

Proceedings of the Iowa Academy of Science

Volume 1 | Part 4, 1893; (1887) -

Article 16

1893

Southern Extension of the Cretaceous in Iowa

E. H. Lonsdale

Copyright ©1893 Iowa Academy of Science, Inc.

Follow this and additional works at: <https://scholarworks.uni.edu/pias>

Recommended Citation

Lonsdale, E. H. (1893) "Southern Extension of the Cretaceous in Iowa," *Proceedings of the Iowa Academy of Science*, 1(Pt. 4), 39-43.

Available at: <https://scholarworks.uni.edu/pias/vol1/iss4/16>

This Research is brought to you for free and open access by the Iowa Academy of Science at UNI ScholarWorks. It has been accepted for inclusion in Proceedings of the Iowa Academy of Science by an authorized editor of UNI ScholarWorks. For more information, please contact scholarworks@uni.edu.

SOUTHERN EXTENSION OF THE CRETACEOUS IN IOWA.

BY E. H. LONSDALE.

The Cretaceous deposits of Iowa, from time to time, have received the attention of a number of geologists. The most important researches were made by Marcou, Meek, Heer, White and Calvin. Their investigations were carried on chiefly in the vicinity of Sioux City. The formation elsewhere in the State has, with a few exceptions, received no consideration. Its exact extent is yet to be determined; its vertical thickness is yet unknown; the relative ages of some of its beds remain to be established.

Over western Iowa, in fact, over practically the whole State, resting upon the pre-tertiary beds, whatever these beds may be, is a mantle of debris collected and carried by the great glaciers as they advanced and receded, then and in the end depositing that material which is now recognized as drift clays, sands, gravels and boulders.

This drift material, as a whole, commonly so extensive in vertical thickness, so persistent in its occurrence, and so readily yielding to the weathering agencies, has almost completely concealed the older rocks upon which it traveled and deposited itself. There are, however, occasional exposures of these rocks standing out more or less precipitously along preglacial streams which were of such magnitude or position, as the case may be, to withstand the attack made by the glaciers, and thereby continue their existence; along postglacial water courses which have cut through the drift and upper strata of the underlying formations thus developing a narrow or broad channel and growing new exposures along its way. These few outcroppings afford about the only source from which reliable geological results can be gathered.

The Cretaceous, made up as it is of soft layers, such as sandstones, whose particles are commonly loosely or not cemented together, and beds of clay shales, would naturally suffer to a greater extent from the effects of the glaciers and weathering than would the limestones and other hard rocks of older formations. It would consequently be expected that the limits of the former would not now be even approximately the same as the original restriction of the Cretaceous in Iowa, nor, as nearly the same as are the boundaries of the earlier formations. Again, on account of the texture of the Cretaceous the exposures soon became covered with debris, even though at the close of the glacial period they were yet bare. Therefore, only rarely will faces of rocks be left to view. This is the case not only inland but along the bluffs of large and small streams.

White has probably given more attention to the inland exposures of Cretaceous than any one else. In addition to the Sioux City region he

described beds *in situ*, in Guthrie and some of the southwestern counties and set them down as Cretaceous. To those in Montgomery county, consisting of almost wholly of ferruginous grits, he gave the name Nishnabotna sandstone. The exposures farthest to the southeast were located in Guthrie county; the southernmost at Red Oak, Montgomery county. These are all described as outliers, the distance from the assumed eastern and southern limits of the main Iowa Cretaceous deposits, of which the Sioux City beds form by far the most important adjunct, varying from twenty to nearly one hundred miles. In individual size these outliers have been considered as only a few miles, perhaps one to less than twenty, in their greatest diameter.

During the field season which has recently closed a considerable amount of work was done in southwestern Iowa; additional information pertaining to the Cretaceous outliers in general, was secured; the southern limit was extended and conclusions pertaining to areal mileage of the different outliers have been drawn with greater or less satisfaction.

