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<p><b><u>Precambrian Era (4.6 billion to 544 Million Years Ago)</u></b></p> <p>The Precambrian rocks located within the area contain no paleontological resources.</p>	
<p><b><u>Paleozoic Era (544 to 245 Million Years Ago)</u></b></p> <p>The Paleozoic Era is divided into seven periods: Cambrian, Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, and Permian.</p>	
	<p><b>Cambrian Period (544 to 505 Million Years Ago)</b></p> <p>The Cambrian Formations present in the Pinedale RMPPA include the Flathead Sandstone, the Gros Ventre Formation, and the Gallatin Limestone (Love et al. 1993).</p> <ul style="list-style-type: none"> <li>• <u>Flathead Sandstone</u>--Fossil vertebrates and significant invertebrate fossils have not been reported from the Middle Cambrian Flathead Sandstone (Daitch and Robinson 2002). Brachiopods are known to occur in several Flathead localities throughout Wyoming; however, they have not been determined to be significant.</li> <li>• <u>Gros Ventre Formation</u>--Fossil vertebrates and significant invertebrate fossils are not known to occur in Gros Ventre sediments (Daitch and Robinson 2002). Reported insignificant invertebrate fossils include trilobites (<i>Alokistocare</i>, <i>Bolaspis</i>) and mollusks (<i>Hyolithes</i>).</li> <li>• <u>Gallatin Limestone</u>--No significant invertebrate or vertebrate fossils are known to occur within the formation (Daitch and Robinson 2002).</li> </ul>
	<p><b>Ordovician Period (505 to 440 Million Years Ago)</b></p> <p>Several invertebrate groups, such as mollusks and corals, as well as nonvertebrate chordates (conodonts and graptolites), are reported from the Upper Ordovician Bighorn Dolomite. Significant fossil vertebrates are rare. The only known occurrences of fossil vertebrates within the Bighorn Dolomite are from the upper part of the Bighorn Dolomite in the Bighorn Mountains in northeastern Wyoming (Daitch and Robinson 2002).</p>
	<p><b>Silurian Period (440 to 410 Million Years Ago)</b></p> <p>There are no rocks or paleontological resources of Silurian age in the Pinedale RMPPA.</p>
	<p><b>Devonian Period (410 to 360 Million Years Ago)</b></p> <p>The Upper Devonian Darby Formation has been assigned a Class 3 paleontology potential throughout Wyoming. Fossils in the Upper Devonian Darby Formation include several invertebrate groups and conodonts (Daitch and Robinson 2002). No fossil vertebrates have been reported; however, based on age and sediment type, it is possible for as yet unidentified vertebrate fossils to occur within the unit.</p>

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	<p><b>Mississippian Period (360 to 325 Million Years Ago)</b></p> <p>The Mississippian Madison Limestone has produced abundant invertebrates including mollusks, crinoids, brachiopods, and corals; however, no significant vertebrate fossils have been reported (Daitch and Robinson 2002). There is the possibility that unidentified fossil vertebrates are present in Madison Limestone sediments.</p>
	<p><b>Pennsylvanian Period (325 to 286 Million Years Ago)</b></p> <p>There are two Pennsylvanian-age formations mapped within the Pinedale RMPPA, the Lower Pennsylvanian Amsden Formation, and the Pennsylvanian Tensleep Formation.</p> <ul style="list-style-type: none"> <li>• <u>Amsden Formation</u>--The Amsden Formation is well known for its diverse invertebrate fauna, and rare fossil fish remains have been reported in Wyoming as well (Daitch and Robinson 2002).</li> <li>• <u>Tensleep Sandstone</u>--Fossils recorded in the Pennsylvanian Tensleep Sandstone include several invertebrate groups, although no significant fossil vertebrates have been reported (Daitch and Robinson 2002). It is possible for unidentified vertebrate fossils to occur within the unit.</li> </ul>
	<p><b>Permian Period (286 to 245 Million Years Ago)</b></p> <p>The Permian Phosphoria Formation is known for its extensive invertebrate fauna, and fish remains, although fairly rare, have been reported (Daitch and Robinson 2002). Fossil shark teeth from the genus <i>Heliocoprion</i> have been collected from Phosphoria sediments. The teeth are often sold on the commercial market, where they are prized for their unusual spiral arrangement and display value (Daitch and Robinson 2002).</p>
<p><b><u>Mesozoic Era (245 to 65 Million Years Ago)</u></b></p> <p>The Mesozoic Era is often referred to as the “age of dinosaurs.” The Mesozoic is divided into three periods: Triassic, Jurassic, and Cretaceous.</p>	
