made up of quartz, feldspar, and volcanic grains. *Inoceramus*, ammonite, and belemnite fossils.	**Paleontological Resource Inventory, Monitoring, and Protection**—A field-based paleontological resource survey can provide detailed, site-specific descriptions and resource management recommendations although these units are not mapped within the monument and preserve.	**Cretaceous Sedimentary Rocks and Unconformity**—**Khe** and **Kst** deposited in marine setting between approximately 145 and 135 million years ago.
EARLY CRETACEOUS	Staniukovich Formation (**Kst**)	Marine siltstone and shale with minor sandstone.	**Upper Jurassic to Lower Cretaceous Marine Sedimentary Rocks**—*Buchia*, *Inoceramus*, and other bivalve fossils.		

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Age	Map Unit (Symbol)	Description	Features and Processes	Resource Management Issues	History
LATE JURASSIC	Naknek Formation, undivided (**Jn**)	Marine and locally nonmarine arkosic conglomerate and sandstone with abundant feldspar grains and plutonic clasts.	**Upper Jurassic to Lower Cretaceous Marine Sedimentary Rocks**—The oldest rocks within the map area, and the most extensive Mesozoic rock unit. The Naknek Formation was derived predominantly from Jurassic plutonic rocks of the Peninsular terrane. *Buchia*, bivalve, ammonite, belemnite, and gastropod fossils. Potential for dinosaur tracks in lowest nonmarine member. **Jni** forms the lower white cliffs at The Gates and The Garden Wall and contains *Buchia*, bivalve, ammonite, belemnite, and gastropod fossils. **Jns** contains *Buchia*, bivalve, ammonite, belemnite, and gastropod fossils. **Jnn** contains aeolian and fluvial cross-bedding. Potential for dinosaur tracks in lowest nonmarine member.	**Paleontological Resource Inventory, Monitoring, and Protection**—Possible theft or vandalism of invertebrate fossils or dinosaur tracks. A field-based paleontological resource survey can provide detailed, site-specific descriptions and resource management recommendations	**Jurassic Volcanic Arc and Sedimentary Rocks**—Records initiation of major uplift of the parts of the Peninsular terrane west of the Bruin Bay fault.
LATE JURASSIC	Naknek Formation, Indecision Creek Sandstone Member (**Jni**)	Arkosic sandstone.			
LATE JURASSIC	Naknek Formation, Snug Harbor Siltstone Member (**Jns**)	Marine siltstone and shale containing calcareous concretions.			
LATE JURASSIC	Naknek Formation, Northeast Creek Sandstone Member (**Jnn**)	Nonmarine and shallow marine sandstone and conglomerate.			