

# Proceedings of the Iowa Academy of Science

---

Volume 23 | Annual Issue

Article 20

---

1916

## A Correlation of the Peneplains of the Driftless Area

Urban B. Hughes  
*State University of Iowa*

Copyright ©1916 Iowa Academy of Science, Inc.

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

---

### Recommended Citation

Hughes, Urban B. (1916) "A Correlation of the Peneplains of the Driftless Area," *Proceedings of the Iowa Academy of Science*, 23(1), 125-132.

Available at: <https://scholarworks.uni.edu/pias/vol23/iss1/20>

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](mailto:scholarworks@uni.edu).

## A CORRELATION OF THE PENEPLAINS OF THE DRIFT- LESS AREA.

URBAN B. HUGHES.

The conclusions reached in this paper in regard to the erosion-  
al history of the Driftless Area are the results of evidence secured  
from three sources: (1) Field work during the summer of 1915,  
carried on by the writer in the Baraboo district and the Rich-  
land Center quadrangle, Wisconsin, has furnished direct evidence  
for the northern portion of the area under consideration. (2)  
The literature on the subject has been used freely, the Lancaster-

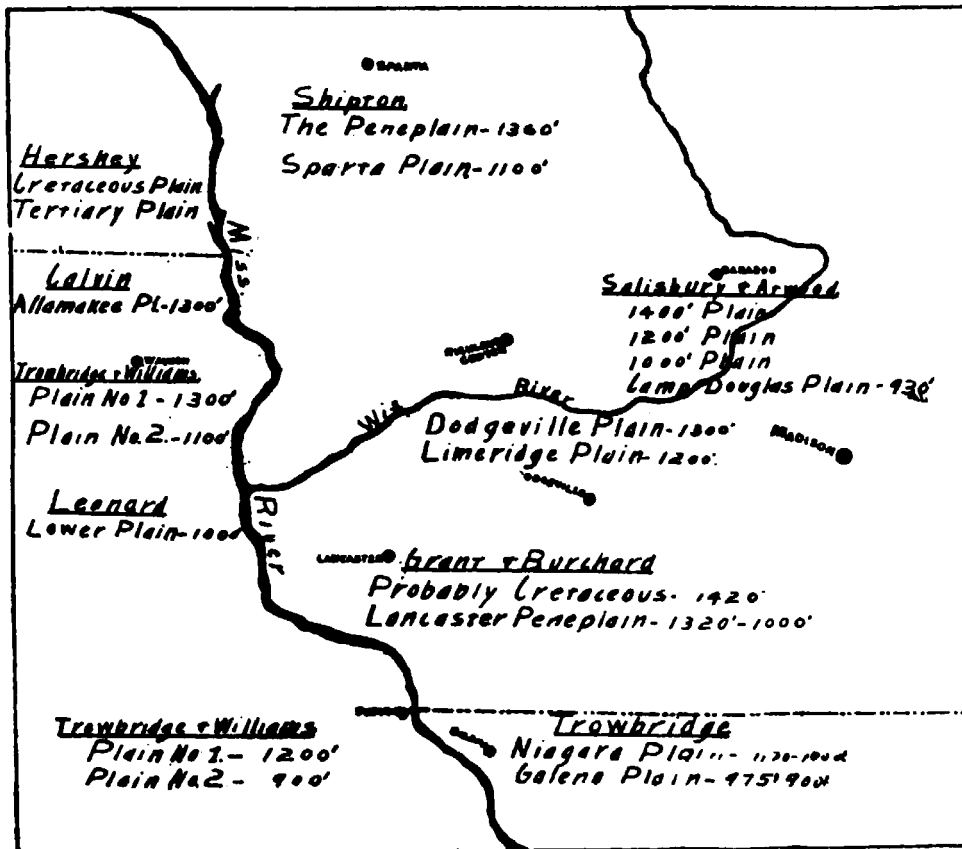


FIG. 10—A sketch map of the southern half of the Driftless Area, showing where and by whom work has been done on the upland plains and the general conclusions reached by the various workers.

