

Faults

A fault is a fracture or zone of fractures between two blocks of rock. Faults allow the blocks to move relative to each other. This movement may occur rapidly, in the form of an earthquake - or may occur slowly, in the form of creep. Faults may range in length from a few millimeters to thousands of kilometers. Most faults produce repeated displacements over geologic time. During an earthquake, the rock on one side of the fault suddenly slips with respect to the other. The fault surface can be horizontal or vertical or some arbitrary angle in between. [1]

Earth scientists use the angle of the fault with respect to the surface (known as the dip) and the direction of slip along the fault to classify faults. While motion on faults is often characterized by making observations from one block relative to the other, for example, using the Law of Superposition. In 1638 Danish Anatomist and Geologist, Nicolaus Steno proposed the Law of Superposition: saying that as a rule each layer of rock is older than the layer above it. Therefore, if a geologist comes across layers of rock that do not follow this rule, e.g. older rocks lying on top of younger rocks, or missing time between two layers, then some sort of deformation (faulting or folding) or erosion must have occurred.

Types

There are three main types of faults, characterized based on the type of movement they exhibit.

- ***Normal Faults***: The most common type of fault. It forms when the block above an inclined fracture plane (i.e. the fault) moves downward relative to the block below, sliding along the rock on the other side of the fracture. This type of faulting occurs in response to extension.
- ***Reverse or Thrust Faults***: The opposite of a normal fault, a reverse fault forms when the block above the fault plane moves up/over relative to the lower block. When the dip angle is shallow, a reverse fault is often described as a thrust fault. This type of faulting is common in areas of compression.
- ***Strike-slip Faults***: Sometimes referred to as a lateral fault, this type forms when the blocks of rock on either side of a vertical (or nearly vertical) fracture move past each other. These faults are described as right lateral or left lateral, depending on which way the movement goes. A *left-lateral strike-slip fault* is one on which the displacement of the far block is to the left when viewed from either side. A *right-lateral strike-slip fault* is one on which the displacement of the far block is to the right when viewed from either side. The San Andreas Fault is an example of a right lateral fault. [1,2]

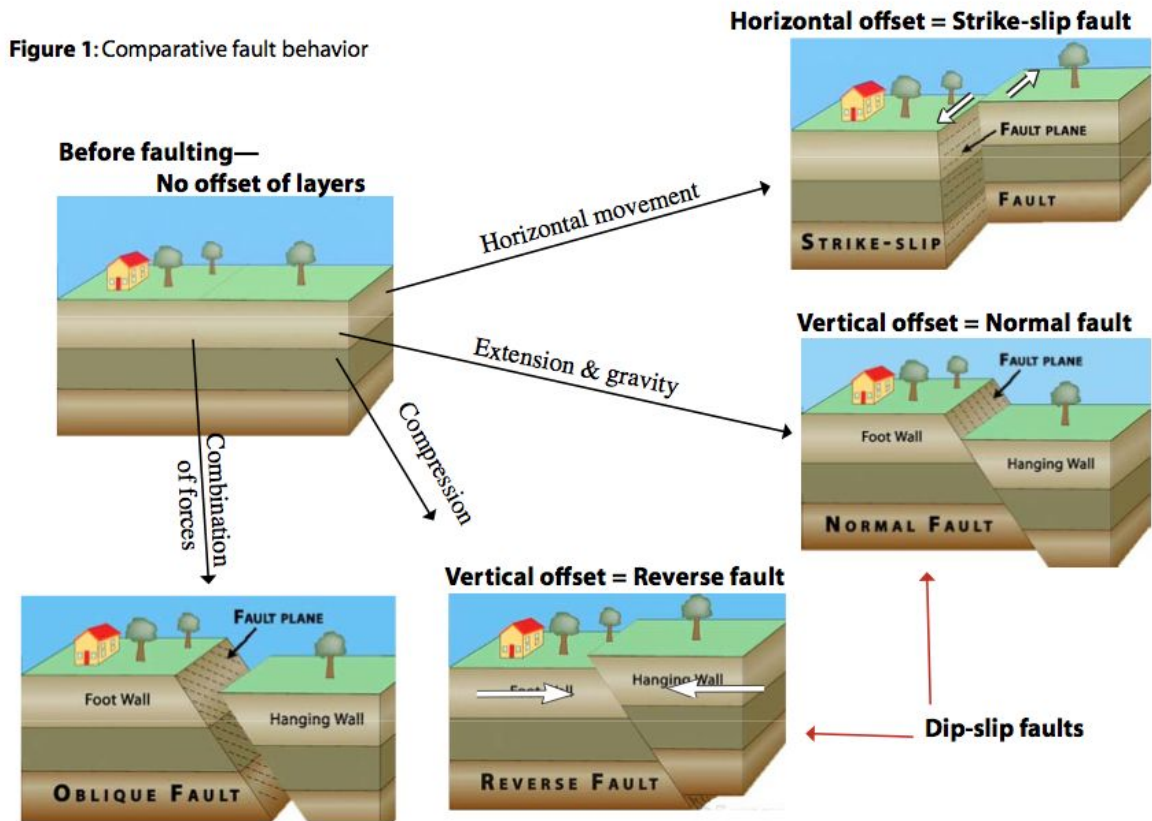


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Where?

A fault is formed in the Earth's crust as a brittle response to stress. The sense of stress determines which type of fault will form. We categorize stress into three different forms:

- Compression: Reverse faults often form in areas where the compressional stress in the region causes blocks to converge (i.e. move towards each other)
- Tension: Normal faults are often found in areas where tension or extensional stresses cause blocks to diverge (i.e. move away from each other)
- Shear: Shear stresses cause blocks to slide past one another: creating strike-slip faults (also referred to as transform faults)

References

[1] https://www.usgs.gov/faqs/what-a-fault-and-what-are-different-types?qt-news_science_products=0#qt-news_science_products

[2] <https://www.calacademy.org/explore-science/faults-where-earthquakes-occur>

IRIS: <https://www.iris.edu/hq/>