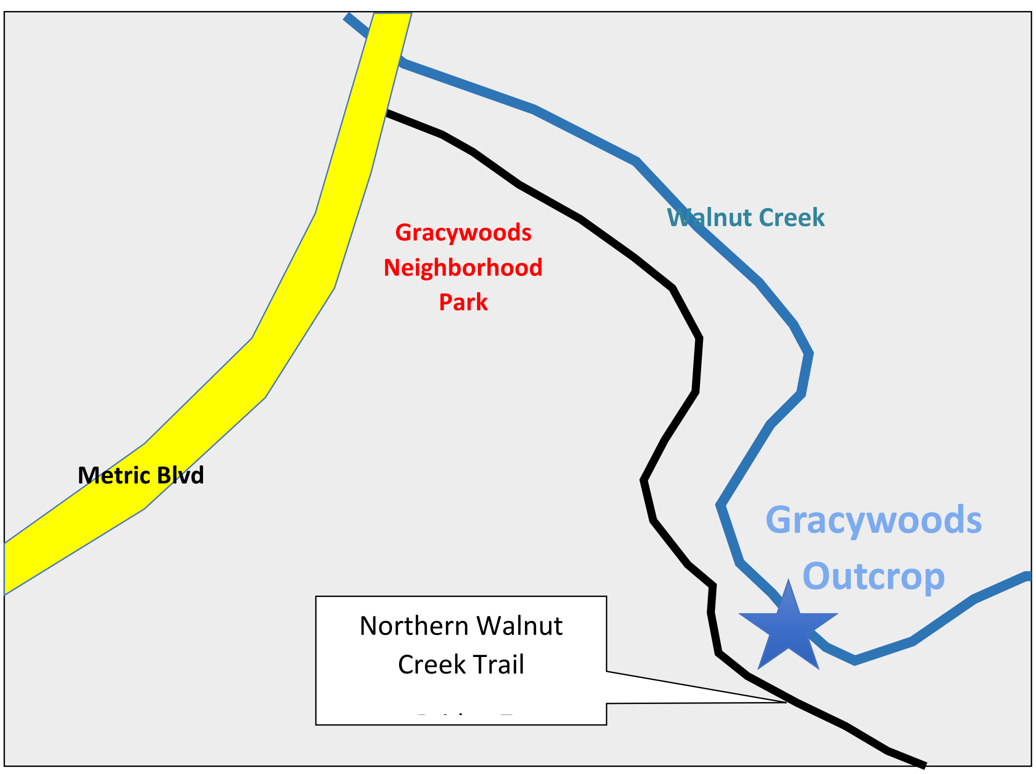
Austin Chalk Do It Yourself Field Trip – Gracywoods Neighborhood Park

Austin Chalk Overview

The Austin Chalk is a white to gray limestone that can be seen from Dallas to west of San Antonio (https://en.wikipedia.org/wiki/Austin_Chalk, https://mrdata.usgs.gov/geology/state/sgmc-unit.php?unit=TXKau%3B0) as part of the Balcones Fault Zone (https://www.beg.utexas.edu/geowonders/centtex). It was deposited from about 90 to about 85 million years ago during the Cretaceous period. Below the surface, it extends across large areas of eastern Texas and Louisiana where it forms an important oil and gas reservoir in places (https://austinchalkoilgas.com/). The Austin Chalk is a formation that includes two main types of rock: chalk and marl. Chalk is a limestone composed of microscopic plankton fossils so it formed in an ocean environment. Chalk is dominated by the calcium carbonate mineral calcite. Marl is a mixture of calcite, clay, and silt. Clay and silt are grains of quartz and other silica-based minerals. The chalk formed directly from living organisms in the ocean and the marl formed where clay and silt from the land was mixed into the chalk by rivers and storms.

Gracywoods Neighborhood Park

Gracywoods park is in northern Austin on Metric Boulevard and between Parmer and Braker. Because there is a median at the park entrance, access must be from the south by using the northbound lane of Metric. It has a small parking area and provides access to North Walnut Creek Trail 12. Head east on the trail for about a quarter mile to the east end of North Walnut Creek Trail Bridge 7 and find the dirt trail that leads down to Walnut creek. Use caution and non-slip soles because the trail is steep.



Interesting Things To See

The Gracywoods Park outcrop is unique because it provides a large, three-dimensional view of the lower part of the Austin Chalk.

