GEOLOGY OF U.S. PARKLANDS pdf

1: www.enganchecubano.com | Geology of U.S. Parklands, Eugene P. Kiver | | Boeken

The purpose of this book is toprovide you with the knowledge you need to read and interpret thatstory, and to make visits to the parklands even more www.enganchecubano.coming no prior familiarity with the geological sciences, thisregion-by-region exploration of the U.S. parklands teaches theprinciples of physical and historical geology by example.

Pacific Province[edit] This region is one of the most geologically young and tectonically active in North America. The generally rugged, mountainous landscape of this province provides evidence of ongoing mountain-building. This province includes the active and sometimes deadly volcanoes of the Cascade Range and the young, steep mountains of the Pacific Border and the Sierra Nevada. Geology of the Yosemite area Although the Sierra Nevada and Cascade Range form a nearly continuous barrier along the western edge of the United States, the two ranges really have very little in common. They have been and continue to be formed by quite different geological forces and processes. At that time, an arc-shaped chain of volcanoes, similar to the present-day Cascade volcanic arc, erupted where the Sierra Nevada now stands. Rising through older Paleozoic rock, molten rock erupted at the surface as lava, but most solidified deep within the earth, forming the gray granitic rocks familiar to any Sierra traveler. By a few tens of millions of years ago, so much of the upper part had worn away that the surface of the ancient range had a low relief of just a few thousand feet. During the Miocene Epoch, less than 20 million years ago, the continental crust east of the Sierra Nevada began to stretch in an east-west direction. The crust broke into a series of north-south-trending valleys and mountain ranges: Less than five million years ago, the range that we now know as the Sierra Nevada began to rise along its eastern margin. Through a combination of uplift of the Sierran block and down-dropping of the area to the east, the Sierra rose upward. Glaciers grew in the Sierra highlands and made their way down former stream channels, carving U-shaped valleys. The sheer walls and hanging valleys of Yosemite National Park are a product of this chilly past. The Cascades Province forms an arc-shaped band extending from British Columbia to Northern California, roughly parallel to the Pacific coastline. Within this region, 13 major volcanic centers lie in sequence like a string of explosive pearls. Helens get the most attention, the Cascades is really made up of a band of thousands of very small, short-lived volcanoes that have built a platform of lava and volcanic debris. Rising above this volcanic platform are a few strikingly large volcanoes that dominate the landscape. As if volcanic hazards were not enough, the Ring of Fire is also infamous for its frequent earthquakes. In order to understand the origins of this concentrated band of Earth hazards, we have to slice deep into the Earth. Beneath the Cascades, a dense oceanic plate plunges beneath the North American Plate ; a process known as subduction. The water vapor rises into the pliable mantle above the subducting plate, causing some of the mantle to melt. Yellow indicates earthquakes, black lines indicate faults A close-up look at the Cascades reveals a more complicated picture than the simple subduction zone shown in the image on theleft. Not far off the coast of the North Pacific lies a spreading ridge ; a divergent plate boundary made up of a series of breaks in the oceanic crust where new ocean crust is created. On one side of the spreading ridge new Pacific Plate crust is made, then moves away from the ridge. Where the Juan de Fuca Plate sinks beneath the North American Plate there is no deep trench, seismicity earthquakes are fewer than expected, and there is evidence of a decline in volcanic activity over the past few million years. The probable explanation lies in the rate of convergence between the Juan de Fuca and North American Plates. These two plates converge at 3â€”4 centimeters per year at present. This is only about half the rate of convergence of 7 million years ago. The Explorer Plate broke away from the Juan de Fuca about 4 million years ago and shows no evidence that it is still being subducted. The Gorda platelet split away between 18 and 5 million years ago and continues to sink beneath North America. More than vents erupted during the most recent volcanic episode that began 5 million years ago. As long as subduction continues, new Cascade volcanoes will continue to rise. The topography here is dominated by geologically young lava flows that inundated the countryside with amazing speed, all within the last 17 million years. These tremendous flows erupted between 17 million years ago. Most of the lava flooded out in the first 1. Looking like a great spoon scooped out the Earth surface, the smooth topography of this province forms a striking contrast with the strong mountainous fabric around it. At the western end, the base has dropped down along normal faults, forming a graben structure. Although there is extensive faulting at the eastern end, the structure is not as clear. The earliest Snake River Plain eruptions began about 15 million years ago, just as the tremendous early eruptions of Columbia River Basalt were ending. But most of the Snake River Plain volcanic rock is less than a few million years old, Pliocene age Not so in the Snake River Plain, where relatively quiet eruptions of soupy black basalt lava flows alternated with tremendous explosive eruptions of rhyolite , a light-colored volcanic rock. Some are aligned along vents, the fissures that fed flows and cone-building eruptions. Calderas , great pits formed by explosive volcanism, and low shield volcanoes , and rhyolite hills are also part of the landscape here, but many are obscured by later lava flows. However, the focus of volcanism at Yellowstone in the Columbia Plateau Province is far inland from the subduction zone that lies along the Oregon and Washington coast. In an effort to figure out why this area, far from a plate boundary, had such an enormous outpouring of lava, scientists established hardening dates for many of the individual lava flows. They found that the youngest volcanic rocks were clustered near the Yellowstone Plateau, and that the farther west they went, the older the lavas. We know that beneath Hawaii and Iceland , a temperature instability develops for reasons not yet well understood at the boundary between the core and mantle. The concentrated heat triggers a plume hundreds of kilometers in diameter that ascends directly through to the surface of the Earth. It is this molten lithosphere that becomes the basalt lavas that gush onto the surface to form the Columbia River and Snake River Plain basalts. The steaming fumaroles and explosive geysers are ample evidence of a concentration of heat beneath the surface. The hot spot is stationary, but the North American plate is moving over it, creating a record of the rate and direction of plate motion. Steep climbs up elongate mountain ranges alternate with long treks across flat, dry deserts. This basic topographic pattern extends from eastern California to central Utah, and from southern Idaho into the state of Sonora in Mexico. The forces which created this distinct topography lie deep beneath the surface. The entire region has been subjected to extension that thinned and cracked the crust as it was pulled apart, creating large faults. Along these roughly north-south-trending faults mountains were uplifted and valleys down-dropped, producing the distinctive alternating pattern of linear mountain ranges and valleys of the Basin and Range province. The upthrown side of these faults form mountains that rise abruptly and steeply, and the down-dropped side creates low valleys. The fault plane, along which the two sides of the fault move, extends deep in the crust, usually an angle of 60 degrees. The exposed bedrock is attacked by water, ice, wind and other erosional agents. Rock particles are stripped away and wash down the mountain sides, often covering young faults until they rupture again. Sediment collects in the adjacent valleys, in some places burying the bedrock under thousands of feet of rock debris. Great Basin The Great Basin is the geographical and hydrological region comprising most of Nevada, southern Oregon and Idaho, western Utah, and a little of eastern California. Most precipitation in the Great Basin falls in the form of snow that melts in the spring. Rain that reaches the ground, or snow that melts, quickly evaporates in the dry desert environment. Some of the water that does not evaporate sinks into the ground to become ground water. The remaining water flows into streams and collects in short-lived lakes called playas on the valley floor and eventually evaporates. Any water that falls as rain or snow into this region does not escape out of it; not one of the streams that originate within this basin ever find an outlet to the ocean. The extent of internal drainage, the area in which surface water cannot reach the ocean, defines the geographic region called the Great Basin. Much of the present-day Great Basin would drain to the sea, just as it did in the recent Ice Ages, if there were more rain and snowfall. This is a vast region of plateaus, mesas, and deep canyons whose walls expose rocks ranging in age from billions to just a few hundred years old. Most are metamorphic rocks formed deep within the Earth while continental collision on a grand scale produced the nucleus of the North American continent well over a billion years ago. By million years ago, North America had been beveled off to a remarkably smooth surface. It is on this crystalline rock surface that the younger, more familiar layered rocks of the Colorado Plateau were deposited. Thick layers of limestone, sandstone, siltstone, and shale were laid down in the shallow marine waters. During times when the seas retreated, stream deposits and dune sands were deposited or older layers were removed by erosion. Over million years passed as layer upon layer of sediment accumulated. The