Mineral Point folio by Grant and Burchard having proven especially valuable. (3) The details of the Elizabeth and Galena quadrangles were furnished by Prof. A. C. Trowbridge under

whose direction the work has been carried on and whose advice was most valuable because of his intimate acquaintance with numerous localities in the Driftless Area.

#### FORMER WORK DONE.

For the past twenty years geologists who have worked in the Driftless Area have noticed the broad stretches of upland surface lying at approximately the same levels and harboring a civilization quite distinct from that of the deep, gorge-like valleys below the upland levels. In many cases the upland flats are so conspicuous as to be known locally as "prairies" on which are located villages, woodland areas, main roads, and many square miles of flattish, rolling country. These striking features have been described in the reports, barely receiving mention in some, whereas in other cases they have been treated as fully as available data permitted. It is not surprising that different men, working independently, at different times, and in widely separated portions of the Driftless Area did not round out their combined work into the harmonious whole. Accordingly, when an attempt is made to build the blocks as worked out into a unit, the wide divergence of conclusions is emphasized. The results of some of the most important work done and the geographical location of this work is shown in figure 10. For more detailed accounts of this work, see the brief bibliography following.

#### BIBLIOGRAPHY.

- Bain, H. F.*, Zinc and Lead Deposits of Northwestern Illinois: Bull. U. S. Geol. Survey No. 246, pp. 13-16.
- Calvin, Samuel*, Geology of Allamakee County: Ia. Geol. Survey, Vol. IV, pp. 41-44.
- Grant and Burchard*, Lancaster-Mineral Point Folio: U. S. Geol. Survey, pp. 1 and 2.
- Hershey, O. H.*, The Physiographic Development of the Upper Mississippi Valley: Am. Geologist, Vol. 20, pp. 246-268.
- Howell, J. V.*, The Occurrence and Origin of the Iron Ores of Iron Hill, near Waukon, Iowa: Iowa Geol. Survey, Vol. XXV, pp. 33-69.
- Leonard, A. G.*, Geology of Clayton County: Iowa Geol. Survey, Vol. XVI, pp. 220-233.
- Salisbury, R. D.*, Preglacial Gravels on the Quartzite Range near Baraboo, Wisconsin: Jour. Geology, Vol. III, pp. 655-667.
- Salisbury, R. D., and Atwood, W. W.*, The Geography of the Region about Devils Lake and the Dalles of the Wisconsin: Bull. No. V, Wisconsin Geol. and Nat. Hist. Survey, pp. 60-64.

- Shipton, W. D.*, The Geology of the Sparta Quadrangle, Wisconsin: Master's Thesis State Univ. of Iowa, unpublished.
- Trowbridge, A. C.*, Some Partly Dissected Plains in Jo Daviess County, Illinois: Jour. Geology, Vol. XXI, pp. 731-742.
- Preliminary Report on Geological Work in Northeastern Iowa: Proc. Iowa Acad. Sci., Vol. XXI, pp. 205-209.
- Physiographic Studies in the Driftless Area (abstract): Bull. Geol. Soc. America, Vol. 26, p. 76.
- Trowbridge, A. C., and Shaw, E. W.*, Geology and Geography of the Galena and Elizabeth Quadrangles: Bull. No. 26, Illinois Geol. Survey, pp. 136-146.
- Williams, A. J.*, Physiographic Studies in and around Dubuque, Iowa; Master's Thesis State Univ. of Iowa, unpublished.

