

## Field Trip to the Miocene Fleming Formation of Jasper County, East Texas

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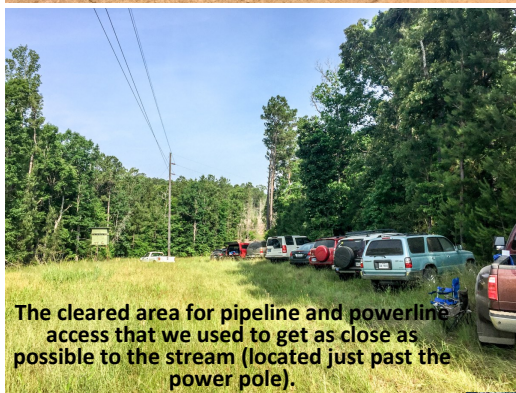
**O**n May 14, 2016, the HGMS held a field trip to familiar hunting grounds in East Texas, just south of Sam Rayburn Reservoir. The field trip was made possible by Joe Liggio, HGMS member and a retired botanist with the State of Texas, who arranged the trip through his friend Keith Stephens, a land use forester with Campbell Global. Keith

allowed us access onto timber company land and accompanied us on the trip. The trip was organized on the HGMS side by Mike Dawkins, field trip chair for the Paleo Section.

Twenty HGMS members met with our host at 8:30 a.m. at the usual meeting place, The Stump Restaurant a few miles past the Sam Rayburn Reservoir dam. Several of the party had already been making good use of the country breakfast buffet at the restaurant. By 9:15 under rapidly warming skies, Keith led our caravan to the site. However, instead of the usual location at Beef Creek, Keith surprised everyone and led us to a completely new site which was about five miles east of the Stump and then about a mile north on a timber company dirt road. We all parked along a graded clearing made for an



**The Stump Restaurant, our traditional meeting place. Shown in the picture (left to right) are Troy Bell, Owen Martin, Scott Singleton, Joe Liggio, and Tony Ma.**



**The cleared area for pipeline and powerline access that we used to get as close as possible to the stream (located just past the power pole).**

underground pipeline and then walked down to the stream crossing where we began our hunt.

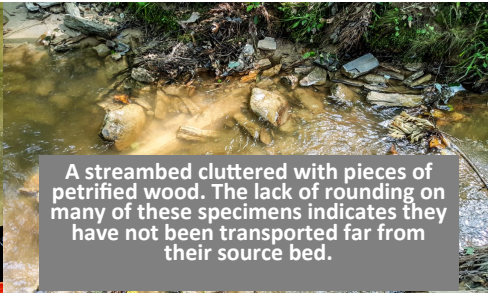
Actually, hunting is too glamorous a term. A more accurate description would be high-grading the stream bed. Petrified wood was everywhere, and the question was, which pieces each person would decide to collect and haul back to their car (which was the tough part, as usual). After an initial period where everyone just hung out along the buried pipeline clearing (where a lot of really



**The access point to the stream within the cleared pipeline and powerline corridor.**



A stream gravel bar cluttered with large pieces of petrified wood. The long log in the middle is a modern-day fallen log.



A streambed cluttered with pieces of petrified wood. The lack of rounding on many of these specimens indicates they have not been transported far from their source bed.



View along the length of a section of the stream showing petrified wood on the inner gravel bar while the outer bank is a cut bank where erosion is actively taking place, thus possibly exhuming more in-situ petrified wood from the Miocene sediments.



Left: Palm stem found by the author at the point of entry into the stream along the pipeline/powerline corridor. This specimen was at my feet as I was standing in the stream describing the geology of this locality. The hand on the right belongs to our host, Keith Stephens. Terry Proctor is shown in the background.



Above: Palm bulb found by Owen Martin a considerable distance upstream in one of the tributaries. This is one of two large pieces found by Owen.



Above: Our host, Keith Stephens, creating a pile of petrified wood pieces in the middle of the stream. I think in most circles this would be known as doodling....



Above: The end of a palm specimen found by Troy Bell that shows a chip knocked off the end, thus revealing a highly silicified specimen. This beautiful translucent yellow matrix with palm "straw" (vascular bundles) will make exceptional cutting material.



Owen Martin getting up close and personal with pieces of petrified wood. Certainly can't let any pieces of palm escape....



A happy Beverly Mace standing in a stream cluttered with petrified wood.



A cottonmouth found and photographed by Mike Dawkins. Fortunately these snakes are not often encountered, but they are present in the East Texas woods and can certainly ruin a field trip if not seen before reaching down to pick up that rock.

