What is in the poop?
or
Thin section examination of shark coprolite from the Arroyo Formation, Witchita Group, HMNS Craddock Ranch dig site, Seymour, TX.

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for use on the CSI blog on the dig at Seymour, Tx
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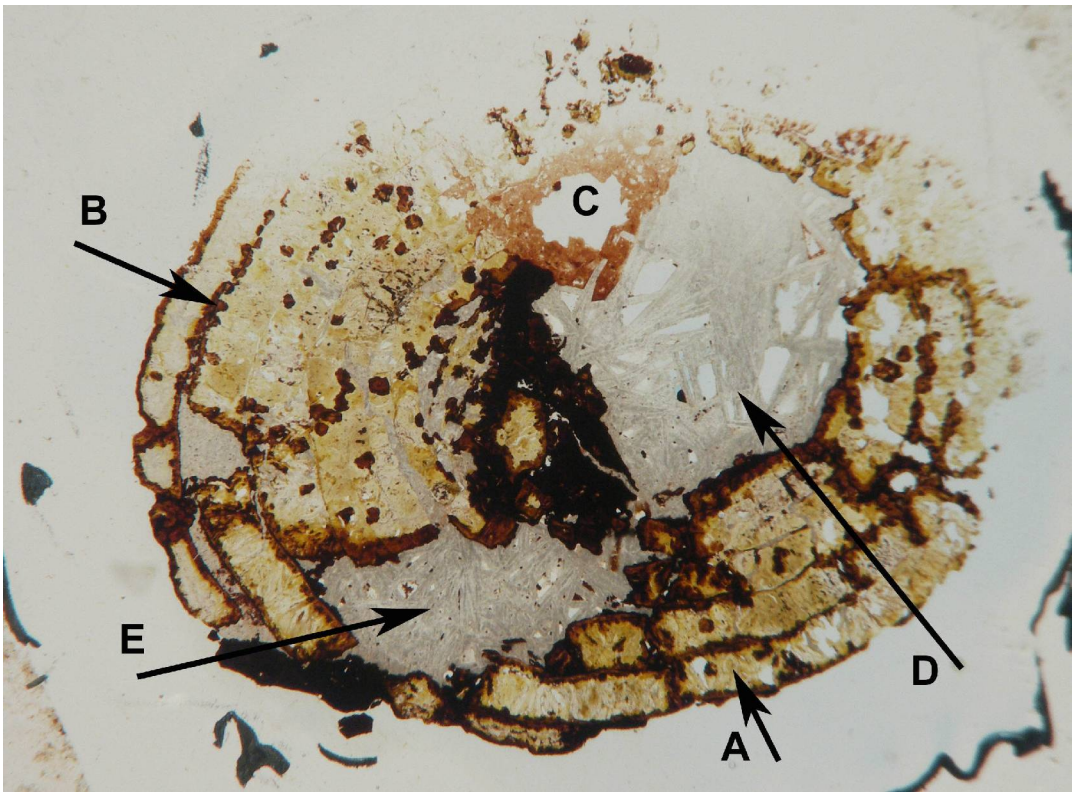
Readers of this blog might remember that I offered to EAT the sandstone pebble that David Temple (curator HMNS) found if it were a shark coprolite (i.e. poop). I want to go on record that after 3 months, David has yet to produce the pebble of concern. Could he have just misplaced it or is it an attempt to avoid being proven wrong!

Today I am doing a detailed study of a broken coprolite collected about a mile from our main dig site, called *Spine*. It was selected because it is not a display grade specimen (i.e. one that might go on display at the museum) and that it shows what might be fish scales.

Lets go straight to the payoff, photographs of the thin section of the coprolite. The specimen in this picture is about ½ inch across.



Thin section of a shark coprolite.

A. The spiral pattern on the outside is matched by a spiral pattern inside.
B. Brown iron oxide has been precipitated on the boundaries of the layers.
C. Possible fish scale.
D and E. Barite filled cavity. You can see the bladed crystal forms.

It looks as if the barite in cavity E has exploded the coprolite. Try to mentally erase the cavity and see if the nodule would go back together. Many of our fossils have been exploded by the process of caliche deposition. I have seen barite before as infillings in bones. Caliche is a mixture of calcite and gypsum deposited by ground water evaporating at the surface. It occurs in dry areas where the rainfall is much less than the evaporation rate and Seymour certainly qualifies in the summer. It may be that we have barite caliche here also.