Grant and Burchard describe one undoubted peneplain at 1,320 to 1,000 feet altitude which they call the Lancaster Peneplain, and mention a probable higher peneplain at about 1,420 feet. In the Galena-Elizabeth quadrangles, Illinois, Trowbridge found two peneplains, the Niagara plain at 1,170 to 1,100 feet, and a lower plain, the Galena plain at 975 to 900 feet. Likewise, field work by A. J. Williams and others under the direction of Professor Trowbridge in northeastern Iowa has established two peneplains. During the past summer W. D. Shipton found a peneplain and a probable lower one in the Sparta district of Wisconsin. Work by the writer in the Richland Center quadrangle, Wisconsin, seems to have established plains at two distinct levels. But all the work has not been so nearly harmonious, for Salisbury and Atwood have suggested the possibility of four peneplains in the Baraboo district and Hershey has given the number as five for the entire Driftless Area.

On account of the wide distribution of the areas studied it has not until now been possible to study the peneplains continuously over wide areas. At the present time, however, sufficient data are in hand to make possible the correlation of an area extending from Baraboo, Wisconsin, to Waukon and Dubuque, Iowa, and to the southern part of the Elizabeth quadrangle in Illinois.

#### STRUCTURE OF THE ROCKS.

The structure of the stratified rocks of the area is simple, with two exceptions. In general the strata form a gently-dipping monocline, in which the dip is about fifteen feet per mile in a southwest direction. But the quartzite formation at Baraboo is closely and intricately folded, and the Paleozoic strata in the

southern part of the Elizabeth quadrangle have much steeper dips than the average for the Driftless Area. The seemingly simple monoclinical structure is further complicated by numerous gentle anticlines and shallow synclines, much jointing, and slight faulting.

#### THE UPPER PLAIN.

Of the two plains, the upper and older one will be discussed first. Reference to figure 11 shows that over the whole region there is much flat land which stands distinctly above the level of other flats and which forms remnants of a now much dissected plain. In drawing conclusions concerning the origin and correlation of this plain, several points are to be considered.

(1) There are monadnocks standing above it, which are erosional remnants of a once still higher surface. This is well illustrated in the Baraboo region where Sauk Point at 1,620 feet above sea level and the west bluff at Devils Lake at 1,560 feet stand above the plain whose altitude here is 1,400 feet. The same relation is found at Waukon, Iowa, where a monadnock rises at least 100 feet above the uppermost plain. Also Platte Mounds and Blue Mounds may be considered to be monadnocks standing upon the upper plain.

(2) At many points throughout the southern portion of the Driftless Area, patches of water-worn gravel are found on the upper plain. On the west bluff of Devils Lake several feet of these quartzose gravels are found on an old erosional surface and they are here closely associated with numerous potholes. These same gravels are found near Sparta, Wisconsin, at an elevation of 1,360 feet, they are known at Seneca, Wisconsin, and at Waukon, Iowa, they occur at 1300 feet altitude. This deposit of gravel, together with the remnants of higher land above the plain points to the previous existence of a surface which was in an imperfect state of peneplanation, with moderate relief, and whose streams had sufficient gradient to carry gravel such as is found.

(3) The plain is not parallel with the underlying strata but cuts across the bevelled edges of dipping formations, rising stratigraphically to the south, as shown in figure 11. About Devils Lake and adjacent districts to the west, there are conspicuous levels at 1400 feet, which cut across the hard Baraboo quartzite, which dips at angles of 15° and more. If a line is drawn (the



FIG. 11.—A structure section from Baraboo, Wisconsin, across the Denzer, Richland Center, Mineral Point quadrangles, to the south side of the Elizabeth quadrangle in Illinois. The vertical scale is exaggerated.

uppermost line, figure 11) from this 1400-foot level to the tops of the mounds in the southern portion of the Elizabeth quadrangle in Illinois, remnants of this plain between the two extreme points come to about the level of this line. South of Baraboo, the first great area of upland is an east-west ridge, known as Military Ridge or locally known as Dodgeville Prairie because it is a gently undulating plain and almost treeless. This flattish surface averages 1200 feet in altitude, with occasional swells and knobs reaching higher levels. It is here underlain by Galena dolomite. Farther south the plain is found on the tops of numerous mounds and ridges at elevations of 1170, 1152, 1160 feet in the northern part of the Elizabeth quadrangle, at 1112, 1145, 1065, 1060, 1072 feet in the central part, and at 944, 964, 1027, 1004 and 1000 feet in the southern part of the quadrangle. In the northern part of the Elizabeth quadrangle the plain is on about twenty feet of Niagaran dolomite whereas in the southern part it is on more than 100 feet of the same formation.