Mesozoic Era sedimentary deposits are striking. Great accumulations of dune sand hardened to form sweeping arcs in cross-bedded sandstone. Eruptions from volcanic mountain ranges to the west buried vast regions beneath ashy debris. Short-lived rivers, lakes, and inland seas left sedimentary records of their passage. Relatively little rock deformation e. In contrast, the plateau is surrounded by provinces that have suffered severe deformation. Mountain building thrust up the Rocky Mountains to the north and east and tremendous, earth-stretching tension created the Basin and Range Province to the west and south. In the early part of this Era Paleogene Period , both regions had low elevations of probably less than 1 kilometer. Geologists are still gathering evidence and debating what came next. Great tension developed in the crust, probably related to changing plate motions far to the west. As the crust stretched, the Basin and Range Province broke up into a multitude of down-dropped valleys and elongate mountains. Yet for some reason not fully understood, the neighboring Colorado Plateau was able to preserve its structural integrity and remained a single tectonic block. Eventually, the great block of Colorado Plateau crust rose a kilometer higher than the Basin and Range. The most well-known of these streams, the Colorado River , began to carve the Grand Canyon less than 6 million years ago. The forces of erosion have exposed the vivid kaleidoscope of rock layers that make the Colorado Plateau a mecca for rock lovers. Although formidable, a look at the topography reveals a discontinuous series of mountain ranges with distinct geological origins. The cores of the mountain ranges are in most places formed of pieces of continental crust that are over one billion years old. In the south, an older mountain range was formed million years ago, then eroded away. The rocks of that older range were reformed into the Rocky Mountains. The Rocky Mountains took shape during a period of intense plate tectonic activity that formed much of the rugged landscape of the western United States. Three major mountain-building episodes reshaped the west from about to 40 million years ago Jurassic to Cenozoic Periods. The last mountain building event, the Laramide orogeny , about million years ago the last of the three episodes, is responsible for raising the Rocky Mountains.

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2: Geology of the Lassen volcanic area - Wikipedia

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Lowest Price on amazon: USD 87 A fascinating and accessible introduction to the principles of physical and historical geology. For the millions who visit them each year, U. But beyond the spectacular scenery, these national treasures have a much bigger, more awe-inspiring tale to tellâ€”a sprawling story of upheaval and transformation, involving forces and time-spans almost beyond imagining. The purpose of this book is to provide you with the knowledge you need to read and interpret that story, and to make visits to the parklands even more special. Requiring no prior familiarity with the geological sciences, this region-by-region exploration of the U. It begins with a general introduction to all important concepts, terms, and principles. In the chapters that follow, the authors take you on a tour through the geological regions of the United States. At the same time, you can get the access to best deals on audio books on amazon. You can get the best deals on Geology of U. Sometimes, it is not always the best decision to buy a book; instead you can rent them at better price if you find useful for temporary reasons. Here you can get the best rental deals on books Geology of U. You may look for Geology of U. Parklands best deals on book rental. Lowest Price Guaranteed Here I am personally a great fan of amazon prime. You can find the most useful books on amazon prime. Also, you can order books on amazon unlimited and get a great deal. Recently, I started using amazon echo and books on amazon echo are awesome. You can find your Geology of U. Alternatively, you can try books on amazon prime reading. Amazon Prime Reading offers a great experience of book reading on amazon. My friend got this book Geology of U. Parklands books on audio amazon. Here is a great scheme of amazon â€" amazon buy back books. However it is not available on all kinds of books. You can always browse the amazon best sellers books and see if you can strike a deal over there. Most of the books by amazon are books for best bargain on amazon. Last but not the least, you can find amazon free books here. Are you looking for Assignment help in Geology of U. Parklands Get the best assignment help in Geology of U.

3: geologic references - Capulin Volcano National Monument (U.S. National Park Service)

A fascinating and accessible introduction to the principles of physical and historical geology. For the millions who visit them each year, U.S. national parklands offer a glittering spectacle of natural wonders.