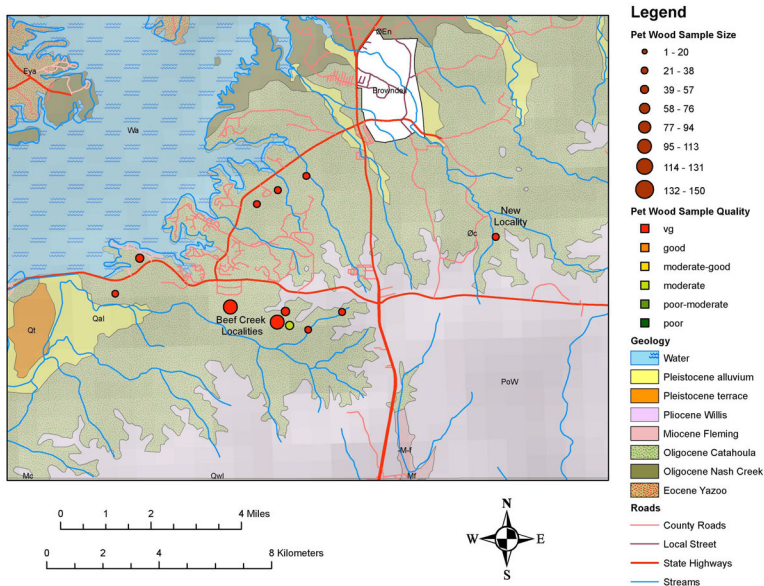
good material was collected, including my palm trunk), people fanned out, going both downstream and upstream.

Over the course of the morning, exhausted groups struggled back to their cars with loads and stories to go along with them. Owen Martin and Troy Bell went way upstream along a tributary, and Owen came down with two large palm stems, including a bulb (see photo). Troy found a large palm trunk that probably wins the prize for the highest silicification, with a translucent yellow matrix color (see photo). Mike Dawkins came away with two large palm pieces, and Ken & Andrea Bruneau collected a large number of smaller pieces.

People drifted away through the morning as they had collected what they wanted or had had enough of the sun and humidity. About eight of us waited until no more were left in the stream, then we headed out around midday, Keith locking the gate behind us. We met at The Stump for a BBQ buffet lunch, meeting a group that had just finished and was leaving. Afterwards we all said our goodbyes to Keith for showing us such a wonderful time at a new spot and limped home, our tailgates hanging much lower than when we left Houston that morning.

### Geology of the Field Trip Site

Geologically, this site is identical to our old Beef Creek site (see map). As we drove into the site from St. Rd. 255, we were driving over the sandy loam of the Pliocene Willis Fm (Formation). This formation is typically found on roads as loose sand, but in formation it is a fine-to-coarse fluvial sandstone with iron staining and cementing and results in a resistant “cap” in the topography. It’s known to be the source of “sand traps” along dirt roads in



this part of Texas, and it is common to see Southern Yellow Pine forests where the Willis is exposed because of the well-drained loose sand which pines love. Petrified wood occurs in this formation, but I suspect it to be eroded remains of Miocene Fleming Formation wood (I will eventually prove this, but it may take some time to build up enough samples).



**Above**—View upstream showing a waterfall formed as the stream eroded into the Catahoula Formation. In the distance, the stream is following along the top of the formation. The petrified wood source beds are within the first 10 feet or so of the Fleming Formation lying on top of the Catahoula Formation.

As soon as we dropped down in elevation, we were leaving the Willis Fm behind and entering the Miocene Fleming Formation.

The description in Singleton (2008) is “fine to medium clayey sandstone or sandy claystone with poor sorting and is typically mottled with masses of orange and gray clay, suggesting extensive soil formation on the sediments.” This formation produces a rich, dark soil that supports a diverse hardwood forest in East Texas. It often doesn’t have extensive areal exposures because it is so soft. In fact, the various geologic maps put out by the BEG don’t even show there being any Fleming Fm exposure between the Willis Fm and the Oligocene Catahoula Fm., which of course is not true as the mapping in Singleton (2008) demonstrated. Nonetheless, just as this formation is important for the diverse forest it supports, it also is the source of much of the petrified wood in this part of East Texas, as I will describe in the next section.