The plain is seen to cut from Huronian quartzite at Baraboo across the Prairie du Chien, St. Peter, Platteville, Decorah, Galena, and Maquoketa formations, to the Niagaran formation at the south border of the Driftless Area. It slopes to the amount of six feet per mile in a direction  $16^{\circ}$  west of south.

(4) The surface of the upper plain does not conform to the dip of the strata. The strata dip S.  $45^{\circ}$  W.; the surface of the plain slopes S.  $16^{\circ}$  W. The strata dip about fifteen feet for each mile; the plain slopes only six feet for each mile.

(5) The surface of the upper plain wherever found is characteristically more dissected than the lower and younger plain. This is especially noticeable near Dodgeville. Near Highland, Wisconsin, the erosion is pronounced and the sharp draws show to what extent the original plain has been dissected.

(6) It is not necessary to suppose that the plain is controlled by layers of resistant rock and therefore structural. On the contrary the features as found in the field are exactly what would be expected of a partly dissected peneplain. Wherever the less resistant rocks, like the Maquoketa shale, formed the original surface, they have been more eroded than the more resistant formations, whose surfaces are left to form the remnants of the plain today.

## THE LOWER PLAIN.

There are considerable areas of flat land throughout the region which lie at distinctly lower levels than the flats referred to the upper plain (see the lower of the two straight lines in figure 11). In the Baraboo district west of Devils Lake, the lower plain is extensively developed at 1200 feet altitude, or 200 feet lower than the upper plain in the same locality. In the Richland Center quadrangle there is a remarkably flat area, in places almost untouched by stream work, which is seven miles long and as much as two and one-half miles wide in places. South of the Wisconsin river the lower plain is well developed at Lancaster where it has an altitude of 1100 feet, and still farther south it is ideally represented in the Elizabeth quadrangle at 975 to 900 feet. This plain has been traced in Iowa by Trowbridge and Williams from the Minnesota line to Dubuque. In the correlation of these various patches of the lower plain and in assigning their origin to peneplanation, the following facts are taken into consideration:

(1) The plain has numerous erosional remnants above it, for wherever the remnants of the upper plain occur in the form of mounds or ridges they rise above the lower plain surface, in most places as much as 200 feet or even more.

(2) This plain is in no way influenced by the strata of resistant rock, since it cuts across formations dipping at varying angles, the slope of the plain being remarkably uniform. In the Baraboo district the flat at 1200 feet above sea level cuts across the Baraboo quartzite formation which has dips of  $15^{\circ}$  or more. In the adjacent area to the west at the same elevation, the plain lies upon Prairie du Chien dolomite. South of the Baraboo district, the plain next cuts across the Galena dolomite at Lancaster at an elevation of 1100 feet, and finally in the Elizabeth quadrangle it is found upon five to fifteen feet of soft Maquoketa shale. In Iowa the plain cuts from the Prairie du Chien formation at the Minnesota line, across the St. Peter, Platteville, Decorah, and Galena formations, to the Maquoketa formation at Dubuque.

Over the area studied this plain dips at the rate of about four feet per mile in a direction  $26^{\circ}$  west of south. Thus it is seen that it dips at an angle smaller than that of the upper plain; accordingly the two plains draw more nearly together as they are projected to the southwest. Moreover, both plains have

angles of dip which are less than the dip of the underlying strata, and they rise stratigraphically. For the relation of this plain to the underlying formations and to the upper plain in Wisconsin and Illinois, see figure 11.

