Preliminary palynology of MoSU Ridge, a complete exposure of a coal and associated sediments in the Hooper Formation, Wilcox Group, Texas

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Introduction

Students and Faculty at Morehead State University have been studying exposures of the poorly-documented Hooper formation, lowermost Wilcox Group of Texas since 2017. The Middle Paleocene age 'Hooper formation,' immediately overlying the Caldwell Knob oyster bed, has never been formally defined. A type locality, now very poorly exposed in and near McKinney Roughs Nature Park (Figure 1, Figure 2) near Bastrop Texas, was designated by Sharp (1951) in a Master's Thesis, but never validly published. In McKinney Roughs, approximately 64 meters of section is present (Figure 3), although due to the slumping and vegetation cover, only about 30 meters of this are accessible.

In December 2018, MSU students, enrolled in ESS 399 - Geology of a Region: Central Texas, faculty, and collaborators found a new exposure of the coal in the upper portion of the Hooper Formation during field reconaissance. This exposure was designated 'MoSU Ridge' in their honor. MoSU Ridge consists of an approximately 2-m thick exposure of clay-rich seat earth and a coal seam broken in the lower third by a tonstein (altered volcanic ash) parting and the upper third by a shale parting (Figure 3). Above the coal is a carbonaceous shale that rapidly degrades into a modern soil.

While the palynology of previous exposures has been studied (Killen et al., this meeting), MoSU ridge represents the freshest and most complete exposure of coal in the upper Hooper formation. This poster documents the palynomorphs present in the initial processing run of sediments collected from the coal (Figure 3).

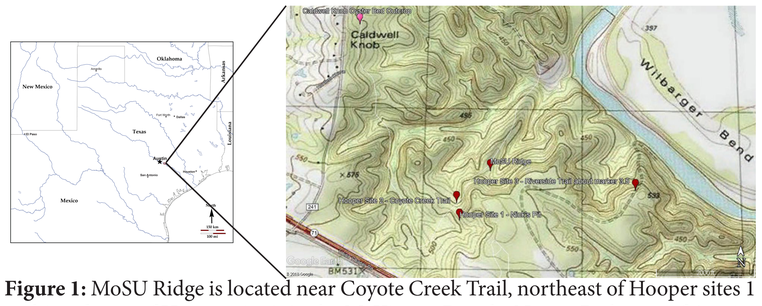

Figure 1: MoSU Ridge is located near Coyote Creek Trail, northeast of Hooper sites 1 and 2 and west of Hooper site 3, in the McKinney Roughs Nature Park, east of Austin, TX.

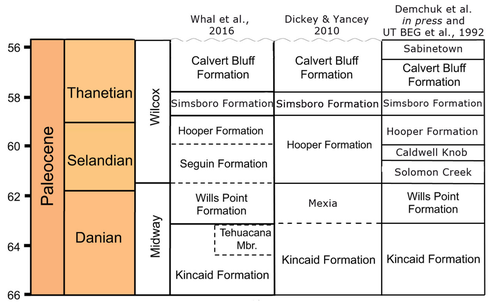

Figure 2: The Hooper formation of the Wilcox Group was deposited across the Selandian-Thanetian boundary, approximately 58.9 MA.

Results and Discussion

To date, all 18 samples have been processed, five have been examined for palynomorph (pollen, spores, algae, etc.) content, and three have been photo-documented.

Examination revealed that there were problems with processing. For example, many slides still contained abundant clay minerals (Figure 4a). Several of the others are either barren or contain pale, degraded polynomorphs (Figure 4b). It is clear that the clay removal step was rushed and that the weak oxidation and lignin depolymerization used to process these samples were unnecessary and may have caused some of the damage to the fossils. Samples will need to be reprocessed with 1% liquinox rather than calgon, because it is gentler, and all other chemical treatment must be avoided.

With the caveat of poor processing in mind, the examined samples do contain a sparse flora of algae, fern spores, palm pollen, and bald cypress pollen. Fungi are sparse as well, but represent soil-inhabiting, coprophilous, and saprophitic fungi (Figure 4k-o).