Once we hit the floor of the gullies in this area, we find ourselves standing on the resistant Oligocene Catahoula Formation. This formation is a hard,



Two pieces of petrified wood in situ within the lower portion of the Fleming Formation. The Catahoula Formation is in the lower portion of the picture, at and just above the water level (at this location the stream has eroded into the uppermost portion of the Catahoula).

gray to white clayey siltstone with a prominent unconformity at the top. It tends to produce ledges and high outcrops where it is eroded into. In the field trip site, the tributary stream we hunted along was entirely flooded by the top of the Catahoula. Eventually downstream (to the north) the stream will erode into the Catahoula, and eventually upstream the creek will peter out into the Fleming Fm (as we saw in some of the feeder gullies to the creek). It is because of this highly fortuitous stratigraphic position that this area produces so much petrified wood.

## **Petrified Wood at the Field Trip Site**

The purpose of the mapping done in Singleton (2008) was to document the stratigraphy and occurrence of fossil wood in this area. According to the results of that work, "petrified wood found in situ occurs within relatively narrow lenses of fluvial stream channels within the lower 10 ft. (3 m) of the Fleming Formation. The wood varies from small pieces to large logs and typically has a small degree of rounding, indicating that it is not in the original fossilization location. However, the presence of large, intact logs indicates that it has not been transported far. Paleobotanical evidence corroborates this, indicating that the logs are either Miocene or Oligocene in origin."

Since that article was written, I've come to believe that wood occurring in lag deposits at the base of formations immediately above an unconformity primarily contain wood from that formation and not the immediately older formation. There are numerous examples of this phenomenon in the Texas Gulf Coast. Both the Catahoula and Fleming have unconformities at their bases and contain wood in fluvial lag deposits. I have not seen to this point in time any examples of wood in these basal lag deposits that was sourced in the preceding formation. Of course, having made that comment, it still remains to work out the details of how wood is emplaced in these basal lag deposits with rounding. If the rounding was due to transport of the original logs then that is to be expected. However, if the rounding is due to transport of the fossilized wood (as my 2008 article suggests), then that is a problem because that wood would have needed to be preserved at some point, unearthed, and then transported, all within the same geologic age. That's a difficult scenario to envision and I feel it is unlikely.

At our field trip site, much of the material appeared to be in modern-day lag deposits produced as fossil wood was unearthed from the Miocene source beds and deposited into the current-day stream (as we saw on our field trip), then the stream meandered and its previous stream bed was buried along with larger pieces of fossil wood. This is because several of the lag deposits I observed were immediately above the top of the Catahoula (i.e. lying on the Catahoula surface), which is the precise stratigraphic location of the current stream, and the lags were floored with pebbles and petrified wood with some degree of rounding. What I was looking for is an original stream lag deposit that was entirely surrounded by undisturbed formation sediments (as I showed in my 2008 article). I did find that in one location (see picture below), which was enough to demonstrate to me that the surrounding lower Fleming are the source beds of all the petrified wood we were finding in the modern day stream bed. This assumption was further strengthened by the presence of several feeder gullies leading to the main stream bed. Many of these feeder gullies were choked with petrified wood, further giving credence to the hypothesis that they were traversing the actual source beds for the petrified wood we were seeing in the main stream.

## **ID of Petrified Wood in the Fleming Formation of East Texas**

My ID project for petrified wood in Texas is ongoing, but to date there are several families that I always find in the East Texas Miocene. These families appear to be an unusual mix of tropical holdovers from the warm climates of the Eocene and invaders that had been progressively moving south with the cooling climates of the late Eocene, Oligocene, and Miocene. I will divide these into three classes depending on the time of invasion:

## Tropical Woods

These woods are holdovers from the warm climates of the Eocene. Many of their contemporaries have already disappeared, but these genera seem to hold on for a little while longer.

1. **Palm**—these plants never seem to be predominant components of the fossil wood assemblage, but nonetheless they are common enough and have been since the Cretaceous. Because of the primitive cellular structure of the Monocots, it is not possible to identify genera or families from wood structure alone.
2. **Apocynaceae family**, *Couma* genus (?)—these plants have been in Texas since the Eocene, but it's difficult nailing down the exact genus because there are several that look similar. And in fact, the possible matches extend to other families. I suspect that at different localities and in different age formations, the identification could vary significantly. Today this family consists of shrubs and trees in tropical and sub-tropical environments worldwide, even some in temperate climates. In the Americas, it is known as the Dogbane family. The *Couma* genus is currently native of northern South America.
3. **Flacourtiaceae family**, *Scottellia* genus—these plants are found in Texas in the Eocene similar to *Couma* and have hung on since then. This family is strictly tropical but has had lots of problems with its definition, so much so that it has been officially disbanded and its genera scattered to several other families. It is likely that I will have to re-identify this genus before I manage to publish an ID of it. Currently the genus *Scottellia* is restricted to the West African tropical rain forests.