	<p><b>Triassic Period (245 to 208 Million Years Ago)</b></p> <p>Five Triassic-age formations are mapped within the area: the Dinwoody Formation, the Woodside Shale, the Thaynes Limestone, the Ankareh Formation, and the Nugget Sandstone.</p> <ul style="list-style-type: none"> <li>• <u>Dinwoody Formation</u>--Fossils reported in the Lower Triassic Dinwoody Formation include invertebrates and conodonts (Daitch and Robinson 2002). No vertebrate fossils have been recorded; however, unidentified vertebrate fossils may be present within the unit.</li> <li>• <u>Woodside Shale</u>--No fossils have been recovered from the Woodside shale; nevertheless, sediment type and age indicate that significant fossils may be present in some areas (Daitch and Robinson 2002).</li> </ul>

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	<ul style="list-style-type: none"> <li>• <u>Thaynes Limestone</u>—Fossils recorded in the Lower Triassic Thaynes Limestone include invertebrates and trace fossils. The lower-most limestone contains a prolific ammonoid-bearing bed, containing <i>Meekoceras</i>. No vertebrate fossils have been reported from the Thaynes Limestone; nevertheless, sediment type and age indicate that significant fossils may be present in some areas (Daitch and Robinson 2002).</li> <li>• <u>Ankareh Formation</u>-- Fossils reported from Ankareh sediments include various invertebrate groups, plant remains, and root casts. Significant vertebrate fossils are limited to lungfish tooth plates (Daitch and Robinson 2002).</li> <li>• <u>Nugget Sandstone</u>--The Nugget Sandstone is of uncertain age (Upper Triassic or Lower Jurassic). No vertebrate bones have been reported, although vertebrate tracks are well known (Daitch and Robinson 2002).</li> </ul>
	<p><b>Jurassic Period (208 to 146 Million Years Ago)</b></p> <p>There are six Jurassic-age formations mapped in the area: the Gypsum Springs Formation, the Twin Creek Limestone, the Preuss Formation, the Stump Sandstone, and the Morrison and Cloverly Formations. All six units have the potential to produce significant fossils in the area.</p> <ul style="list-style-type: none"> <li>• <u>Gypsum Springs Formation</u>--The Jurassic Gypsum Springs Formation is, in general, poorly fossiliferous, although reports of <i>Pholadomya</i>, <i>Trigonia</i>, and <i>Astarte</i> are known (Wanless et al. 1955).</li> <li>• <u>Twin Creek Limestone (Sundance Formation)</u>--Fossils have been reported in the Middle to Upper Jurassic Twin Creek Limestone; however, only invertebrate faunas, including <i>Grypaea</i> and <i>Pentacrinus</i>, have been found to date (Daitch and Robinson 2002).</li> <li>• <u>Preuss Formation</u>--No significant vertebrate fossils have been recorded in the Middle to Upper Preuss Formation, although unidentified significant paleontological resources may be present.</li> <li>• <u>Stump Sandstone</u>--Rare fossil vertebrates have been reported in the Middle to Upper Stump Sandstone sediments, and both invertebrate and trace fossils have been reported in abundance (Daitch and Robinson 2002).</li> <li>• <u>Morrison Formation and Cloverly Formation</u>--The Morrison Formation is well known for producing significant and highly diverse fauna and flora that includes mollusks, fish, trace fossils, as well as various dinosaurs, such as <i>Camptosaurus</i>, <i>Allosaurus</i>, <i>Brachiosaurus</i>, <i>Apatosaurus</i>, and <i>Stegosaurus</i> (Jenkins and Jenkins 1993, Turner and Peterson 2002). The Cretaceous Cloverly Formation has produced a diverse dinosaur fauna, as well as other Mesozoic reptiles and early Cretaceous mammals (Daitch and Robinson 2002).</li> </ul>
	<p><b>Cretaceous Period (146 to 65 Million Years Ago)</b></p> <p>There are ten geologic units of Cretaceous age in the area, including the Gannett Group, the Bear River Formation, the Mowry Shale, the Thermopolis Shale, the Aspen Shale, the Frontier Formation, the Hilliard Shale, the Cody Shale, the Adaville Formation, and the Pinyon Conglomerate. All ten formations have a moderate to high potential to produce significant vertebrate fossils in the Pinedale area.</p> <ul style="list-style-type: none"> <li>• <u>Gannett Group</u>--Fossils in the Lower Cretaceous (or possibly upper Jurassic) Gannett Group appear to be rare and discoveries have thus far been limited to invertebrates and pollen.</li> <li>• <u>Bear River Formation/Mowry Shale</u>--Fossils reported from the Mowry Shale include various invertebrate groups, fish (including the oldest known acanthomorph teleost), ichthyosaurs, plesiosaurs, and crocodylians. Fossils assigned to the Bear River Formation include both fresh</li> </ul>

