

GLG 101 – CHAPTER 10 - CRUSTAL DEFORMATION

- **Deformation** refers to the change in shape and/or volume of a body of rock. This most commonly occurs at plate margins, particularly in association with metamorphic processes.
- **Stress** is the force experienced by the rocks. **Strain** is the change in shape in response to the stress.
- **Confining pressure** is uniform stress in all directions, like the pressure you feel when diving beneath the water. For rocks, this force increases with depth beneath the Earth's surface.
- **Differential stresses** are different for different parts of the rock body, and include **compression**, **tension** and **shear**. Compression is squeezing, tension is pulling, and shear is equivalent to dragging the top of a stack of cards to the side to produce a leaning or angled stack.
- **Strains** are of three types: **elastic** (bends and snaps back to shape after stress is removed), **plastic** (bends and stays bent after stress is removed), and **brittle** (breaks under stress).
- The strain exhibited by a given rock will differ depending on the rock composition, the environmental conditions, and the rate at which stress is applied. An example of this is trying to bend a candy bar into a horseshoe shape. Whether it has been in the sun or the freezer, and how fast you bend it will determine whether it bends or breaks.
- The orientations of rock units, faults and fractures can be described by the **strike** and **dip** of their planar surfaces. **Strike** is the compass direction of a line produced by the intersection of the planar feature with a horizontal plane. **Dip** is the angle, in degrees from horizontal, at which a planar feature is tipped.
- The most basic geologic structures are **folds** (bends in the rock layers), and **faults** (breaks in rock layers along which movement of the rocks has occurred). **Joints** are fractures (cracks) in rock along which no significant movement has taken place. Folds are examples of plastic strain. Faults and joints are examples of brittle strain.
- **Anticlines** are “up” folds. **Synclines** are “down” folds. Folds can be **symmetrical**, **asymmetrical**, or **overturned**. **Basins** and **domes** are circular or elongated elliptical folds produced by centralized **downwarping** or **upwarping**, respectively.
- **Dip-slip** faults have primarily vertical motion. **Strike-slip** faults have primarily lateral (side-to-side) motion.
- The fault ‘block’ above the fault is called the **hanging wall**. The fault block below the fault is called the **footwall**.
- Compression will push the hanging wall up the fault – this is called a **reverse fault**. Low-angle (<30° above horizontal) reverse faults are called **thrust faults**. Reverse and thrust faults are common at **convergent plate boundaries**.
- Tension will allow the hanging wall to slide down the fault – this is called a **normal fault**. When a central block slides down along two normal faults facing one another, to form a flat-bottomed valley, this is called a **graben**. Such features are common at **divergent boundaries**.
- **Strike-slip** faults are produced by shear stresses. Large strike-slip faults are known as **transform faults**, which characterize **transform plate boundaries**. The San Andreas Fault in California is the best-known example of this type of fault. The direction the rocks on the other side of the fault appear to an observer to be moving during strike-slip faulting tells whether the fault is **right-lateral** or **left-lateral**.