Almost certainly, caliche was deposited here during Permian times and then again in modern times. The caliche will make it very difficult to prepare the fossil bones. More on that in a later blog entry on thin sections of the bones.

When I started, the coprolite looked like this.

Shark coprolite exterior.

Spiral pattern characteristic of shark poop. It seems to be part of their anatomy because old and modern sharks have it.

The end view makes the coprolite look like it is made of rolled up sheets. The white spots which I though were scales are really barite crystals.

End view of the coprolite.

After a thin section has been cut off, the end looks like this. Note that the white bladed barite filling is now in the center. This is another suggestion that the coprolite has been exploded by the barite filling. The blue edge on the upper right is the remnants of the epoxy used to harden the specimen. You might ask how I know that this mineral is barite. Barite, calcite and gypsum are the only common minerals that grow in bladed, white colored crystals. Gypsum is easy to test for because it is softer than your fingernail. So, I tested that by rubbing my fingernail across the white patch. The mineral is harder than my fingernail. The white mineral also does not fizz when wet with 5% hydrochloric acid, and so it is not calcite.

Bladed barite in the center of the coprolite.

So what is a thin section and how do I did I make this one? A thin section of rock is made by gluing the rock to a glass slide and then grounding it thin enough to read a newspaper through. The standard for thin sections for mineral identification is 30 microns, much less than the thickness of a piece of paper. Paleontologists are not so picky; we generally stop grinding when the section looks good.

Lets examine some other shapes to see if they are also coprolites. Flattened ovals shapes are also present, but are they coprolites? Enlarge the following picture and look at the surface and you will not see much of anything.

A view from the side.

But the broken end of the nodule is much more interesting. You can see a round spiral in the center just like on the first specimen. The rest of the rock also shows spirals flattened into an oval shape.

End view of the same coprolite.

We have now determined that coprolites can be found in round and oval spindle shapes, which may or may not have an external spiral pattern. A broken specimen shows a spiral structure and may or may not have been filled or exploded by caliche. There may be white barite blades present that look like fish scales. Breaking the nodule is as good as cutting a thin section (and much quicker). I have learned from this process.

So? Lets get to the real payoff. What did the sharks eat? Since these sharks have little teeth, Dr. Bob Bakker thinks they ate small food like arthropods and salamanders. I cannot confirm this because I see no bone or shell fragments. It is going to take a better paleontologist than I to figure it out.

Now, how did I cut the thin section?

The process goes like this.

1. If the nodule shows the complete football shape with spiral markings on the outside, cut it in half.
2. If it is a broken specimen, grind a flat face.
3. Mix up highly fluid epoxy and stain it with a bit of blue dye.
4. Make a little tub out of aluminum foil, the size of the cut face of the specimen.
5. Put the epoxy in and immerse the specimen. The epoxy will be drawn up into the specimen by capillary pressure, hardening it. You will be able to see the added epoxy because it will be colored blue. This is a standard oil company technique. Put the tub on a hot plate to make the epoxy really fluid. I use a 1:10 hardener/resin slow set epoxy specifically designed for this.
6. Heat for 30 minutes at 150 degrees F. Cool.
7. Your specimen now has an aluminum foil tub glued to its end with dark blue epoxy. Using a flat lap, grind it delicately until the blue epoxy is gone from the end.
8. Using single part epoxy, glue the specimen to a glass slide and put in the sun for 5 minutes. I use a UV setting epoxy to glue the specimen to the slide. If I used 2-part epoxy, the mixing process would introduce innumerable bubbles, spoiling the slide.
9. I now have a rock glued to the slide. To save most of the rock, I use s special jig to cut it off the slide. This leaves about 1/20 an inch of rock on the slide.
10. Grind off most of the rock with a 600-grit diamond lap plate and lots of water.
11. *This is the tricky part.* STOP before it is all gone. This means that you check it frequently and stop when you can see through the rock. You have to be able to read newspaper through the rock.
12. Mineralogists grind their rocks to 30 microns in thickness but as a paleontologist, I grind until I can see what I want to see. I can always grind it thinner. It also does not matter very much if the slide is wedged (not even in thickness) and this can even be useful, because some things are easier to see in thicker or thinner slices of rock.