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Chapter 1 : What Is a Fault Line? - calendrierdelascience.com

A fault plane is the plane that represents the fracture surface of a fault. A fault trace or fault line is a place where the fault can be seen or mapped on the surface. A fault trace is also the line commonly plotted on geologic maps to represent a fault.

The light layer of rock shows the displacement. A second normal fault is at the right. Fault mechanics Because of friction and the rigidity of the constituent rocks, the two sides of a fault cannot always glide or flow past each other easily, and so occasionally all movement stops. The regions of higher friction along a fault plane, where it becomes locked, are called asperities. When a fault is locked stress builds up, and when it reaches a level that exceeds the strength threshold, the fault ruptures and the accumulated strain energy is released in part as seismic waves , forming an earthquake. Strain occurs accumulatively or instantaneously, depending on the liquid state of the rock; the ductile lower crust and mantle accumulate deformation gradually via shearing , whereas the brittle upper crust reacts by fracture â€" instantaneous stress release â€" resulting in motion along the fault. A fault in ductile rocks can also release instantaneously when the strain rate is too great. Slip, heave, throw[edit] A fault in Morocco. The fault plane is the steeply leftward-dipping line in the centre of the photo, which is the plane along which the rock layers to the left have slipped downwards, relative to the layers to the right of the fault. Slip is defined as the relative movement of geological features present on either side of a fault plane. In practice, it is usually only possible to find the slip direction of faults, and an approximation of the heave and throw vector. Hanging wall and foot wall[edit] The two sides of a non-vertical fault are known as the hanging wall and footwall. The hanging wall occurs above the fault plane and the footwall occurs below it. Strike-slip faults[edit] Satellite image of the Piqiang Fault , a northwest trending left-lateral strike-slip fault in the Taklamakan Desert south of the Tien Shan Mountains , China In a strike-slip fault also known as a wrench fault, tear fault or transcurrent fault , [7] the fault surface plane is usually near vertical and the footwall moves laterally either left or right with very little vertical motion. Strike-slip faults with left-lateral motion are also known as sinistral faults. Those with right-lateral motion are also known as dextral faults. A special class of strike-slip fault is the transform fault , when it forms a plate boundary. This class is related to an offset in a spreading center , such as a mid-ocean ridge , or, less common, within continental lithosphere , such as the Dead Sea Transform in the Middle East or the Alpine Fault in New Zealand. Transform faults are also referred to as "conservative" plate boundaries, inasmuch as lithosphere is neither created nor destroyed. In a normal fault, the hanging wall moves downward, relative to the footwall. A downthrown block between two normal faults dipping towards each other is a graben. An upthrown block between two normal faults dipping away from each other is a horst. Low-angle normal faults with regional tectonic significance may be designated detachment faults. Cross-sectional illustration of normal and reverse dip-slip faults A reverse fault is the opposite of a normal faultâ€"the hanging wall moves up relative to the footwall. Reverse faults indicate compressive shortening of the crust. The terminology of "normal" and "reverse" comes from coal-mining in England, where normal faults are the most common. Flat segments of thrust fault planes are known as flats, and inclined sections of the thrust are known as ramps. Typically, thrust faults move within formations by forming flats and climb up sections with ramps. Fault-bend folds are formed by movement of the hanging wall over a non-planar fault surface and are found associated with both extensional and thrust faults. Faults may be reactivated at a later time with the movement in the opposite direction to the original movement fault inversion. A normal fault may therefore become a reverse fault and vice versa. Thrust faults form nappes and klippen in the large thrust belts. Subduction zones are a special class of thrusts that form the largest faults on Earth and give rise to the largest earthquakes. Oblique-slip faults[edit] Oblique-slip fault A fault which has a component of dip-slip and a component of strike-slip is termed an oblique-slip fault. Nearly all faults have some component of both dip-slip and strike-slip, so defining a fault as oblique requires both dip and strike components to be measurable and significant. Some oblique faults occur within transtensional and transpressional regimes, and others occur where the direction of extension or shortening changes during the deformation but the earlier formed faults remain active. The hade angle is defined as the complement of the