Dacite magma that is extruded nonexplosively as lava forms lava domes because it is too viscous sticky to flow far away from its source. Low-silica basaltic magma is more fluid and usually erupts as lava in less explosive eruptions than dacite because gas and water vapor escape easily from it. Prolonged basaltic volcanism at a single site can produce a sizeable edifice, like the broad, relatively flat shield volcanoes of Prospect Peak and Sifford Mountain. Northwest of the park lies the Klamath Mountains a collective term for the Siskiyou , Trinity , Salmon and Marble mountain ranges. To the west lies the Sacramento Valley. Geologic history of the region[edit] The major volcanoes of the Cascade Range are fed from heat generated as tectonic plates dive below North America. All rock now exposed in the area of the park is volcanic , but this has not always been the case. For hundreds of millions of years, the Lassen region underwent repeated uplifting to form mountains , only to have them worn down and submerged under encroaching seas. During the periods of submersion, sand , mud and limestone were deposited. Occasionally volcanic activity was associated with the mountain building. Gradually during millions of years, crustal rocks were folded and fractured and the seas driven away. Volcanoes burst into activity starting 30 million years ago from Washington southward along the Cascades and in the area now occupied by the Sierra Nevada. Meanwhile, toward the end of this activity, eruptions of a different kind took place on an unprecedented scale in eastern Oregon and Washington. The youngest part of the formation consists of interbedded conglomerates and volcanic breccias that are 2 million years old. Basaltic lavas poured forth in the vicinity of Willow Lake in the southwestern portion of the park. Included among these flows were the Twin Lake lavas of black porphyritic andesite, which are notable in that they contain xenocrysts of quartz. Apparently, the vents of these lavas renewed activity at a much later date to form three cinder cones: Somewhat later, andesitic lavas poured out from what is now Reading Peak and mainly flowed to the south and east, reaching the head of Warner Valley. Taken together, these various flows built the lava plateau that the Lassen volcanic area is located on. That event was 50 times larger than the eruption of Mount St. The trigger for this possible collapse may have been the release of the extensive amounts of lava that formed the dacite domes on its flank. More likely, the volcano weathered away; hot volcanic gases and steam turned hard rock into soft clay that were easily eroded by glacial action. Each of these volcanoes developed a cinder cone on its summit during their last stages of eruption. Later, a mass of rhyolite was forced through the north flank of Sifford Mountain and a plug of dacite was pushed up through the west flank of Raker Peak. Later, but not precisely dated, eruptions from the Lassen volcanic area have formed over 30 smaller steep-sided, mound-shaped accumulations of volcanic rock, called lava domes. Glacial action[edit] Lassen Peak as seen from Lake Helen. Lake Helen fills a cirque created by a glacier that once flowed down the side of Lassen Peak. Glaciers existed throughout the park area during most of the Pleistocene with smaller ones persisting at higher elevations until comparatively recent times. Lassen Peak is situated at a center from which many of these glaciers originated. Ice moving southward united with some of the above glaciers and emptied into Warner Valley. Harkness and Sifford Mountain also wound up in Warner Valley. The crest of Saddle Mountain served as a divide with ice north of it moving into the depression containing Snag and Butte Lakes, while those to the south entered Warner Valley. A flow of quartz -studded basalt lava the Fantastic Lava Beds poured from the Cinder Cone and dammed the streams that fed nearby Butte Lake to the north, forming Snag Lake to the south. Stinson Explosions recurred at irregular intervals on Lassen Peak for most of The resulting debris swept down the slope. A great explosion blasted out a new crater three days later on May 22, Less explosive activity continued through Pumice ejected during the eruption of Lassen Peak is conspicuously banded with light streaks of dacite and dark andesite, which appears to represent two distinct magmas imperfectly mixed during the eruption. The eruption of Lassen Peak was the second most recent volcanic outburst in the contiguous 48 U. Because these eruptions are relatively nonviolent, they rarely cause human fatalities. Micrograph of Rockland Ash. Volcanic ash is composed of tiny shards of angular and sharp glassy dust that melts when ingested into jet engines and damages the lungs of people who inhale it. Dacite eruptions in the Lassen area typically begin with steam explosions caused by the interaction of rising magma with ground water. The areas of highest hazard are those that could be affected by pyroclastic flows and lahars see map. These areas, including Hat Creek Valley, are those in the immediate vicinity and downhill from likely eruption sites. Fallout of ash will affect areas downwind at the time of an eruption. Within the hazard zones, relative hazard is gradational, decreasing away from the location of potential vents. After an initial explosive eruption, extrusion of gas -depleted dacite magma commonly forms lava domes. Growing lava domes are inherently unstable, and collapse of their steep sides often generates pyroclastic flows of lava blocks and ash that can travel several miles. Because of this, active volcanoes that have a significant snow and ice cover can be particularly dangerous. The lahars that threatened residents of the Lassen area in May were generated by relatively small eruptions of Lassen Peak. Recently erupted volcanic domes are unstable and can collapse, generating small to large rockfalls. Approximately years ago, collapse of one of the Chaos Crags domes generated huge rockfalls, creating an area now called the Chaos Jumbles. The trigger for the rockfall is unknown, but it was most likely a large earthquake. Normal weathering also weakens fractured volcanic rock and contributes to small rockfalls. The only current visible activity in the Lassen volcanic area is from the various geothermal areas in Lassen Volcanic National Park ; boiling hot springs , bubbling mud pots and fuming fumaroles. A prominent steam plume marks the site of Big Boiler, the largest fumarole steam and volcanic-gas vent in the park. The steam-heated waters of the features are typically acidic and, even if cool enough, are not safe for bathing. Notes[edit] See below for full reference information for Alt, Harris and Kiver.

4: Geologic Planning - Geology (U.S. National Park Service)

The purpose of this book is to provide you with the knowledge you need to read and interpret that story, and to make visits to the parklands even more special. Requiring no prior familiarity with the geological sciences, this region-by-region exploration of the U.S. parklands teaches the principles of physical and historical geology by example.

