

The Journey of a River from Mountain to Sea

A Science Saturday presentation featuring the screening of *Planet Earth: Fresh Water*
Led by Joel Scheingross, graduate student in Geological and Planetary Sciences at Caltech

Ever wonder where all that sand on the beach comes from? How the Grand Canyon got to be so deep? Or why mountain ranges have tall peaks and deep valleys side by side? Believe it or not, these are all examples of the work of rivers. Living in the greater Los Angeles area it can be hard to see the interactions between rivers and the surrounding landscape (the giant concrete box that the LA River runs through was built specifically to keep the river from flooding adjacent areas and altering our local environment), however, rivers are all around us and play a major role in the shaping of landscapes both over short timescales (days to years) and long time scales (thousands to hundreds of thousands of years).

Today's program will cover the journey of a river from the mountains to the sea. We'll divide this into three sections: **mountain rivers**, **lowland meandering rivers** on floodplains, and **deltas**.

Mountain Rivers

This is where most of the **bedrock erosion** in rivers happens. Mountain rivers are responsible for breaking down large boulders and eating away at rock. **Sediment** (the rocks that are sitting in the river, generally gravel, cobbles, and boulders) skips along the bottom of the river and (just like running sandpaper against a wooden surface) slowly erodes the rock on the river bottom. Over long periods of time (thousands to hundreds of thousands of years) this erosion forms deep canyons and valleys.

Characteristics of mountain rivers:

- These rivers are small (generally 10s of feet wide) and shallow enough to walk across
- Sediment is large (can have boulders over 10 feet in diameter!)
- The slope of the river channel is steep (sometimes even vertical with big waterfalls)
- Erode bedrock at a pace of approximately 0.01 – 1 mm/year (much slower than the rate at which your fingernails grow!)

Lowland Meandering Rivers on Floodplains

Unlike mountain streams which exist in deep valleys, lowland meandering rivers have lots of flat, open space surrounding them, and the river itself makes big horseshoe shaped bends called **meanders**. When meandering rivers flood after heavy rain, the river overtops its banks and spills out onto the surrounding area (the **floodplain**), leaving behind a thin layer of sand and mud. The sediment in the meandering rivers is slowly transported downstream until it finally reaches the ocean.

Characteristics of lowland meandering rivers:

- These rivers are wide (can be over 4 miles across!)
- They're also deep (great for jumping into and large enough for big boats)
- Sediment is small (often sand size grains)
- The slope of the river channel is low

Deltas

As rivers get near and eventually enter the ocean they tend to spread out into multiple channels forming triangle shaped **deltas**. Here water speed slows, causing sediment to be deposited on the river bed and the ocean floor. This deposited sediment can both add onto the area of the continent (the state of Louisiana is partially built on sediment deposited in the Mississippi delta) and in some cases will sit on the ocean floor for hundreds of thousands to million of years before eventually being recycled into the Earth.

Characteristics of deltas:

- Sediment is very small (sand, mud, silt, and clay)
- The main river splits into multiple channels spreading out to form a triangle
- Sediment is deposited on the delta and in the ocean
- The slope of the river channel is extremely low

Key words:

Bedrock: Solid rock that is attached to the surface the Earth. You often can't see bedrock as it is overlain by soil, sediment, or vegetation.

Delta: The triangle shaped network of streams that form when a river enters a sea or ocean. Here water slows down and sediment is deposited.

Erosion: The process by which material is broken off from the surface of the Earth and transported away. We'll talk about "bedrock erosion" today, which is when bedrock is broken off from the surface of the Earth.

Floodplain: The flat area adjacent to a river. This is the area that the river covers during a big flood, hence its name. Floodplains are built out of sediment carried by the river.

Meander: A horseshoe-shaped bend in a river.

Sediment: All the loose rocks, gravel, sand, and boulders that can be found on the bottom of a river, in river banks, or even on the sides of hills and mountains.

Joel Scheingross is a graduate student in Geological and Planetary Sciences Division at Caltech. His research is focused on understanding the physical processes which shape the surface of the Earth and he has undertaken projects on the transport of gravel in mountain streams, controls on the occurrence of slow moving landslides, and the physics of waterfall erosion. When he's not stuck in the lab or the office, Joel enjoys spending time in the mountains hiking, rock climbing, and snowshoeing.