These perliminary results are somewhat comperable to those obtained by Killen et. al (this meeting) for Nick's Pit, Coyote Road, and Riverside Trail, but appear to indicate overall wetter conditions. This wetland environment is likely similar to ponded water areas found today in Brazos Bend State Park (Figure 5).

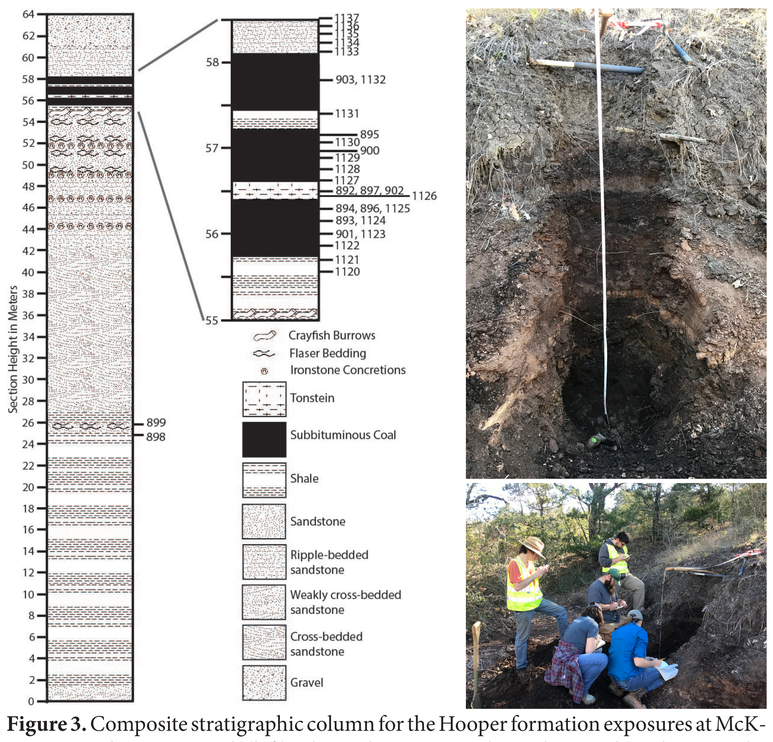

Figure 3. Composite stratigraphic column for the Hooper formation exposures at McKinney Roughs Nature Park (left). The coal at MoSU Ridge is thinner than shown in the idealized section (upper right). Sampling was completed by WI 2018 ESS 399 (lower right).