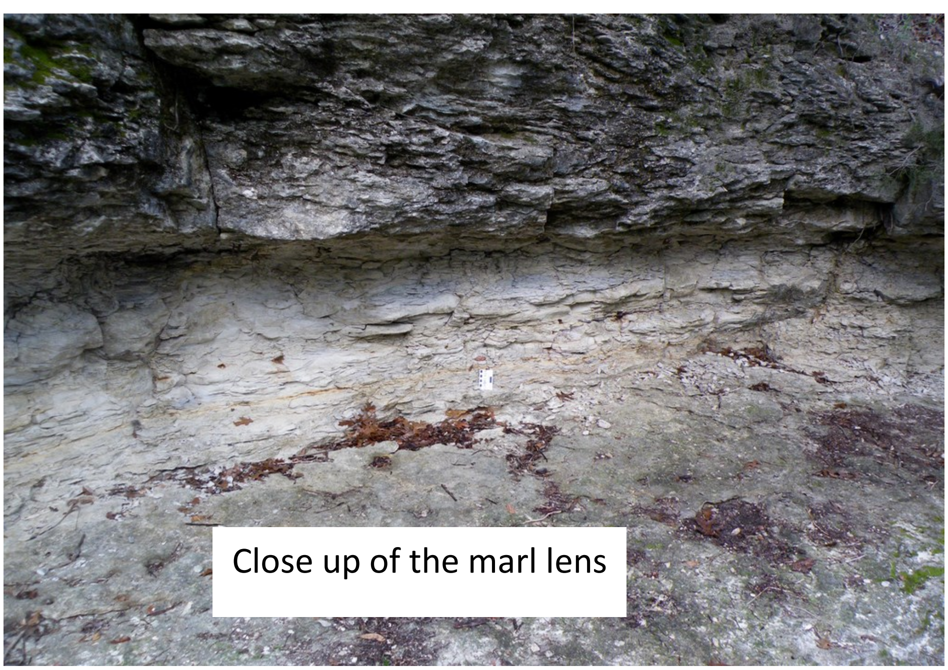
There is a wide bench of white limestone at the base of the trail. This is a very common rock type for the Austin Chalk: a limestone without many noticeable features. Because we don't see obvious layering, geologists call this a "massive" or "structureless" limestone. We see a sharp contrast when we look up to the top left of the outcrop where there is obvious laying that geologists call "bedding". In the Austin Chalk, bedding is created when waves and currents move the ocean sediments around. One good example: storms over the ocean create large waves that have enough energy to move the ocean sediments around. The largest particles are swept along the ocean floor to form layers. The smallest particles are picked up and held in the water until the storm energy dies out. Once the wave energy has stopped, the finer-grained sediments will settle out to cover the layer on the bottom. This pattern of a larger-grained (coarser) layer overlying a fine-grained layer is a classic "storm deposit". These groups of layers, or beds, often have a sharp base caused during the highest energy time of the storm when the bottom is eroded. As the energy wanes, the storm deposit covers the eroded surface.

So how does structureless limestone form? For the Austin Chalk the most common cause was probably a result of animals living on the ocean bottom that burrow into the sediment before it turns to rock. This is known as "bioturbation" and, given enough time, the burrowers can completely churn the sediment thereby destroying all the bedding.

Another thing to notice in the photo is that the base of the bedded section forms an overhang above the underlying layer. This is because the layer under the overhang is much softer, so it gets removed more easily when the creek floods. It is softer because it is a marl bed containing more clay than the limestones above an below. The next photo gives more detail.

This photo was taken from the creek just downstream from where the trail ends. You can see that the marl bed is thickest near the center and that it thins to either side until it is not present. Geologists call this type of bed a “lens” because of its shape in cross-section.

So how did the marl lens form? To me, some of the story is clear and other parts are more mysterious. The bottom surface is curved downward, so it looks like it was formed when a high-energy current eroded a scoop out of the massive bed. This raises an interesting question: If the surface formed from high energy, why was the scoop filled with low-energy sediments? Because the marls have the smallest particles throughout, they represent low-energy environments. One possible explanation is that the currents that created the scoop were so strong that all the available coarser sediments were moved further out into the ocean. The marl probably filled the scoop much later when energy levels were lower. This is a common occurrence in shallow ocean environments that geologists refer to as “sediment bypass”. Of course, this is only one possible explanation and further detailed study of the rocks might strengthen this hypothesis or help reject it for something more likely.