## Warm Temperate Woods

These are woods that started invading the southern North American continent (likely from the north) during the late Eocene, although the timing varies with family.

1. **Legumes**—this is a very large family (Leguminosae, also known as Fabaceae) and is known as the bean family or the pea family because all of its members have bean pods. It consists of ground-hugging shrubs such as the lima bean and trees such as *Mimosa* and *Acacia*. Legumes are found all through the Eocene but only become a major component of the assemblage in the Late Eocene through the Miocene. In the fossil record, there are several distinct genera represented; usually I can find two distinct wood types. I have not yet made the effort to identify them to genus or species, although I can say that I often see *Locust* in the East Texas Miocene.
2. **Juglandaceae family**, *Engelhardia* genus—this is the tropical representative of the walnut family. It has been identified in the Miocene of the northwestern US and now I have extended its range to Texas. It has long been established that the pollen of the walnut family sometimes dominates the entire assemblage in some sites in the Late Eocene of Texas; this is when I start finding this genus in the fossil wood record.

## Temperate Woods

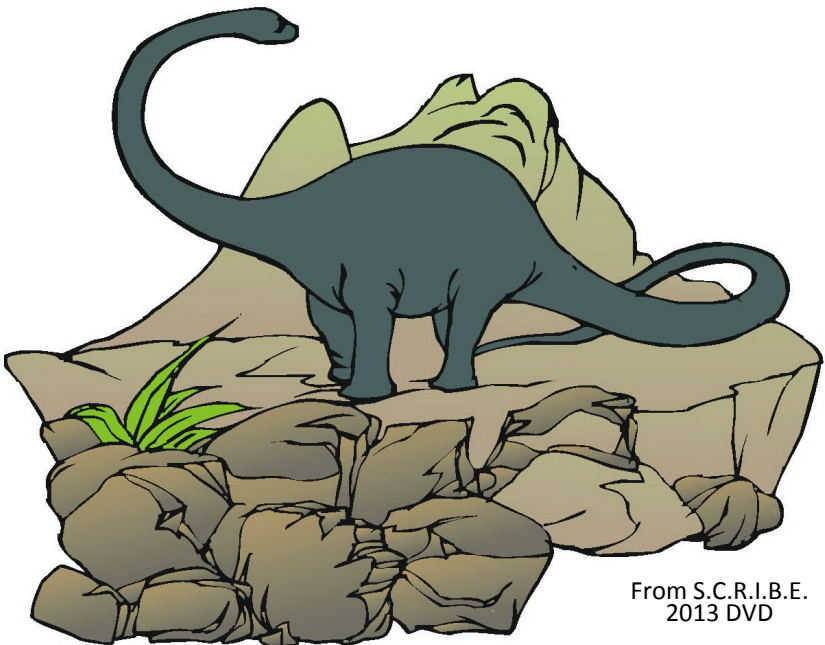
1. **Live Oak**—this genus sometimes makes up well over half the

specimens in the East Texas Miocene. Other Miocene sites in Central or South Texas also share this predominance. To this date, I have not seen any difference in the cellular structure of Miocene live oaks from present day live oaks (*Quercus virginiana*).

- 2. Elm**—this wood type is as ever-present as live oaks in the Miocene fossil assemblage and probably invaded at the same time. The specific type of elm represented in the Texan fossil assemblage is the hard elm group, such as the Winged Elm (*Ulmus alata*), which is distinct from the elm that now populates North America (the American Elm, *Ulmus americana*).
- 3. Conifers**—strictly speaking, conifers are not an invader from cooling climate although the family did undergo a change. In the Texas Eocene, conifers are well represented but exclusively by the Taxodiaceae family (bald cypress, sequoia). My research has indicated there were a number of genera present although they probably were specific to the time interval and location. These genera are very difficult to separate based on wood anatomy characteristics so I haven't yet done so. At some point, either in the Oligocene or Miocene (I haven't determined when exactly) this assemblage changed and the Taxodiaceae were replaced by either the Cupressaceae (cedar family) or the Podocarpaceae, which are currently restricted to the southern hemisphere and are similar in wood characteristics to the Cupressaceae.

### References

Singleton, S.W., 2008, Petrified wood in the Miocene Fleming Formation, Jasper County, Texas: Gulf Coast Association of Geological Societies Transactions, v. 58, p. 797-814.



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