



## Geological Work of River (Part-2)

### Types of Erosional Features Produced By River Action (Continued....)-

**3. Escarpments-** In regions of alternate hard and soft rocks, due to differential erosion of rocks, it gives rise to erosional landforms called escarpments. They have steep slopes and usually developed in regions with dipping beds of hard rock overlying a soft rock. The soft rock bed erodes very fast compared to the hard rock bed due to variation in resistance to erosion thus, forming steep slope on one side and gentle slope on the other side of the structure. The steep side is called as escarpment or scarp face. They are also called as homoclinal structure.

Following are the types of escarpments-

i) **Hogback-** It is a long, narrow sharp crested, saw-toothed ridges or a series of hills with a narrow crest and steep slopes of nearly equal inclination on both flanks. Typically, the term is restricted to a ridge created by the differential erosion of outcropping, steeply dipping (greater than  $40-45^\circ$ ), homoclinal, and typically sedimentary strata. One side of a hogback (its back slope) consists of the surface (bedding plane) of a steeply dipping rock stratum called a dip slope. The other side (its escarpment, front -slope or "scarp face") is an erosion face that cuts across the dipping strata that comprises the hogback.

Hogbacks which are a typical regional topographic expression of outcrops of steeply dipping strata, commonly sedimentary strata, that consist of alternating beds of hard or well-lithified strata (i.e. sandstone and limestone) and weak or loosely cemented strata ( i.e. shale, mudstone, and marl). The surface of a hard, erosion-resistant layer forms the back slope (dip-slope) of the hogback whereas the weaker strata get preferentially stripped off of it by erosion. The opposite slope that forms the front of a hogback, which is its escarpment or scarp face, consists of a slope that cuts across the bedding of the strata.

ii) **Cuestas-** Cuesta are erosional landforms that are specifically refers to asymmetric low ridges, with a long and gentle back-slope called a dip slope that conforms with the dip of a resistant stratum or strata, called caprock. The outcrop of the caprock forms a steeper cliff-like front-slope (escarpment), cutting across the dipping strata that comprise the cuesta. Cuestas are the expression of extensive outcrops of gently dipping strata,



typically sedimentary strata, that consist of alternating beds of weak or loosely cemented strata (i.e. shale, mudstone, and marl) and hard, well-lithified strata (i.e. sandstone and limestone). The surfaces of the hard, erosion-resistant rock strata form the caprock of the back-slope (dip-slope) of the cuesta, where erosion preferentially erodes away the weaker strata. The front-slope of the cuesta consists of an escarpment that cuts across the bedding of the strata comprising it. Because of the gently dipping nature of the strata that forms a cuesta, a significant shift in horizontal location will take place as the landscape is lowered by erosion. Cuestas landforms are mostly found in coastal plains.

#### **Facts To Know**

**Scarp-and-vale topography**- A landscape consisting of a roughly parallel sequence of cuestas (scarps or dip slopes) and intervening valley (or vales). Typically found in homoclinal structures consisting of alternate layers of hard and soft rocks, that are eroded differentially.

iii) **Mesa**- A mesa is an isolated, **flat-topped tableland**, which is bounded from all sides by steep escarpments and stands distinctly above a surrounding plain. Mesas characteristically consist of flat-lying soft sedimentary rocks capped by a more resistant layer of harder rock, (e.g. shales overlain by sandstones). The resistant layer acts as a caprock that forms the flat summit of a mesa.

iv) **Butte**-Buttes are tall, flat-topped, steep-sided ridges. Buttes were once part of flat, elevated areas of land known as mesas. In fact, the only difference between a mesa and a butte is its size. Buttes were created through the process of continued erosion of the mesas by the action of streams. The streams slowly cut through a mesa where the hard top layers called caprock, resisted weathering and erosion, as a result the formations stay about of the same height as the original mesa. But due to continued erosion by streams, the softer rocks surrounding the caprock gets slowly eroded away eventually giving the buttes a slender spire like shape.

**4. Peneplain and Monadnocks** - Peneplain are nearly smooth and gently undulating, almost featureless erosion surface of relatively low relief. They cover large areas and are produced by fluvial erosion. Peneplains are landforms that are considered to be the ultimate result of erosion (i.e. in the course of geologic time, the land is



reduced almost to base-level (sea level), leaving so little gradient that essentially no more erosion could occur). These landforms are common in **temperate humid regions**.

**Monadnocks**- They are small rounded hillocks of resistant rocks that occurs at the surface of the peneplain. These hillocks give a dotted appearance at the surface of peneplains by virtue of their shape. In other words, Monadnocks are remnants of the pre-existing country rock that survived the episodes of fluvial erosion.

**5. Pediments, Pediplains and Inselberg** - These are erosional landforms mostly found in **arid regions**. The landform is a gentle sloping plain worn down by scarp retreat. They are developed in the piedmont area fringing a mountain. The portion of a plain adjacent to mountain slopes is known as a piedmont. In desert regions the characteristic faceted slopes of the mountain front result in a pronounced juncture between mountain and piedmont known as the piedmont angle. Where piedmonts experiences extensive erosion, often to a degree that bedrock is exposed, they constitute pediments. There may be a veneer of alluvium over the erosional surface, particularly where soft rocks (e.g., shales) occur on the piedmont. Massive rocks, such as granite, may develop spectacular bare-rock pediments that sharply mark a mountain front. Pediments are most common in areas where tectonic movement is relatively slow, since rapid uplift increases the capability of streams to deliver sediment to piedmont areas, leading to a dominance of deposition over erosion. The growth of pediments takes place at the expense of the mountain mass as a result of scarp retreat (i.e. retreat of the mountain front). For a small mountain range in an area of tectonic stability, the entire range may be eroded, this leaving a dome-like surface composed of the coalesced pediments.

**Pediplains**- Pediplain are broad, relatively flat rock surface formed by the coalescence of several pediments. Pediplains are usually formed in arid or semi-arid climates and may have a thin veneer of sediments. It is considered that the pediplain represents the last stage of landform evolution and are the final result of the erosion. Pediplains are associated with alluvial fan and playa surfaces that are generally occurs near the pediments.

**Inselberg** – They are steep sided, isolated hills that stands above a pediment or pediplain as round-topped mounds. They are the residual parts of bedrock that had survived the erosional process .

### **Facts To Know**

**Piedmont** is landform created at the foot of a mountain or mountains by debris deposited produced by the erosional action shifting streams. Such an alluvial deposit in a humid climate is known as a piedmont whereas similar deposit in arid climate is called a **bajada**.

**Bornhardt** is an elevated portion of dome-shaped rock with steep sides(at least 100 feet high) and bare on top. Most often they are made of granite or other hard rock, but can also be formed of limestone or sandstone, or a mixture of hard and soft rock. The shape of a bornhardt is often irregular. When they exist in a tropical climate, a little vegetation may be seen growing from its surface. They are often found in the desert. But a bornhardt in a tropical or other location may indicate that the region was at one time a desert in the past.