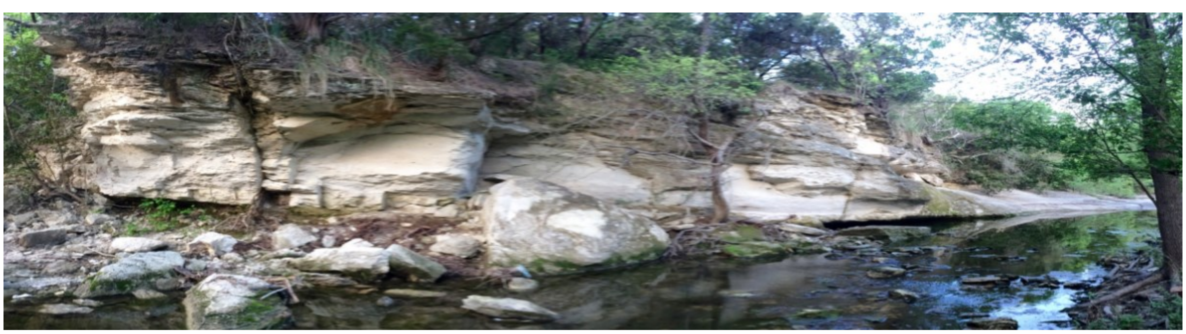


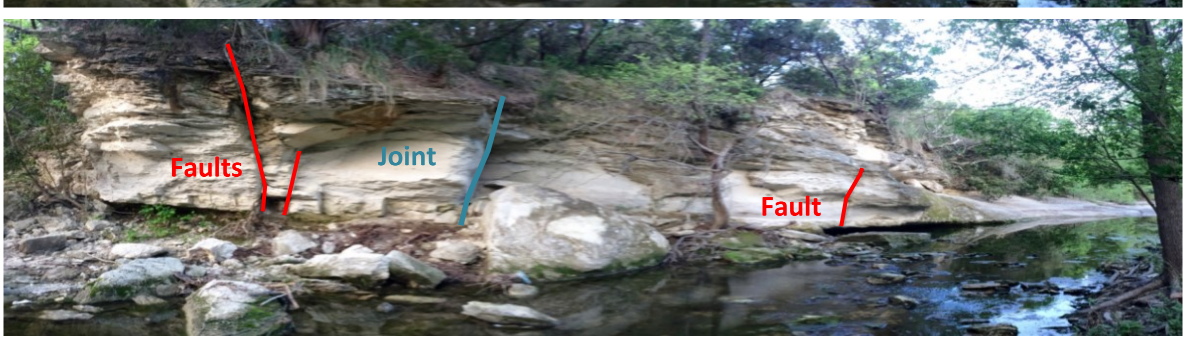
Close up of the marl lens

The marl lens is composed of several thin beds that have irregular thicknesses and lengths. The photo below is zoomed into the center of the photo above. The beds in the center look like they are the hardest, so they probably contain less clay than the other beds. The darker gray beds above the harder beds look very soft so they are probably the highest in clay content. This group of beds is typical of low-energy sediments.

If you choose to wade or walk down the creek bed, you can find the base of the Austin Chalk and see some other interesting features. The photo below shows the entire outcrop with the people on the right near the base of the trail and those on the left at the spot where the base is exposed.

This photo shows the base of the Austin Chalk and the underlying Eagle Ford formation. The Eagle Ford is mostly shale, a rock dominated by clay, so it is soft. It is difficult to see the internal features of it because it falls apart and turns to soil. Notice how the base of the Austin Chalk is uneven with one segment higher than the others. These segments are bounded by vertical cracks which in this case are small faults. A fault is a crack with movement up or down across the crack. Cracks without movement across them are called "joints". The photos below show these two small faults and some joints.





These are very small faults and may just be the result of the outcrop falling apart as the creek erodes it. However, they might be part of the Balcones Fault Zone (https://en.wikipedia.org/wiki/Balcones_Fault), a group of major faults that helps form Austin's scenic spots like Mount Bonnell. This group of faults extends from Del Rio east to San Antonio and north to Dallas. Faults and joints are very important to oil and gas production from the Austin Chalk because they provide pathways for fluids to flow.