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	<p>and brackish water invertebrates, as well as plant remains.</p> <ul style="list-style-type: none"> <li>• <u>Thermopolis Shale/Aspen Shale</u>-- The only reported fossils within both units are invertebrates; no fossil vertebrates have been recorded.</li> <li>• <u>Frontier Formation</u>--The Frontier Formation contains rare fish, and numerous plant and invertebrate fossils; it is known for its abundant ammonite fauna (e.g., Knowlton 1917; Ware 1927; Andrews and Pearsall 1941; Cobban 1987a, 1987b, 1988, 1990).</li> <li>• <u>Hilliard Shale/Cody Shale</u>--To date, foraminiferal (microfossil) studies comprise the bulk of the paleontologic investigation in the Hilliard Shale.</li> <li>• <u>Adaville Formation</u>--The Upper Cretaceous Adaville Formation contains invertebrate and plant remains, but no vertebrates have thus far been reported (e.g., Rubey et al. 1975).</li> <li>• <u>Pinyon Conglomerate</u>--The Upper Cretaceous/Lower Tertiary Pinyon Conglomerate and its correlative formations contain abundant and important vertebrate remains (fish, lizard, and mammal fossils), in addition to invertebrate and plant remains.</li> </ul>
<p><b><u>Cenozoic Era (65 Million Years Ago to Present Day)</u></b></p> <p>The Cenozoic Era, also known as the “age of mammals,” spans from 65 million years ago to the present day. The Cenozoic is broken into two periods of geologic time, the Tertiary and the Quaternary. Due to a more complete fossil record, the Tertiary Period can be broken down further into five epochs: Paleocene, Eocene, Oligocene, Miocene, and Pliocene. The Quaternary Period is broken into two epochs: the Pleistocene and Holocene (or Recent; our current period of geologic time). A discussion of the paleontological resources of Cenozoic age contained within the area is presented below.</p>	
	<p><b><u>Tertiary Period (65 to 1.8 Million Years Ago)</u></b></p> <p>The Tertiary Period is broken into five epochs, the Paleocene, Eocene, Oligocene, Miocene, and Pliocene. Highly significant paleontological resources of Tertiary age are found in the Pinedale RMPPA.</p> <ul style="list-style-type: none"> <li>• <u>Paleocene Epoch (65 to 54 Million Years Ago)</u>--There are no rocks or paleontological resources assigned to formation status of Paleocene age in the area, although the Pinyon Conglomerate (see above) may be in part Paleocene in age, and the Chappo Member of the Wasatch Formation may contain a mammalian fauna of mid- to late Paleocene age.</li> <li>• <u>Eocene Epoch (54 to 38 Million Years Ago)</u>--Strata of Eocene age in the Pinedale RMPPA consist of the Wasatch, Green River, and Pass Peak Formation (Bradley 1964). These formations were deposited somewhat contemporaneously and contain rich vertebrate remains; thus, they have similarly high Paleontological Class designations (4 or 5).</li> <li>• <u>Pass Peak Formation</u>--The Lower Eocene Pass Peak Formation contains a diverse vertebrate fauna typical of the upper Wasatchian land mammal stage (early Eocene), as well as a molluscan fauna (Dorr 1969).</li> <li>• <u>Wasatch Formation</u>--Much of the Wasatch Formation is considered Lower Eocene, although a mid- to late Tiffian (mid- to late Paleocene) mammalian fauna is known from the Chappo Member (Gunnell 1994) and a middle Eocene mammalian fauna has been reported from the Cathedral Bluffs Tongue (West and Dawson 1973). The Wasatch Formation contains a well preserved but fragmentary record of vertebrate fossils, including fish, reptiles, birds, and mammals, as well as invertebrate and plant fossils. A large body of literature has been published on the Wasatch Formation (e.g., McKenna 1960, West 1973, West and Dawson 1973, Dorr 1978, Gingerich and Dorr 1979, Gautier 1982, Roehler et al. 1988, Gunnell 1994).</li> <li>• <u>Green River Formation</u>--As a consequence of the superb vertebrate fossil preservation and diversity present in the Green River Formation, it represents one of the most important Eocene</li> </ul>

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	<p>deposits in the world. It is particularly famous for excellently preserved fish fossils; well preserved turtle, ray, snake, alligator, bird, insect, and plant fossils are also known from the Green River Formation in addition to the famous fish fossils. Grand (1980) reviewed important fish and other vertebrate fossil discoveries.</p>
	<p><b>Oligocene-Miocene-Pliocene Epoch (38 to 2.8 Million Years Ago)</b></p> <p>There are no rocks or paleontological resources of Oligocene, Miocene, or Pliocene age in the area.</p>
	<p><b>Quaternary Period (1.8 Million to Present Day)</b></p> <p>The Quaternary is broken into two epochs: the Pleistocene (the time of the “ice ages”), and the Holocene. No significant vertebrate fossils have been recorded from the alluvium and colluvium and grave-pediment-fan deposits, although unidentified significant paleontological resources may be present.</p>