dip angle; it is the angle between the fault plane and a vertical plane that strikes parallel to the fault. Listric fault[edit] Listric fault red line Listric faults are similar to normal faults but the fault plane curves, the dip being steeper near the surface, then shallower with increased depth. The illustration shows slumping of the hanging wall along a listric fault. Where the hanging wall is absent such as on a cliff the footwall may slump in a manner that creates multiple listric faults. Ring fault[edit] Ring faults, also known as caldera faults, are faults that occur within collapsed volcanic calderas [12] and the sites of bolide strikes, such as the Chesapeake Bay impact crater. Ring faults are result of a series of overlapping normal faults, forming a circular outline. Fractures created by ring faults may be filled by ring dikes [12]. Synthetic and antithetic faults[edit] Synthetic and antithetic faults are terms used to describe minor faults associated with a major fault. Synthetic faults dip in the same direction as the major fault while the antithetic faults dip in the opposite direction. These faults may be accompanied by rollover anticlines e. Fault rock[edit] Salmon-colored fault gouge and associated fault separates two different rock types on the left dark gray and right light gray. From the Gobi of Mongolia. Inactive fault from Sudbury to Sault Ste. Marie , Northern Ontario, Canada All faults have a measurable thickness, made up of deformed rock characteristic of the level in the crust where the faulting happened, of the rock types affected by the fault and of the presence and nature of any mineralising fluids. Fault rocks are classified by their textures and the implied mechanism of deformation. A fault that passes through different levels of the lithosphere will have many different types of fault rock developed along its surface. Continued dip-slip displacement tends to juxtapose fault rocks characteristic of different crustal levels, with varying degrees of overprinting. This effect is particularly clear in the case of detachment faults and major thrust faults. The main types of fault rock include: Cataclasite â€” a fault rock which is cohesive with a poorly developed or absent planar fabric , or which is incohesive, characterised by generally angular clasts and rock fragments in a finer-grained matrix of similar composition. Rock clasts may be present Clay smear - clay-rich fault gouge formed in sedimentary sequences containing clay-rich layers which are strongly deformed and sheared into the fault gouge. Mylonite - a fault rock which is cohesive and characterized by a well-developed planar fabric resulting from tectonic reduction of grain size, and commonly containing rounded porphyroclasts and rock fragments of similar composition to minerals in the matrix Pseudotachylite â€” ultrafine-grained glassy-looking material, usually black and flinty in appearance, occurring as thin planar veins , injection veins or as a matrix to pseudoconglomerates or breccias , which infills dilation fractures in the host rock. Impacts on structures and people[edit] In geotechnical engineering a fault often forms a discontinuity that may have a large influence on the mechanical behavior strength, deformation, etc. Subsurface clues include shears and their relationships to carbonate nodules , eroded clay, and iron oxide mineralization, in the case of older soil, and lack of such signs in the case of younger soil. Radiocarbon dating of organic material buried next to or over a fault shear is often critical in distinguishing active from inactive faults. From such relationships, paleoseismologists can estimate the sizes of past earthquakes over the past several hundred years, and develop rough projections of future fault activity.

Chapter 2 : Fault Lines | Al Jazeera America

Leaflet | Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN.

If you saw the Warner Bros. But why does the San Andreas Fault get all the attention in movieland? Check out these 5 scary seismic zones that are just as nerve-racking as the San Andreas Fault. The few remaining Native Americans in the area spoke of the earth shaking and ocean rising to consume the land. Many tribes even left the region permanently. Running miles along the Pacific Northwest coastline, the Cascadia Fault directly threatens 3 major metropolitan areas Portland, Seattle, and Vancouver. With Cascadia capable of producing a magnitude 9. Between and , this zone experienced some of the largest quakes in history. And although they originated in the Mississippi Valley, they rang church bells in Boston and shook New York City â€" over 1, miles away! After one particularly large rupture in the fault, the mighty Mississippi River was forced to run backward for several hours, devastating acres of forest and creating 2 temporary waterfalls. Fortunately the Mississippi Valley was sparsely populated back then. Today millions of people live in densely populated urban areas like St. Louis and Memphis, making this zone one of the biggest concerns for the Federal Emergency Management Agency. While studies have shown that a quake greater than 5. A mid-magnitude earthquake in the right or worst place could cause devastating damage. The last major movement along the Hayward Fault occurred on October 21, , virtually destroying downtown Hayward. Running for nearly 74 miles through cities including Fremont, Hayward, Oakland, Berkeley, and Richmond, the Hayward Fault has the potential to wreak more havoc than most California faults. Starting on the Susitna Glacier Thrust Fault, the rupture raced along the Denali Fault System and continued kilometers until it reached the Totschunda Fault, rattling 70 more kilometers. The estimated magnitude of this earthquake ranged from 7. This almighty quake caused extensive damage to the transportation systems in central Alaska. This event was literally felt across the nation, even causing waves in pools and lakes in Texas and Louisiana! Find out what you need to know, and how to be prepared for what nature throws your way.

