

Heebner Transgression

The Heebner Shale has long been referred to as an “inside” or “core shale” in that it represents maximum water-depth deposits of the Oread transgressive-regressive cycle – or in modern-day sequence-stratigraphic terminology, maximum flooding deposits of the Oread depositional sequence. Characteristics of the Heebner are its black color, relative richness in organic matter, rare fossils, thin bedding, and presence of pyrite – all indicative of deposition in deep, stagnant and anoxic (oxygen-deficient) waters. The Heebner is present over most of the state, and it indicates uniform deep-water deposition across a very large area. Its contact with underlying shallow-water deposits (which are not exposed in Figure 1, which is from an outcrop in Atchison, KS) is sharp in many places, which indicates that the change from shallow-water to deep-water deposition due to transgression was very rapid – so rapid that a slightly more gradual vertical change, say perhaps from shaly limestone to calcitic shale to black shale, is not readily apparent in many areas. It is musings on the possible causes of such a rapid transgression and deepening, and likewise, the sharp change from deep-water shale deposition to shallow-water limestone deposition (of the overlying Plattsmouth Limestone) as shown in Figure 1, that are the focus of this contribution.

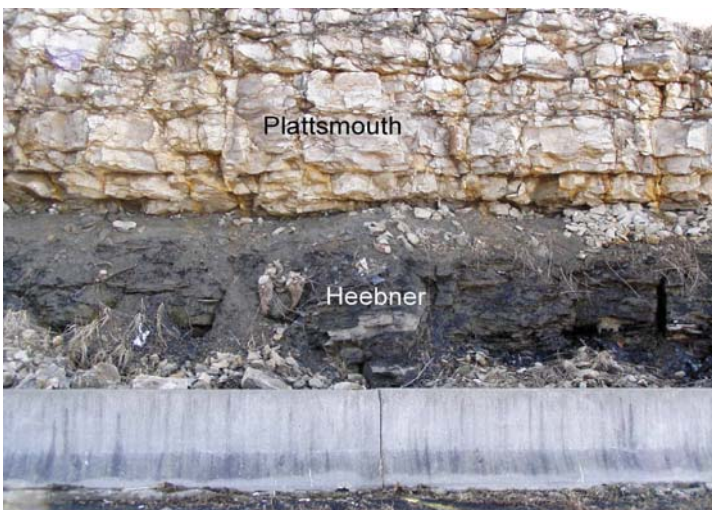


Figure 1 - Outcrop of the Heebner Shale in Atchison, KS, overlain sharply and conformably by the Plattsmouth Limestone. For scale, the letter “H” in the word Heebner is approximately 1 ft tall.

The Heebner cycle has long been considered to have resulted from sea-level rise due to glacio-eustasy (namely, deglaciation). Post-Pleistocene deglaciation, and that sea level rise was rapid. But are such rates rapid enough to have resulted in deep-water black shale deposition seemingly almost instantaneously, which shut off carbonate production across the entire state almost instantaneously? If the base of the Heebner is the same age everywhere, then the answer to this question is a resounding “perhaps....but then again, perhaps not”. To paraphrase a marine biologist buddy of mine in Belize, “maybe yes, no?”. Another possibility is that the base of the Heebner is time-diachronous (within the Virgilian), and that whereas it indeed represents rapid transgression and water deepening, such deepening did not occur everywhere at the same time. But can that tenet be proved or dis-proved? Unfortunately not with our current state of geo-technology. Rapid transgression and seemingly instantaneous water deepening could result from rapid tectonic movement, but such a cause seems unlikely for the Heebner because any invoked tectonic mechanism would have to explain how seemingly state-wide subsidence could have occurred. Again, maybe yes, no? Similarly, we are not quite sure how to explain the rapid change from Heebner Shale deposition to shallow-water Plattsmouth Limestone deposition. Hence, all we can do at this point is continue picking the top of the Heebner on our logs, and be content with the knowledge that Earth is a mysterious vixen, whose secrets are not always readily forthcoming, and that as individuals we are not alone in our quest for some answers.

Prominent Unconformity

By any measure, unconformities represent vast periods of time that are not represented by sediments or rocks. We are all familiar with the great unconformities at the tops of the Miss and Arbuckle, along which prolific giant oil fields like El Dorado, Augusta, and Oklahoma City fields, and the Golden Lane Field in Mexico, have been carved by weathering and erosion. Shown in Figure 2 is a dramatic unconformity exposed a few miles north of