Interbeded between these layers were volcanic deposits, probably from an island arc. These sediments were later lithified into sandstones , limestones , and various shales. The green to black serpentine created was used by Native Americans to make bowls. The prominent black diabase dike on Mount Moran is representative of similar dikes formed about 1. More than million years elapsed between intrusion of the black dikes and deposition of the first Paleozoic sedimentary rocks. At the close of Precambrian time, about million years ago, the plain slowly subsided and the site of the future Teton Range disappeared beneath shallow seas that were to wash across it intermittently for the next million years. This unit was laid down in a shallow sea and later became a discontinuous mix of dolomite , limestone, sandstones, and shales. The layers of this unit are relatively undeformed for their age even though periodic upwarp exposed them to erosion , creating uncomformities. Fossilized brachiopods , bryozoans , corals , and trilobites are found in the carbonate rock layers with the best examples found outside the park in the Alaska Basin. The most complete examples of this unit are found to the west, north, and south of park borders. Early in Cambrian time a shallow seaway, called the Cordilleran trough , extended from southern California northeastward across Nevada into Utah and Idaho. The site of the Teton Range was part of this plain. Slow subsidence of the land caused the sea to spread gradually eastward during Middle Cambrian time flooding the Precambrian plain. Sand accumulated along the beaches just as it does today. As the sea moved still farther east, mud was deposited on the now-submerged beach sand. In the Teton area, the oldest sand deposit is the to feet 53 to 60 m thick Flathead Sandstone. Mud was laid down on top of the Flathead Sandstone as the shoreline advanced eastward across the Teton area. The resulting soft greenish-gray shale with beds of purple and green sandstone near its base, became the feet 30 m thick Wolsey Shale Member of the Gros Ventre Formation. Small phosphatic-shelled animals called brachiopods inhabited these tidal flats but as far as is known, nothing lived on land. Many shale beds are marked with faint trails and borings of worm-like creatures, and a few contain the remains of tiny trilobites. Covered by a shallow sea[edit] The region was covered by the shallow seaway by the end of the Late Cambrian. As the shoreline continued to move eastward, the foot-thick 87 m Death Canyon Limestone Member of the Gros Ventre Formation was laid down in clear water farther from shore. It consists of two thick beds of dark blue-gray limestone that are separated by 15 to 20 feet 4. Following this the sea retreated to the west for a short time. The foot-thick 67 m Park Shale Member of the Gros Ventre Formation was deposited in the shallow muddy water resulting from this retreat. It is a gray-green shale that contains beds of platy limestone conglomerate along with fossils of trilobites and brachiopods. By Late Cambrian, the shoreline had once again crept eastward, resulting in clearer water that was probably to feet 30 to 60 m deep. The foot-thick 30 m Gallatin Limestone was formed. It consists of blue-gray limestone that is mottled with irregular rusty or yellow patches. Now at its maximum extent, the sea covered all of Idaho , Montana , most of Wyoming and extended eastward across the Dakotas to connect with shallow seas that covered the eastern United States. Soon after, a slow uplift caused the sea to gradually retreat westward. The site of the Teton Range emerged above sea level , where, as far as is known, it may have been exposed to erosion for nearly 70 million years. Dolomite is calcium-magnesium carbonate, but the original sediment probably was calcium carbonate mud that was altered by magnesium-rich sea water shortly after deposition. Corals and other marine animals were abundant in the clear warm seas at this time. Dolomite in the Devonian Darby Formation differs greatly from the Bighorn Dolomite; in the Darby is dark-brown to almost black, has an oily smell, and contains layers of black, pink, and yellow mudstone and thin sandstone. The sea bottom during deposition of these rocks was foul and frequently the water was turbid. Abundant fossil fragments indicate fishes were common for the first time. Exposures of the Darby Formation are recognizable by their distinctive dull-yellow thin-layered slopes between the prominent gray massive cliffs of formations below and above. It is noted for the abundant remains of beautifully preserved marine organisms. The fossils and the relatively pure blue-gray limestone in which they are embedded indicate deposition in warm tranquil seas. Cliffs of the Tensleep Sandstone can be seen along the Gros Ventre River at the east edge of the park. The Amsden, below the Tensleep, consists of red and green shale, sandstone, and thin limestone. The shale is especially weak and slippery when exposed to weathering and saturated with water. These are the strata that make up the glide plane of the Lower Gros Ventre Slide east of the park. The Phosphoria Formation and its equivalents of Permian age are unlike any other Paleozoic rocks because of their extraordinary content of uncommon elements. The formation consists of sandy dolomite, widespread black phosphate beds and black shale that is unusually rich not only in phosphorus, but also in vanadium, uranium, chromium, zinc, selenium, molybdenum, cobalt, and silver. The formation is mined extensively in nearby parts of Idaho and in Wyoming for phosphatic fertilizer, for the chemical element phosphorus, and for some of the metals that can be derived from the rocks as by-products. Mesozoic deposition[edit] Cretaceous Seaway Mesozoic deposition changed from primarily marine to a mix of marine, transitional, and continental that varied over time as crustal conditions altered the region. By the close of this era, 10, to 15, feet 3, to 4, m of sediment accumulated in 15 recognized formations. The most extensive non-marine formations were deposited in the Cretaceous period when the eastern part of the Cretaceous Seaway a warm shallow sea that periodically divided North America in that period covered the region. Their sediment came from rock eroded from a mountain chain east of the seaway interbeded with ash from volcanos west of the seaway in the Sierran Arc a long volcanic island chain like the modern Andes Mountains but in island form. This ash eventually became bentonite , a clay which expands in water and thus causes landslides in the park. Coalbeds were eventually created from the swamps and bogs left behind after the last stand of the seaway retreated. Coal outcrops can be found near abandoned mines in and outside of the eastern margin of the park. Outcrops of older Mesozoic-aged formations can be found north, east, and south of the park. The distribution of Mud cracks, fossilized reptiles and amphibians suggest deposition in a tidal flat environment with a sea several kilometers southwest of Jackson Hole. Evaporite deposits of a few beds of white gypsum calcium sulfate were likely formed after shallow bodies of salt water were cut off from the sea. A small amount of iron oxide creates the red color and the formation erodes into colorful hills east and south of the park. As the Triassic gave way to the Jurassic, wind spread salmon-red colored sand across the red beds of the Chugwater Formation to form the Nugget Sandstone. The Nugget in turn was buried by the deposits of thin red shale and thick gypsum of the Gypsum Springs Formation. Later, a warm, muddy, shallow sea with abundant marine mollusks called the Sundance Sea started to spread from Alaska south to Wyoming. After the sea withdrew, the Jurassic and Lower Cretaceous-aged Morrison and Cloverly Formations were laid down on low-lying tropically humid flood plains. These formations erode into colorful badlands of red, pink, purple, and green claystones and mudstones, and yellow to buff sandstones. Large and small dinosaurs roamed the abundant vegetation and swamps. Western Interior Seaway expands and retracts[edit] Brightly colored rocks continued to be deposited as the final period of the Mesozoic, the Cretaceous dawned. The Western Interior Seaway retreated eastward from the Teton region around 85 million years ago, marked by deposition of the Bacon Ridge Sandstone. Extensive coal swamps formed along and followed the retreating seashore, leaving coal beds 5 to 10 feet 3. Examples of these coal beds are visible in abandoned mines found in the eastern margin of the park. A modern analog of this depositional environment is the hot and humid climate of the Florida Everglades. About 5 feet 1. Fine-grained volcanic ash from volcanoes west and northwest of the Teton area was periodically deposited in the quiet shallow water of the Western Interior Seaway throughout Cretaceous time. Ash deposited in this manner was later altered to bentonite ; a type of clay used in the foundry industry and as a component of oil well drilling mud. Elk and deer in Jackson Hole use exposures of bentonite as a bitter salt lick. Bentonite swells when wet, which causes landslides that sometimes block access roads into Jackson Hole. Cretaceous-aged rocks in the Teton region form part of a huge east-thinning wedge of crust that is locally almost 2 miles 3. Most of these rocks are from debris eroded from slowly rising mountains in the west. Bentonite, crude oil and natural gas are commonly produced from the various Cretaceous formations. Rocky Mountains rise[edit] The period of uplift that resulted in the formation of the ancestral Rocky Mountains is called the Laramide orogeny. Mountains already existed west and southwest of