Chapter 3 : Fault Line | Definition of Fault Line by Merriam-Webster

Faults are fractures in Earth's crust where rocks on either side of the crack have slid past each other. Sometimes the cracks are tiny, as thin as hair, with barely noticeable movement between the.

The red line on this map follows the surface trace of the San Andreas Fault across California. Areas to the east right of the fault are on the North American tectonic plate. Areas to the west left of the fault are part of the Pacific tectonic plate. The arrows show the directions of relative motion along the fault. Map copyright by David Lynch click to enlarge. What is the San Andreas Fault? It slices California in two from Cape Mendocino to the Mexican border. What Type of Fault is the San Andreas? The San Andreas Fault is a transform fault. Imagine placing two slices of pizza on the table and sliding them past one another where they touch along a common straight edge. Bits of pepperoni from one side crumble across the boundary onto the anchovy side. The same thing happens with the fault, and the geology and landforms along the mighty rift are extremely complicated. You Can See a Plate Boundary! Photo of the San Andreas Fault near Gorman, California, showing rocks of the Pacific Plate gray rocks on the left side of the fault and the North American Plate tan rocks on the right side of the fault. There are very few places on Earth where you can see two plates in contact like this. Photograph copyright by David Lynch. How Fast Does It Move? The plates are slowly moving past one another at a couple of inches a year - about the same rate that your fingernails grow. But this is not a steady motion, it is the average motion. For years the plates will be locked with no movement at all as they push against one another. Suddenly the built-up strain breaks the rock along the fault, and the plates slip a few feet all at once. The breaking rock sends out waves in all directions, and it is the waves that we feel as earthquakes. Is the Fault Visible at the Surface? In San Bernardino and Los Angeles Counties, many of the roads along the fault cut through great mountains of gouge, the powdery, crumbled rock that has been pulverized by the moving plates. The hallmark of the San Andreas Fault is the different rocks on either side of it. Being about 28 million years old, rocks from great distances have been juxtaposed against rocks from very different locations and origins. The Salinian block of granite in central and northern California originated in Southern California, and some even say northern Mexico. Pinnacles National Monument in Monterey County is only half of a volcanic complex, the other part being miles southeast in Los Angeles County and known as the Neenach Volcanics. Aerial photo of the San Andreas Fault showing drainage that is offset by movement of the fault. Fault Myths There are many myths and legends about the San Andreas Fault, the biggest being that it will one day crack and California will slide into the sea. They are uncrowded and peaceful, perfect for family outings. There is abundant camping, bird watching, wild flowers and wildlife, rock collecting and natural beauty along the way. State and National parks are strung along the fault like beads on a string. About the Author David K. When not hanging around the fault or using the large telescopes on Mauna Kea, he plays fiddle, collects rattlesnakes, gives public lectures on rainbows and writes books Color and Light in Nature, Cambridge University Press and essays. The book contains twelve one-day driving trips along different parts of the fault, and includes mile-by-mile road logs and GPS coordinates for hundreds of fault features.

Chapter 4 : San Andreas Fault Line - Fault Zone Map and Photos

What's at fault? From an earthquake's point of view, there's more than one way to devastate a city. Most earthquakes occur along cracks in the planet's surface called faults.