(3) In spite of minor folds and dips, the plain is uniform. In the southern part of the Elizabeth quadrangle where the strata dip southwestward at an exceptionally high angle, the general level of the plain conforms to the level over the rest of the area, even though it is here on soft Maquoketa shale.

(4) Wherever found the lower plain is characteristically uniform and free from stream dissection except around the borders of its remnants. Especially is this noticeable when compared with the dissected character of the upper plain. This is the topography which a younger plain should have in contrast with that of an older one.

(5) The correlation made in the present paper departs from that of Grant and Burchard who consider that there is in the Lancaster-Mineral Point district an upper plain represented by the tops of the numerous mounds and that all the lower flat areas, including the Dodgeville Prairie, the flat around Lancaster, and the flat north of Cuba, belong to the lower or Lancaster plain. That this is in error is shown by a study of the elevations of this supposed plain. As shown by figure 12, the drop from Mt. Ida,

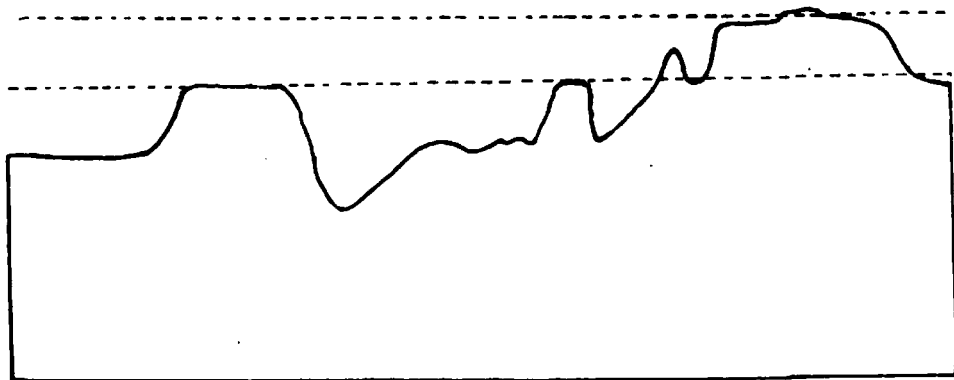


FIG. 12—A profile from Mt. Ida on the Dodgeville Prairie south across a portion of the Lancaster plain. Grant and Burchard assumed that the two upland surfaces shown here belonged to the lower or Lancaster plain. The profile makes it clear that two plains are represented.

a distance of only eight miles, is one hundred feet, or more than ten feet to the mile. Such a relation would be a severe strain on the idea of peneplanation. In characteristic topography, as well as in altitude, the Dodgeville Prairie belongs with the upper rather than with the lower plain.



## AGE OF THE PLAINS.

The question of the age of the two plains is not relevant to the purpose of this discussion and only brief mention is here made of the two sets of interpretations which have been advanced. The earlier workers and some of the later ones consider the upper plain to be of Cretaceous age and the lower one to be Tertiary. On the other hand Salisbury has called the upper plain Tertiary, on the basis of a tentative correlation of the gravels on the plain with the Lafayette formation of the gulf coast. Work by Trowbridge and Williams in Iowa has placed the lower plain tentatively as early Pleistocene in age.

## SUMMARY.

- (1) There are two and only two upland plains in the region.
- (2) Both plains are old peneplains.
- (3) Both plains slope in a direction south by southwest and converge toward the south and southwest.
- (4) The dip of the plains is less than that of the underlying strata and they cut across the bevelled edges of dipping strata, rising stratigraphically to the south.
- (5) The upper plain shows more evidence of stream erosion than the lower.
- (6) The Dodgeville plain belongs to the upper plain and the Lancaster plain of Grant and Burchard is a part of the lower plain.

GEOLOGICAL LABORATORY,  
STATE UNIVERSITY OF IOWA.