Wyoming, with progressively older mountains up to Jurassic age trending west into Nevada. Latest Cretaceous time saw the formation of a low broad northwest-trending arch along the approximate area of the present Teton Range and Gros Ventre Mountains. Part of the evidence for the first Laramide mountain building west of the Teton region is the several hundred cubic miles of quartzite boulders derived from the Targhee uplift , which was located north and west of the northern end of the present-day Teton Range. Streams carried boulders, sand, and clay from the uplift eastward and southeastward across what would become Jackson Hole. Flakes of gold and some mercury are in the resulting Harebell Formation. Two huge depositional troughs were formed in central and southern Wyoming from fine-grained debris carried farther east and southeast. Tertiary uplift and deposition[edit] The tectonic setting of western North America changed drastically as the Farallon Plate under the Pacific Ocean to the west was shallowly subducted below North American Plate. Called the Laramide orogeny , the compressive forces generated from this collision erased the Cretaceous Seaway, fused the Sierran Arc to the rest of North America and created the Rocky Mountains. This mountain-building event started in the Mesozoic 80 million years ago and lasted well into the first half of the Cenozoic era 30 million years ago. By about 34 million years ago, these forces had uplifted a broad part of western Wyoming into a continuous high plateau. A separate area of uplift called the Targhee Uplift formed north of park borders around this time. Subsequent erosion of the Targhee Uplift was driven by steepened stream gradients. Gravel , quartzite cobbles, and sand from this erosion eventually became the 5, foot 1, m thick Harebell Formation seen today as various conglomerates and sandstones in the northern and northeastern parts of the park. The lower members of this formation consist of coal beds and claystone with conglomerate made of quartzite from the Targhee uplift above. Hot and semi-plastic rock deep below western North America responded to the lack of compression beginning 30 million years ago by slowly rising; gradually pushing the overlying rock sideways both east and west. This stretching may have begun to tear apart the previously-mentioned high plateau in western Wyoming around this time, but evidence from ancient sediments indicates that the Teton Fault system developed much later see below. Huge volumes of volcanic material such as tuff and ash accumulated to great depth in the Grand Teton area, forming the Absaroka Volcanic Supergroup. Additional eruptions east of Jackson Hole deposited their own debris in the Oligocene and Miocene epochs. Sediment collected in various lakes in the area from around 17 to 15 million years ago, becoming the Miocene -aged Colter Formation. Geologists call this fault-scarp dammed body of shallow water Lake Teewinot and it persisted for around 5 million years. Eventually all the Mesozoic rock from the Teton Range was stripped away and the same formations in Jackson Hole were deeply buried.

5: - Geology of U.S. Parklands by Eugene P.; Harris, David V Kiver

Get this from a library! Geology of U.S. parklands. [Eugene P Kiver; David V Harris] -- "Requiring no prior familiarity with the geological sciences, this region-by-region exploration of the U.S. parklands teaches the principles of physical and historical geology by example.