In the first place let the topography of southwestern Iowa be considered briefly. Eastward from the bluffs which are prevalent along the great flood plain of the Missouri or adjacent to the river itself the counties consist of gently rolling uplands, which rise gradually to a height of one hundred to two hundred feet above the near by waterways. The tops of the ridges between the usually parallel streams continue in their axial lines in an almost unbroken plane for many miles. The bottom, level land next to the larger streams varies in width from a few yards to one or two miles, this width depending largely upon the size of the stream which penetrates the low land. From the outer margins of these bottoms there rise gradual slopes curving smoothly to the upland drainage lines. Occasionally are found outcroppings of bedded rock in these slopes but they are in no wise extensive in any locality. There are, however, in western Iowa beds of the Coal Measures which are exposed, but rarely are any such beds exposed at a great distance above the streams near which they are situated. The top of many are but a foot or so above the water, others fifty or possibly more; but those approximating the former in extent predominate. In the vicinity of the Cretaceous outliers this is even so and such occurrences would undoubtedly indicate if not certainly prove that these inland streams have cut through friable beds of the Cretaceous and but only a few of the upper beds of the hard Coal Measures, that possibly not unfrequently has the former formation not been passed through by the streams now existing and some of the so-called outliers are connected and not separated as heretofore supposed. The fact that the drift, though omnipresent, in this section of the State is not excessively heavy, not heavy enough to hide precipitous limestone bluffs, if they be of considerable thickness, makes this state of affairs more plausible. This condition seems even more probable in parts of Guthrie county where the bottom lands are much narrower than those to the southwest. Again, it is quite possible that these outliers in Montgomery and adjoining counties extend farther northward and those in Guthrie county farther northwestward, towards the sources of and between the streams along which they lie; at the same time shortening the space intervening between the outliers and the present limits of the main Cretaceous body in Iowa. Although no positive information can be given in support of this theory, the exposures being few in number and only adjacent

to the streams, one must readily infer that this condition exists at least to a greater degree than heretofore accorded. It is a notable fact that between the Guthrie and Cass county outliers there are no exposures of bedded rock either of the Coal Measures or of the Cretaceous and it may even be that one or more of these outliers in the one county are connected with those in the other.

Further, as results of recent investigations, new or previously unrecorded, Cretaceous outcrops have been found; the southernmost deposits of this age are no longer confined to central Montgomery and northeastern Mills counties.

In Montgomery county along the western slope of the ridge lying adjacent to and east of the East Nishnabotna, Cretaceous beds were recognized by an almost continuous exposure from Red Oak, the locality where White claimed the southernmost Cretaceous existed, to the south boundary of the county. The character of the bed varies here from a fine white to brown non-firm sandrock to a compact pudding stone. This latter is composed largely of pebbles from one-fourth to one-half an inch in diameter, imbedded in a somewhat to quite siliceous limonite matrix. In some of these exposures are absorbed excellent samples of cross bedding. At Coburg, only one mile north of the south line of Montgomery county a bluff rises abruptly from the outer margin of the here rather broad alluvial plain. Near the base of this bluff is a bed of fine friable sandrock eighteen feet thick lying beneath a few feet of coarser sand, small pebbles occurring in bands, over which bed rests about ten feet from the pudding stone. This entire section presents an elegant cross bedded character. About half way between this point and Red Oak these same beds occur and are more fully exposed. The total exposed thickness of the lower sandstone is thirty feet while that of the overlying pudding stone is perhaps as great. This latter rock is very hard and firmer than any Cretaceous rock yet noticed in Iowa, and is quite persistent in this vicinity, withstanding to a great degree the eroding agencies, so preserving the under deposits.

Two and a half miles eastward from Coburg, on the county line a soft, Cretaceous sandrock rises above Ramp creek forming on the south side of the creek a perpendicular bluff twenty feet in height. South of this bluff, in Page county, small outcrops of such stone are noticed; some in the slope of the hill higher than the top of the bluff just mentioned. On the hill to the northward a well entered the sandstone at an elevation some higher than that of the top of the creek bluff. These facts go to prove that the thickness of the bed here is not much less than it is found to be in northern Montgomery county. The bottom of the bluff extends into the bed of the creek and only a short distance up the stream Coal Measure limestone crops out, with no perceptible dip in any direction, several feet above the water, indicating again the unconformability of the Cretaceous upon the lower rocks.

In Page county about one mile east of Essex (Tp. 70 N., R. XXXIX W.) the pudding stone such as described elsewhere, is found exposed along the roadside. Here it has about the same relative position above the East Nishnabotna as at points farther northward. This outcrop is only twenty miles north of the Missouri line and is decidedly the southernmost exposure of the formation recorded as existing in Iowa. South of this exposure

about five miles a well more than 300 feet deep was bored and no bed, definitely recognized as Cretaceous, was shown in the record; though it is possible that some of the upper clays there met were of this age. No samples of the borings were seen.

