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Notes on the Lower Strata of the Devonian Series in Iowa

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At the town of Hot Springs some portions of the valley are occupied by horizontal beds of a very coarse conglomerate that lies unconformably on the folded and tilted Red Beds. The thickness of the conglomerate is about forty feet. It is composed of fragments of all the harder formations from the crystalline rocks at the center of the uplift to the purple limestone of the Red Beds and the quartzite of the Cretaceous. When the conglomerate was deposited the valley had essentially its present depth. In some places the streams have just fairly completed the work of cutting through the conglomerate, in other places they have cut twenty or thirty feet below its base. This conglomerate is probably the equivalent of that lying at the base of the White river Miocene. If so it would indicate an enormous amount of erosion between the beginning and middle of the Tertiary as compared with the amount accomplished since.

Returning finally to the main object for which these observations were undertaken, it is clear that *Bennettites dacotensis* Macbride, belongs to the Cretaceous period, and the evidence is practically conclusive that the exact horizon at which the individuals of the species were imbedded is represented by the uppermost layers of the Dakota sandstone.

NOTES ON THE LOWER STRATA OF THE DEVONIAN SERIES
IN IOWA.

BY WILLIAM HARMON NORTON.

In a report recently made to the State Geological Survey, the writer communicates in detail some facts regarding the brecciated zone of the Devonian in Linn county, Iowa, and the terranes subjacent. The following is in part a brief summary of this report:

In the breccia which occupies the same horizon from Davenport to Fayette, and which has been termed by McGee the Fayette breccia, four stages are discriminated.

The fourth, or upper stage, involves in Linn county to a greater or less extent several life-zones of the Cedar Valley limestone, including the horizons of *Acervularia davidsoni* (E. and H.), *Phillipsastrea gigas* (Owen), *Spirifer pennata* (Owen), and *Spirifer dimesialis* (Hall). Matrix and fragments are alike being fossiliferous and shaly, and the fragments are usually large and often but slightly disturbed.

The third stage is distinguished by the predominance of fragmental masses, often large and rectangular, of a tough, grey, crystalline or semi-crystalline, heavily bedded limestone, containing a distinct fauna, of which a large *Gyroceras* and *Rhynchonella intermedia* (Barris) are the most characteristic fossils, and *Gypidula occidentalis* (Hall) and *Orthis macfarlandi* (Meek), the most common. The limestone of which these fragments is composed is not found in place in Linn county.

The second stage is defined by the abundance of fragments, usually small, of a hard, drab, unfossiliferous limestone of finest grain, often thinly bedded, often finely laminated, the laminae frequently being flexed or contorted. This limestone also is not found undisturbed in Linn county.

The first stage is characterized by an abundant buff or brown matrix, the fragments being sparse and small. Some of them are quartzose, belonging like the matrix to the subjacent terrane.

This subjacent terrane, locally called the Kenwood beds, consists of massive argillaceous and ferruginous buff and reddish-brown limestones, irregularly bedded, often flexed and arched and passing horizontally and vertically beneath into buff thinly laminated or shaly limestone, weathering into slopes of marly clay. In these beds nodules of crystalline quartz with calcite and angular fragments of the same are common. Beneath the buff shales which constitute the bulk of the Kenwood beds lies a layer of greenish or bluish fissile shale from a few inches to five feet thick. The upper limestones are usually involved, more or less in the Fayette breccia. The total thickness of the Kenwood beds is nearly forty feet. The basal blue shale in especial is believed to represent the horizon of the Independence shales. The latter term, originally designating some sixteen feet of dark carbonaceous and grey fossiliferous shale pierced by a well near Independence, may readily be extended, however, to include all the limestone and shale of the Kenwood. The latter term is, therefore, used only as a local synonym for the Independence shales, of which it offers many natural sections, the first discovered.

Beneath the Kenwood beds in Linn county lies a Devonian terrane not hitherto known, termed the Otis beds. Like the Kenwood beds, from which it is somewhat sharply divided, the Otis limestone is remarkably constant and uniform in its lithological features, some layers with special characteristics being traced across the county. It consists of nearly pure non-magnesian limestones, some macro-crystalline and some non-crystalline and compacted of impalpable calcareous silt, often heterogeneous in texture, often lying in heavy lenticular masses, passing into thin calcareous plates. In all the numerous exposures of these beds from the Cedar River above and below Cedar Rapids to near the Jones county line southeast of Springville, *Spirifera subumbona* (Hall) is found gregarious in a typical form distinct from the varietal form found in the Independence shales at Independence. On the Buffalo and Wapsipinnicon rivers the numerous sections of the Otis limestone are unfossiliferous. The Otis beds, whose total thickness is thirty feet, include hard thinly-bedded magnesian limestone basal layers by which they pass without unconformity into softer heavily bedded dolomitic limestones, probably Silurian in age, provisionally called the Coggan beds.

It is believed that the Devonian succession in Linn county will be found to obtain elsewhere in the State where the lower strata of the system are exposed.

At Davenport, for example, the lower limestone out-cropping along the Mississippi river from the city northward to Gilbertsville, thinly bedded, arched and partially brecciated, is identical in appearance with the fragments of the second stage of the Fayette breccia from Fayette to Cedar Rapids. Under the saddles of its folds there emerges a brown ferruginous limestone indistinguishable from the Upper Kenwood, whose horizon it

seems to occupy. Lithologically and paleontologically the fossiliferous beds resting on these limestones at Davenport, referred by Barris to the Corniferous, are believed to be equivalent to the *Gypidula occidentalis* and *Rhynchonella intermedia* limestone, whose presence defines the third stage of the breccia in Linn county, and which in Buchanan county has been named the Gyroceras beds. At Davenport, as in the counties to the northwest, the Gyroceras beds are succeeded by a soft, shaly limestone with a characteristic fauna.

The writer has felt the need of definite terms to designate these beds, and therefore suggests for the consideration of workers in this field the name, *Lower Davenport beds* for the lower unfossiliferous limestone at Davenport, the limestone which furnished the fragments for the second stage of the Fayette breccia. If a geographical as well a paleontological term should be found convenient for the fossiliferous limestone overlying these lower beds, the term Upper Davenport beds could be appropriately used as a synonym of the Gyroceras beds.

The change in fauna is so distinct at the summit of the Gyroceras beds that it seems to the writer that they should be separated from the Cedar Valley limestones, as the Independence shales have been.

If the inferences we have drawn are correct, the "Upper Helderberg" of Hall, and the "Corniferous" of Barris, at Davenport, are superior to the horizon of the Independence shales. They must therefore be included in that broad biotic unity whose termini are the Independence shales and the Lime creek shales, whose fauna have been shown by Calvin to be so similar.

It is an interesting fact that the new Devonian terrane, the Otis beds, found beneath the Independence shales, contains, as we have stated, as its characteristic fossil a Hamilton and Chemung species, and carries no species, so far as known, allied to pre-Hamilton faunas in other states.

Geological Laboratory of Cornell College, December 28, 1893.

CRETACEOUS FORMATIONS OF NORTHWESTERN IOWA.

BY CHARLES R. KEYES.

(Abstract.)

Until recently little definite information has been accessible concerning the distribution and subdivisions of the Cretaceous deposits of Northwestern Iowa. Strata of Cretaceous age have been recognized from time to time at various points, but, as a rule, little detailed information has been recorded. As early as 1840 Nicollet called attention to certain sections near the mouth of the Sioux river which he regarded as Cretaceous in age. Since that time Cappellini, Marcou, Meek, Hayden, White and others have been through this region. In all these cases the rocks noted were in the immediate vicinity of the Missouri river. White gave more attention, perhaps, to