Geology of the United States Save Shaded relief map of the United States, showing 10 of the geological provinces discussed in this article The richly textured landscape of the United States is a product of the dueling forces of plate tectonics , weathering and erosion. Differences in roughness topographic relief result from a variety of processes acting on the underlying rock. The plate tectonic history of a region strongly influences the rock type and structure exposed at the surface, but differing rates of erosion that accompany changing climates can also have profound impacts on the land. Each province has its own geologic history and unique features. Pacific Province This region is one of the most geologically young and tectonically active in North America. The generally rugged, mountainous landscape of this province provides evidence of ongoing mountain-building. This province includes the active and sometimes deadly volcanoes of the Cascade Range and the young, steep mountains of the Pacific Border and the Sierra Nevada. They have been and continue to be formed by quite different geological forces and processes. At that time, an arc-shaped chain of volcanoes, similar to the present-day Cascade volcanic arc, erupted where the Sierra Nevada now stands. Rising through older Paleozoic rock, molten rock erupted at the surface as lava, but most solidified deep within the earth, forming the gray granitic rocks familiar to any Sierra traveler. By a few tens of millions of years ago, so much of the upper part had worn away that the surface of the ancient range had a low relief of just a few thousand feet. During the Miocene Epoch, less than 20 million years ago, the continental crust east of the Sierra Nevada began to stretch in an east-west direction. The crust broke into a series of north-south-trending valleys and mountain ranges: Less than five million years ago, the range that we now know as the Sierra Nevada began to rise along its eastern margin. Through a combination of uplift of the Sierran block and down-dropping of the area to the east, the Sierra rose upward. Glaciers grew in the Sierra highlands and made their way down former stream channels, carving U-shaped valleys. The sheer walls and hanging valleys of Yosemite National Park are a product of this chilly past. The Cascades Province forms an arc-shaped band extending from British Columbia to Northern California, roughly parallel to the Pacific coastline. Within this region, 13 major volcanic centers lie in sequence like a string of explosive pearls. Helens get the most attention, the Cascades is really made up of a band of thousands of very small, short-lived volcanoes that have built a platform of lava and volcanic debris. Rising above this volcanic platform are a few strikingly large volcanoes that dominate the landscape. As if volcanic hazards were not enough, the Ring of Fire is also infamous for its frequent earthquakes. In order to understand the origins of this concentrated band of Earth hazards, we have to slice deep into the Earth. Beneath the Cascades, a dense oceanic plate plunges beneath the North American Plate ; a process known as subduction. The water vapor rises into the pliable mantle above the subducting plate, causing some of the mantle to melt. Yellow indicates earthquakes, black lines indicate faults A close-up look at the Cascades reveals a more complicated picture than the simple subduction zone shown in the image on theleft. Not far off the coast of the North Pacific lies a spreading ridge ; a divergent plate boundary made up of a series of breaks in the oceanic crust where new ocean crust is created. On one side of the spreading ridge new Pacific Plate crust is made, then moves away from the ridge. Where the Juan de Fuca Plate sinks beneath the North American Plate there is no deep trench, seismicity earthquakes are fewer than expected, and there is evidence of a decline in volcanic activity over the past few million years. The probable explanation lies in the rate of convergence between the Juan de Fuca and North American Plates. These two plates converge at 3â€”4 centimeters per year at present. This is only about half the rate of convergence of 7 million years ago. The Explorer Plate broke away from the Juan de Fuca about 4 million years ago and shows no evidence that it is still being subducted. The Gorda platelet split away between 18 and 5 million years ago and continues to sink beneath North America. More than vents erupted during the most recent volcanic episode that began 5 million years ago. As long as subduction continues, new Cascade volcanoes will continue to rise. The topography here is dominated by geologically young lava flows that inundated the countryside with amazing speed, all within the last 17 million years. These tremendous flows erupted between 17 million years ago. Most of the lava flooded out in the first 1. Looking like a great spoon scooped out the Earth surface, the smooth topography of this province forms a striking contrast with the strong mountainous fabric around it. At the western end, the base has dropped down along normal faults, forming a graben structure. Although there is extensive faulting at the eastern end, the structure is not as clear. The earliest Snake River Plain eruptions began about 15 million years ago, just as the tremendous early eruptions of Columbia River Basalt were ending. But most of the Snake River Plain volcanic rock is less than a few million years old, Pliocene age Not so in the Snake River Plain, where relatively quiet eruptions of soupy black basalt lava flows alternated with tremendous explosive eruptions of rhyolite , a light-colored volcanic rock. Some are aligned along vents, the fissures that fed flows and cone-building eruptions. Calderas , great pits formed by explosive volcanism, and low shield volcanoes , and rhyolite hills are also part of the landscape here, but many are obscured by later lava flows. However, the focus of volcanism at Yellowstone in the Columbia Plateau Province is far inland from the subduction zone that lies along the Oregon and Washington coast. In an effort to figure out why this area, far from a plate boundary, had such an enormous outpouring of lava, scientists established hardening dates for many of the individual lava flows. They found that the youngest volcanic rocks were clustered near the Yellowstone Plateau, and that the farther west they went, the older the lavas. We know that beneath Hawaii and Iceland , a temperature instability develops for reasons not yet well understood at the boundary between the core and mantle. The concentrated heat triggers a plume hundreds of kilometers in diameter that ascends directly through to the surface of the Earth. It is this molten lithosphere that becomes the basalt lavas that gush onto the surface to form the Columbia River and Snake River Plain basalts. The steaming fumaroles and explosive geysers are ample evidence of a concentration of heat beneath the surface. The hot spot is stationary, but the North American plate is moving over it, creating a record of the rate and direction of plate motion. Steep climbs up elongate mountain ranges alternate with long treks across flat, dry deserts. This basic topographic pattern extends from eastern California to central Utah, and from southern Idaho into the state of Sonora in Mexico. The forces which created this distinct topography lie deep beneath the surface. The entire region has been subjected to extension that thinned and cracked the crust as it was pulled apart, creating large faults. Along these roughly north-south-trending faults mountains were uplifted and valleys down-dropped, producing the distinctive alternating pattern of linear mountain ranges and valleys of the Basin and Range province. The upthrown side of these faults form mountains that rise abruptly and steeply, and the down-dropped side creates low valleys. The fault plane, along which the two sides of the fault move, extends deep in the crust, usually an angle of 60 degrees. The exposed bedrock is attacked by water, ice, wind and other erosional agents. Rock particles are stripped away and wash down the mountain sides, often covering young faults until they rupture again. Sediment collects in the adjacent valleys, in some places burying the bedrock under thousands of feet of rock debris. Great Basin The Great Basin is the geographical and hydrological region comprising most of Nevada, southern Oregon and Idaho, western Utah, and a little of eastern California. Most precipitation in the Great Basin falls in the form of snow that melts in the spring. Rain that reaches the ground, or snow that melts, quickly evaporates in the dry desert environment. Some of the water that does not evaporate sinks into the ground to become ground water. The remaining water flows into streams and collects in short-lived lakes called playas on the valley floor and eventually evaporates. Any water that falls as rain or snow into this region does not escape out of it; not one of the streams that originate within this basin ever find an outlet to the ocean. The extent of internal drainage, the area in which surface water cannot reach the ocean, defines the geographic region called the Great Basin. Much of the present-day Great Basin would drain to the sea, just as it did in the recent Ice Ages, if there were more rain and snowfall. This is a vast region of plateaus, mesas, and deep canyons whose walls expose rocks ranging in age from billions to just a few hundred years old. Most are metamorphic rocks formed deep within the Earth while continental collision on a grand scale produced the nucleus of the North American continent well over a billion years ago. By million years ago, North America had been beveled off to a remarkably smooth surface. It is on this crystalline rock surface that the younger, more familiar layered rocks of the Colorado Plateau were deposited. Thick layers of limestone, sandstone, siltstone, and shale were laid down in the shallow marine waters. During times when the seas retreated, stream deposits and dune sands were deposited or older layers were removed by erosion. Over million years passed as layer upon layer of sediment accumulated. The Mesozoic Era sedimentary deposits are striking. Great accumulations of dune sand hardened to form sweeping arcs in cross-bedded sandstone. Eruptions from volcanic mountain ranges to the west buried vast regions beneath ashy debris. Short-lived rivers, lakes, and inland seas left sedimentary records of their passage. Relatively little rock deformation e. In contrast, the plateau is surrounded by provinces that have suffered severe deformation. Mountain building thrust up the Rocky Mountains to the north and east and tremendous, earth-stretching tension created the Basin and Range Province to the west and south. In the early part of this Era Paleogene Period , both regions had low elevations of probably less than 1 kilometer. Geologists are still gathering evidence and debating what came next. Great tension developed in the crust, probably related to changing plate motions far to the west. As the crust stretched, the Basin and Range Province broke up into a multitude of down-dropped valleys and elongate mountains. Yet for some reason not fully understood, the neighboring Colorado Plateau was able to preserve its structural integrity and remained a single tectonic block. Eventually, the great block of Colorado Plateau crust rose a kilometer higher than the Basin and Range. The most well-known of these streams, the Colorado River , began to carve the Grand Canyon less than 6 million years ago. The forces of erosion have exposed the vivid kaleidoscope of rock layers that make the Colorado Plateau a mecca for rock lovers. Although formidable, a look at the topography reveals a discontinuous series of mountain ranges with distinct geological origins. The cores of the mountain ranges are in most places formed of pieces of continental crust that are over one billion years old. In the south, an older mountain range was formed million years ago, then eroded away. The rocks of that older range were reformed into the Rocky Mountains.