Faults are different from fault lines. A fault is a three-dimensional surface within the planet Earth. At the fault, rocks have broken. The rocks on one side of the fault have moved past the rocks on the other side. In contrast, a fault line is a line that stretches along the ground. Faults come in all sizes, from small ones whose short fault lines you can see in a single road cut, to huge faults whose long fault lines can be seen best in pictures taken from orbiting satellites. A geologic map shows the locations of rocks of different kinds and ages. Because the geologic map shows the rocks that are exposed at ground level, the map also shows fault lines. However, many faults are entirely buried and do not reach ground level. Therefore, these buried faults have no fault lines, and they are usually not shown on geologic maps. If a buried fault is known at all, information about it is usually published in technical articles in geological journals. Why are most faults in the Eastern US buried? The answer is partly related to recognizing Quaternary faults and partly related to differences in geologic conditions in the areas east of and west of the Rocky Mountains. First, many faults are present in the central and eastern U. CEUS , but few of these faults have evidence of being active in Quaternary time. For example, if a fault is present only in pre-Quaternary rocks, then there may be no way to demonstrate Quaternary activity on the fault. Second, the types and ages of strata and deposits at the surface in the CEUS are commonly different from those from the Rocky Mountains west. In late Quaternary time, large parts the CEUS were covered by massive continental glaciers, which buried the landscape with glacial till coarse glacial debris and outwash deposits glacial debris transported by water , or by wind-blown deposits silty loess or eolian sand. These young deposits can bury and conceal evidence of Quaternary fault movement that is older than these deposits. Third, generally the rate of movement on CEUS faults is significantly less than that on faults in the western U. Slower rates of deformation mean that the evidence of Quaternary faulting will be subtler and is therefore, more likely to be missed, destroyed by erosion, or concealed by burial compared to areas having higher deformation rates. All of these factors contribute there being fewer Quaternary faults mapped east of the Rocky Mountains. Some of the best evidence of strong prehistoric earthquakes in the CEUS is from liquefaction features sand boils and dikes , which form as poorly consolidated, water-saturated sediment is forced to the surface by ground shaking. Despite these problems and shortcomings, the distribution of historical earthquakes and the geologic evidence of prehistoric earthquakes provide a reasonable guide to the seismic hazard in much of the CEUS. Earthquakes East of the U. Rocky Mountains In general, east of the Rockies, individual known faults and fault lines are unreliable guides to the likelihood of earthquakes. In California, a large earthquake can generally be associated with a particular fault because we have watched the fault break and offset the ground surface during the earthquake. In contrast, east of the Rockies things are less straightforward, because it is rare for earthquakes to break the ground surface. In particular, east of the Rockies, most known faults and fault lines do not appear to have anything to do with modern earthquakes. An earthquake is as likely to occur on an unknown fault as on a known fault, if not more likely. The result of all this is that fault lines east of the Rockies are unreliable guides to where earthquakes are likely to occur. Accordingly, the best guide to earthquake hazard east of the Rockies is probably the earthquakes themselves. It means that future earthquakes are most likely to occur in the same general regions that had past earthquakes. Some future earthquakes are likely to occur far from past ones, in areas that have had few or no past earthquakes. However, these surprises are not too common. Most earthquakes tend to occur in the same general regions that are already known to have earthquakes. Even if we could pin an individual earthquake on an individual fault, that would still be only part of the answer we want. There is, in general, no reliable way to know where or when the NEXT damaging earthquake will occur, and that is the earthquake that is of the greatest interest to society. Sources of Information State Geological Surveys or State Geologists - Most state geological surveys sell copies of the geologic maps of their states. These maps are probably the best single reference for earthquake hazard in a particular state, but it is technical in nature because it is aimed at

engineers who design buildings and other structures. Of course, no one can predict the future, and earthquake prediction remains beyond our present knowledge, so these maps express the hazard as probabilities.

Chapter 5 : Beyond San Andreas: 5 Scariest Fault Lines in the U.S.

Fault line definition, the intersection of a fault with the surface of the earth or other plane of reference. See more.

Chapter 6 : Fault Lines - Monitoring the cracks in Americaâ€™s criminal justice system

If you saw the Warner Bros. disaster movie, San Andreas, then you know all about the infamous California fault line and its potential for causing calendrierdelascience.com why does the San Andreas Fault get all the attention in movieland?

Chapter 7 : Fault line | Define Fault line at calendrierdelascience.com

The definition of a fault line is a break or fracture in the ground that occurs when the Earth's tectonic plates move or shift and are areas where earthquakes are likely to occur. A break where the Earth's tectonic plates shifted that is a likely site of an earthquake is an example of a fault line.

Chapter 8 : Fault (geology) - Wikipedia

March 8, (Fault Lines) â€" While working for the New York Times as the paper's Supreme Court correspondent, Linda Greenhouse won the Pulitzer Prize and embarrassed the paper along the way as well.

Chapter 9 : Earthquake Fault Map

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