It must be remembered that the surface of the Upper Carboniferous at the incursion of the Cretaceous sea in Iowa was not regular; perhaps even more irregular and broken than the surface of the strata is to-day. Deep channels, gorges, depressions, and rises marked the entire surface. The Cretaceous as a shore deposit may have wholly filled these Carboniferous channels and hollows, spreading itself in great depth near the floor, or partly leaving protuberances and ridges of higher elevations uncovered. However this may have been, the friable Cretaceous was, after the time of its laying down, greatly modified both by the preglacial weathering agencies and the glacial grinding and corroding. During those stages new channels were cut, others more deeply corroded, many extending through the entire thickness of the formation; large areas were disturbed, only to be obliterated by the repeated advancement and retreat of the glacier, and the high and low points were alike mantled with drift debris. The southern and southeastern limits, would, since the glaciers traveled in a southeasterly direction, naturally be more altered than would other portions of this shore deposit, the original shore line would be wholly displaced and a new line, probably a number of miles northward, left to mark the present irregular boundary. Thus it may be seen that the Cretaceous is not one persistent bed everywhere of the same thickness with its boundary an unbroken line, and its character unvarying.

Now extending from some of the outliers noticed the topography presents itself, just as it appears at the outlier, sometimes for several miles in length. To cite a case, consider the outlier which is exposed at Coburg and in that vicinity. Here for several miles to the southwest, between the West Tarkio and the East Nishnabotna rivers the upland topography such as at Coburg, continues without any abrupt change. Again, while no Cretaceous has been noted as occurring between the East Tarkio and the West Nodaway rivers, the topography in Page county between these streams resembles, in many respects, that between those streams to the west, along which Cretaceous beds have been found in Montgomery county.

It would appear, therefore, from surface features of this county, that the upland between these four streams are made up largely of Cretaceous deposits covered only by a mantle of drift. If this is so, it is probable that in the two counties lying in the most northwestern portion of Missouri, along the northern border, and through the entire length of Page county, Iowa, will be found just such beds of Cretaceous age as occur farther northward in the latter State. Additional examination of the region at hand may bring out definite results and prove that Cretaceous beds do now in reality exist in the doubtful localities just mentioned.

In doing this work it must be borne in mind from what has been said, that because the topography appears so in any place it does not necessarily follow that under such topography rests the Cretaceous; the marginal shore deposits may have been so modified and the debris from the Ice age so unevenly laid down that the existence or non-existence of the Cretaceous can no longer be recognized by mere topographic features of the land surface.

Near Coburg the Cretaceous appears to be quite heavy, but if this formation is found to extend southward and into Missouri where no areas, however limited in extent, have yet been found, it would no doubt be quite thin unless in exceptionally rare cases, for towards the southern boundary of Page county the Carboniferous rocks are not infrequently found, where exposed, a considerable distance above the drainage line, the ridges are not more elevated above them nor the drift less thick upon the upland.

Just how far the shore line of the Cretaceous sea extended southward cannot definitely be figured now, but, considering the position and abundance of outliers to the south and southeast along the present border, the direction the glaciers advanced and the readiness with which the friable beds could be broken off and carried away, one can immediately conceive how this shore line and the main deposit have been extensively altered, and how the present southern boundary may be far northward of the southern shore-line of the then probably continuous deposit.

For the present, however, it seems desirable to call the exposure near Essex at least very near the farthest south any Cretaceous *in situ* exists in Iowa; realizing at the same time the possibility, if not probability, that such may yet be found southward and in Missouri.

The finding of Cretaceous boulders amongst the drift is by no means uncommon. At the foot of the Missouri bluffs near Henton, in Mills county, a number of irregularly shaped masses of pudding stone were secured. Those were quite similar to the bedded stone in some of the counties further eastward. Just across into Missouri from Blanchard, Iowa, on the bank of the West Tarkio is, in a cut recently made, a fifteen-foot bed of more or less clayey sandstone doubtless Cretaceous in origin but modified on being removed and deposited here by the glacier. It would not seem that this sandbed nor the pudding stone had been carried away any great distance from their place of original deposition but their sources are yet to be traced.

TOPOGRAPHY OF THE GRANITE AND PORPHYRY REGION OF MISSOURI.

BY E. H. LONSDALE.

When speaking of the Archaean hills of Missouri Pumpelly has likened them unto "an archipelago of islands in the Lower Silurian strata which surrounded them as a whole and separate them from one another." To one who knows this interesting territory with its isolated and grouped knobs hills and mountains of crystalline rocks standing out more or less prominently and dotting the broad expanse of more recent sedimentaries, this figure is an exceedingly happy one; one most admirably taken.

In order to appreciate the picturesqueness of the scenery there presented it becomes requisite that not merely a birds-eye view be taken but also to