6: Geology of the Grand Teton area - Wikipedia

I teach a course in geology of America's National Parklands at a community college. I have tried another book for the required text for the course, with mixed success. Therefore when I found out that Geology of U.S. Parklands, fifth edition, was being released, I ordered it for the course even before I had seen my review copy.

The pink-colored cliffs, alcoves and amphitheaters along the eroding eastern face of the plateau expose the approximately million-year-old Claron Formation. The exposed geology of the Bryce Canyon area in Utah shows a record of deposition that covers the last part of the Cretaceous Period and the first half of the Cenozoic era in that part of North America. This event created the Rocky Mountains far to the east and helped to close the sea that covered the area. While not part of this region, the greater Bryce area was stretched into the High Plateaus by the same forces. The uplift caused the formation of vertical joints which were later preferentially eroded to form the free-standing pinnacles called hoodoos , badlands , and monoliths we see today. The formations exposed in the area of the park are part of the Grand Staircase. The oldest members of this supersequence of rock units are exposed in the Grand Canyon , the intermediate ones in Zion National Park , and its youngest parts are laid bare in Bryce Canyon area. A small amount of overlap occurs in and around each park. There are, however, shared rock units between all three, creating a supersequence of formations that geologists call the Grand Staircase. Younger rock units, if they ever existed, have been removed by erosion. The seaway divided North America into two halves: Alternating layers of nonmarine, intertidal, and marine sediments lay on top of each other as a result. Abundant amounts of petrified wood , oyster beds containing millions of fossils, and coal are all found in the Dakota. Mud and silt were deposited on top of the Dakota Formation as the seaway became deeper and calmer in the area. The cliff-forming sandstone of the Tibbet Canyon Member was conformably deposited on top of the Tropic Shale in shallow marine and later near shore environments. Shale and sandstone from the Smoky Hollow Member were deposited on top of its basal layer of coal-rich mudstone in coastal swamps and lagoons on the shore of the seaway. While the alternating layers of shale and sandstone mixed with massive coal deposits of the John Henry Member were laid down in swamps, lagoons and fluvial environments, one member, the Drip Tank, is not found in the Bryce Canyon area. Shark teeth are found in the lower parts of the formation. It contains abundant fossils of vertebrates , including dinosaurs such as the hadrosaurs. Mud and sand accumulated in this setting to become the gray sandstones and mudstones of the Kaiparowits Formation. The sandstones and conglomerates of these formations record stream and river deposition starting in the Paleocene epoch. This hoisted the once lower uplands skyward while low-lying basins between them gradually subsided. The park also sits on the western gently dipping flank of the much larger Kaibab uplift, which was also formed as a result of the Laramide. Periodic but extensive floods inundated large areas perhaps once every 1, years; spreading mud, cobbles and fine silt over the plains. Oxidation of the iron in the mud and silt turned the soil into hematite , giving it a pink and red hue. Geologist Clarence Dutton called the iron oxide -rich lower member of the Claron the Pink Cliffs series due to its colorful appearance. As they did so, they left beds of differing thickness and composition stacked atop one another;[5] various sand and cobble deposits near shore, calcium -poor muds further from shore, calcium-rich mud in deeper water, and pure limey oozes were deposited in the deepest waters. Fossils are rare in the White Member and consist mainly of freshwater snails and clams , indicating that the lakes supported little life. A slight downwarp running eastâ€”west and perpendicular to the thrust motion called the Bryce syncline was also created. Outcrops of these formations can be found in the northern part of the park and in a few places on the plateau rim. The entire Colorado Plateau then started to uplift from near sea level to several thousand feet over a kilometer in elevation. Modern drainage and erosion Drainage of the Colorado Plateau was significantly altered by the opening of the Gulf of California. Water in the Colorado and its tributaries moved faster as a result and cut down deeper, creating the canyonland topography. Erosion from snow and rain that fall directly on the east-facing rim of the Paunsaugunt Plateau forms gullies that widen into alcoves and amphitheaters while differential erosion and frost wedging create the hoodoos. Streams on the plateau do not contribute to the formation of alcoves or amphitheaters because they flow away from the rim.