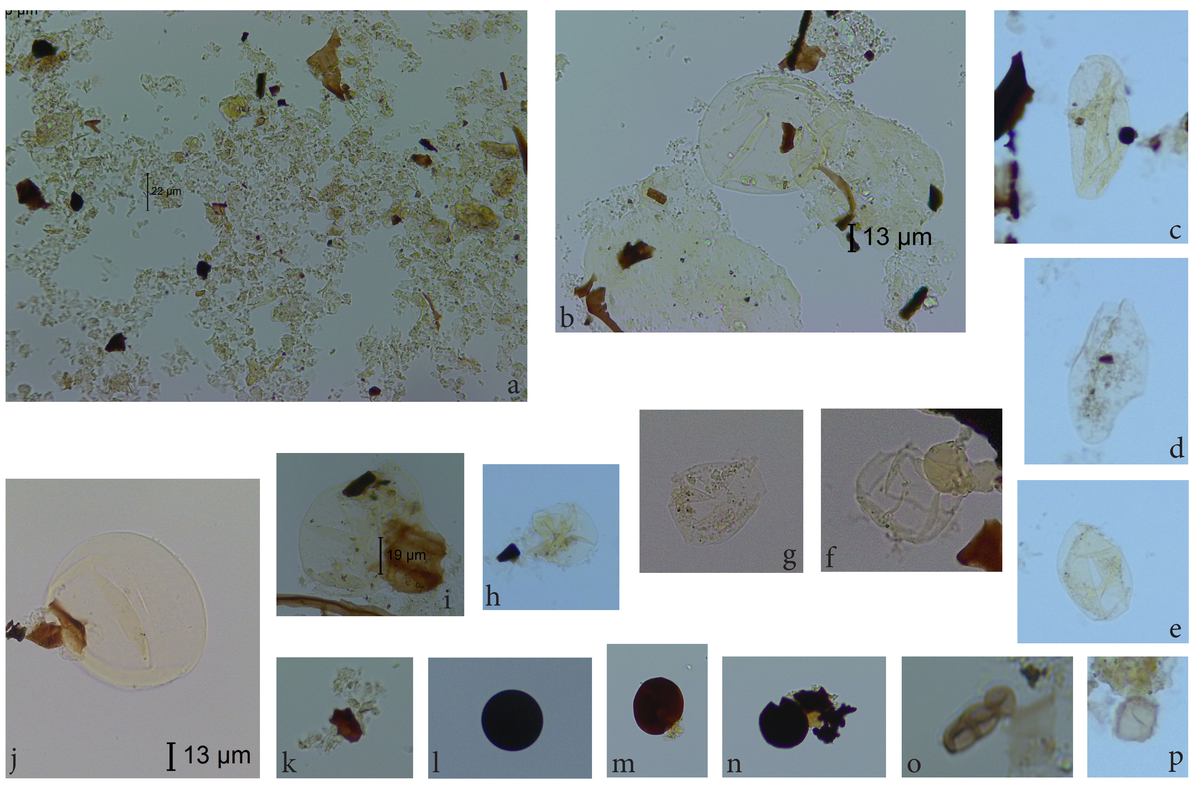

Figure 4: A) overly clay-rich field of view; B) Proxapertites sp. and two degraded algae; C, D) Unidentified Alga 1; E) Spirogyra sp.; F) Freshwater dinoflagellate; G, H) Taxodium sp.; I) Liliacidites sp.; J) Laevigatosporites sp.; K) cf. Gliomastix sp.; L-N) Nigrospora sp.; O) Sporormiella-type; P) Unidentified Alga 2.

Figure 5: A ponded water mire at Brazos Bend State Park with emergent and floating vegetation and algae adjacent to a small high dominated by sedge and wet-tolerant herbaceous plants. Oh yeah, and alligators. In the background, bald cypress trees inhabit another high.

Materials/Methods

MoSU ridge was located during a reconaissance hike in December 2018. A meter-deep vertical trench was dug to expose a fresh coal face. This trench extended through the seat-earth of the coal and through the roof-rock into the overlying soil horizon. The total vertical exposure was approximately 2 meters. Samples were then collected every five cm, beginning at a depth of 1.75m vertically until modern topsoil was reached. Samples were then dried, crushed and sieved using a 1 mm sieve. The crushed samples were placed in 50 ml test tubes and treated with concentrated sodium hexametaphosphate solution. Tubes were sealed and placed on a 1958 vintage Burrell wrist action shaker for approximatly 24 hours. The remainder of the processing followed the O'Keefe and Eble (2012) methods for clay-rich samples. LST® was used as the heavy media, rather than zinc chloride. Two slides were made from each residue: one mounted in glycerin and sealed with clear nail polish and one made with green polyvinyl alcohol.

Slide contents were photodocumented using a Leica 750P microscope with 100, 200, 400, and 1000x total magnification and a Leica ICC50W camera and Leica Application Suite® software.

Future Work

The next step on this project is to reprocess the samples: 1) being very careful to only decant immediately following centrifugation; 2) don't use calgon, use 1% liquinox to disaggregate the sample; 3)avoid use of oxidants and KOH. The samples must then be reanalyzed. Once the samples are analyzed, the results should be compared with those from a forthcoming detailed study of the Nick's Pit locality.

We plan a joint palynology and organic petrography paper to explain the depositional history of the mire preserved as coal and carbonaceous shale in the McKinney Roughs Nature Park.

Acknowledgements

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