Hoodoo formation in Bryce Canyon The Pink Member of the Claron Formation is largely composed of easily eroded and relatively soft limestone. When rain combines with carbon dioxide it forms a weak solution of carbonic acid. This acid helps to slowly dissolve the limestone in the Claron Formation grain by grain. It is this process of chemical weathering that rounds the edges of hoodoos and gives them their lumpy and bulging profiles. In the winter, melting snow seeps into cracks and joints and freezes at night. The force of the expanding ice helps to erode the rock of the Claron Formation. Internal layers of mudstone, conglomerate and siltstone interrupt the limestone horizontally. These layers are more resistant to attack by carbonic acid and they can therefore act as protective capstones of fins, windows and hoodoos. Many of the more durable hoodoos are capped with a type of magnesium -rich limestone called dolomite. However, the same processes that create hoodoos will also eventually destroy them. Once this river flows through Bryce Amphitheater it will dominate the erosional pattern; replacing hoodoos with a V-shaped canyon and steep cliff walls typical of the weathering and erosional patterns created by rivers. A diversion canal has been taking a portion of the East Fork of the Sevier River through this section of the park for over years. Geology of National Parks, page 51 Davis and Pollock Geology of National Parks, page 52 Davis and Pollock Parklands, page Rowley, Peter D. United States Geological Survey. The Geological Society of America. Kiver and Harris Parklands, page Harris, Ann Geology of National Parks, page 53 Harris, Ann Geology of National Parks, page 54 Kiver and Harris Parklands, page Kiver and Harris Parklands, page Davis and Pollock Harris, Ann G; Tuttle, Esther Geology of National Parks Fifth ed. Kendall Hunt Publishing Co.

7: Hoodoo (geology) - Wikipedia

Description A fascinating and accessible introduction to the principles of physical and historical geology. For the millions who visit them each year, U.S. national parklands offer a glittering spectacle of natural wonders.

There are, however, shared rock units between all three, creating a supersequence of formations that geologists call the Grand Staircase. Younger rock units, if they ever existed, have been removed by erosion. Advance[edit] In the Cretaceous , a shallow seaway spread into the interior of North America from the Gulf of Mexico in the south into Utah and later to the Arctic Ocean in the far north. The seaway divided North America into two halves: Alternating layers of nonmarine, intertidal, and marine sediments lay on top of each other as a result. Abundant amounts of petrified wood , oyster beds containing millions of fossils, and coal are all found in the Dakota. Mud and silt were deposited on top of the Dakota Formation as the seaway became deeper and calmer in the area. The cliff-forming sandstone of the Tibbet Canyon Member was conformably deposited on top of the Tropic Shale in shallow marine and later near shore environments. 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Streams on the plateau do not contribute to the formation of alcoves or amphitheaters because they flow away from the rim. Hoodoo formation in Bryce Canyon[edit] The Pink Member of the Claron Formation is largely composed of easily eroded and relatively soft limestone. When rain combines with carbon dioxide it forms a weak solution of carbonic acid. This acid helps to slowly dissolve the limestone in the Claron Formation grain by grain. It is this process of chemical weathering that rounds the edges of hoodoos and gives them their lumpy and bulging profiles. In the winter, melting snow seeps into cracks and joints and freezes at night. The force of the expanding ice helps to erode the rock of the Claron Formation. Internal layers of mudstone, conglomerate and siltstone interrupt the limestone horizontally. These layers are more resistant to attack by carbonic acid and they can therefore act as protective capstones of fins, windows and hoodoos. Many of the more durable hoodoos are capped with a type of magnesium -rich limestone called dolomite. However, the same processes that create hoodoos will also eventually destroy them. Once this river flows through Bryce Amphitheater it will dominate the erosional pattern; replacing hoodoos with a V-shaped canyon and steep cliff walls typical of the weathering and erosional patterns created by rivers. A diversion canal has been taking a portion of the East Fork of the Sevier River through this section of the park for over years.

GEOLOGY OF U.S. PARKLANDS pdf

8: Geology of the United States - Wikipedia

Kiver received hisdoctorate in geology from the University of Wyoming. He is coauthorof the Fourth Edition of this book, and prepared the revisions ofthis Fifth Edition. DAVID V. HARRIS, PhD (deceased), was a professor of geology atColorado State University from until

While hoodoos are scattered throughout these areas, nowhere in the world are they as abundant as in the northern section of Bryce Canyon National Park , located in the U. The hoodoos were depicted on the reverse of the Turkish 50 new lira banknote of â€" The site was also a nominee in the New Seven Wonders of Nature campaign. The stones formed as the seabed rose rapidly out of the ocean during the Miocene epoch. The hoodoos in Drumheller , Alberta are composed of clay and sand deposited between 70 and 75 million years ago during the Cretaceous Period. These hoodoos are able to maintain a unique mushroom-like appearance as the underlying base erodes at a faster rate compared to the capstones, a rate of nearly one centimeter per year, faster than most geologic structures. In glaciated mountainous valleys the soft eroded material may be glacial till with the protective capstones being large boulders in the till. Over time, cracks in the resistant layer allow the much softer rock beneath to be eroded and washed away. Hoodoos form where a small cap of the resistant layer remains, and protects a cone of the underlying softer layer from erosion. The heavy cap pressing downwards gives the pedestal of the hoodoo its strength to resist erosion. For example, the primary weathering force at Bryce Canyon is frost wedging. In the winter, melting snow, in the form of water, seeps into the cracks and then freezes at night. In addition to frost wedging, rain is another weathering process causing erosion. In most places today, the rainwater is slightly acidic, which lets the weak carbonic acid slowly dissolve limestone grain by grain. It is this process that rounds the edges of hoodoos and gives them their lumpy and bulging profiles. Where internal mudstone and siltstone layers interrupt the limestone, you can expect the rock to be more resistant to the chemical weathering because of the comparative lack of limestone. Many of the more durable hoodoos are capped with a special kind of magnesium-rich limestone called dolomite. Dolomite, being fortified by the mineral magnesium, dissolves at a much slower rate, and consequently protects the weaker limestone underneath it. Rain is also the chief source of erosion the actual removal of the debris. In the summer, monsoon type rainstorms travel through the Bryce Canyon region bringing short duration high intensity rain.

9: Geology of U.S. Parklands - Amateur Geologist, Inc

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