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SUNDRY PROVINCIAL AND LOCAL PHASES OF THE GENERAL GEOLOGIC SECTION OF IOWA.

BY CHARLES KEYES.

(Abstract.)

In the consideration of the broader taxonomic aspects of the general geologic section of the rocks of our state two features in particular at once arrest attention.

One of these features is the completeness and discrimination with which the glacial deposits have been differentiated so that the Iowa sequence becomes the standard Pleistocene section for this country. This is one of the distinct advancements recently made in American geology. For it credit is due mainly to workers in Iowa and especially to Iowa men.

Contrasting strangely with this marked evidence of advancing knowledge is a feature which is of far greater general importance, which is stratigraphically of much greater value, which commercially has infinitely larger significance, and which in its influence reaches far beyond the boundaries of our state. Yet, in this field there has been almost no signs of progress. Compared with the similar work done in neighboring states it may be said that we have in this respect actually retrograded to notable extent. This feature is the differentiation and delimitation of the stratigraphic and cartographic units—the factors which make our geologic mapping possible and our understanding of the relations of formations practically valuable.

As is well known, it has long been the desire of paleontologists to have recognized a dual classification of geologic formations—one to be expressed in time-units, the other in space-units. Of course, the first of these is to be based entirely upon a certain sequence of fossils. However, of late years, the tendency among actual field workers in geology has been towards the adoption of a single standard, the taxonomic ranks of the different subdivisions being determined by diverse characteristics in the same way that the systematic arrangements of animals and plants are effected.

No general geologic section of Iowa rocks has ever been published that is strictly in accord with the plan mentioned. Instead, there has been an indiscriminate mingling of the two, or of many classificatory standards. The immediate result has been to obscure rather than illuminate terranal relationships. Moreover, there has been little attempt at exact correlation of the various formations with those of other states. There has been neglect even in considering the provincial correlations—an aspect of the subject which always should receive first attention.

In the accompanying scheme of the geologic terranes of Iowa an attempt is made to keep the several classificatory criteria distinct and to use only the same feature in all cases of like ordinal rank. The dual standard is dispensed with. The time-element is only applied to those taxonomic groups where there is general consensus of opinion as to sufficient exactness. This extends now

to no groups smaller than those of the second order, although for conciseness subperiod is recognized.

Based wholly upon provincial stratigraphy the next smaller group is the serial subdivision. Manifestly beyond the margins of a geologic province the geologic history must be perfectly independent. All attempts to make this subdivision a universal or even a continental time-group have thus far resulted in complete failure, and must necessarily continue to do so.

The terranes are delimited lithologically, stratigraphically, or biotically; or in accordance with the composite determinations of all three criteria. In terranal definition three other features are of great importance; these are geographic extent, topographic expression, and economic content. Some of the Iowa terranes now recognized are no doubt susceptible of further subdivision.

The formations here enumerated are those which must be, sooner or later, generally recognized in the state. Some of them are in Iowa very unimportant; but they find greater development in adjoining states. Many titles appear, indeed, to have been little used in Iowa. The names adopted have all passed the gauntlet of the most exacting synonymic determination. Hence, they are terms which are likely to stand the test of time in our national geologic literature.

GENERAL GEOLOGICAL SECTION OF IOWA ROCKS.

Eras	Periods	Sub-p.	Series.	Terranes	Thick.	Rocks.
CENOZOIC	Quaternaric	Late	Recent	Alluvium	25	Clays, sands.
		Mid.	Pleistocene	Wisconsin	30	Till.
				Peoria	1	Soils.
				Iowa	30	Till.
				Sangamon	1	Soil.
				Illinois	100	Till.
				Yarmouth	1	Soil.
				Kansas	200	Till.
				Afton	40	Sands.
		Nebraska	30	Till.		
Early				10	Clays (geest.)	
Tertiary	Late	Pliocene	Interval		Unconformity.	
	Mid.	Miocene	Riverside	50	Sands.	
	Early	Eocene	Interval		Unconformity.	
	MESOZOIC	Cretacic	Mid.	Coloradan	Niobrara	150
Hawarden					125	Shales.
Crill					100	Limestone.
Woodbury					150	Shales.
Mid.			Dakotan	Ponea	25	Sandstones.
				Sergeant	75	Shales.
				Nishnabotna	200	Sandstones.
				Dodge	75	Shales.
Early			Comanchan	Interval		Unconformity.
Mid.					Missourian	Atehison
	Forbes	25				Limestones.
	Platte	125				Shales.
	Plattsmouth	30				Limestones.
	Lawrence	100				Shales.
	Stanton	20				Limestones.
	Parkville	100				Shales.
	Thayer	75				Shales.
	Bethany	50				Limestones.

Eras	Periods	Sub-p.	Series	Terranes	Thick.	Rocks	
PALEOZOIC	Carbonic		Des Moines	Marais des Cygnes Appanoose Cherokee	300 100 250	Shales. Limestones. Shales.	
			Arkansan	Interval		Unconformity.	
			Early	Mississippian	St. Louis	St. Louis	100
		Spergen			Spergen	10	Limestones.
		Warsaw			Warsaw	65	Limestones.
		Keokuk			Keokuk	75	Limestones.
		Burlington			Burlington	125	Limestones.
		Chouteau			Chouteau	50	Limestones.
		Hannibal			Hannibal	75	Shales.
		Louisiana	Louisiana	10	Limestones.		
	Saverton	Saverton	60	Shales.			
	Grassy	Grassy	50	Shales.			
	Chattanooga	Interval		Unconformity			
	Devonic	Late	Chemungan	Lime Creek	125	Shales.	
			Senecan	Lucas	Lucas	25	Limestones.
				Coralville	Coralville	30	Limestones.
		Rapid		Rapid	35	Limestones.	
		Solon	Solon	25	Limestones.		
		Interval		Unconformity.			
	Mid	Hamiltonian	Fayette	Fayette	75	Limestones.	
Independence			Independence	20	Shales.		
Otis	Otis	10	Limestones.				
Cloggan	Cloggan	15	Dolomites.				
Siluric	Late	Goweran	Bertram	Bertram	35	Dolomites.	
			Anamosa	Anamosa	60	Dolomites.	
	LeClaire	LeClaire	70	Dolomites.			
	Mid	Niagaran	Montecello	Montecello	60	Dolomites.	
Hartwick			Hartwick	80	Dolomites.		
Colesburg	Colesburg	30	Dolomites.				
Sabula	Sabula	50	Dolomites.				
Ordovicic	Late	Maquoketan	Brainard	Brainard	125	Shales.	
			Atkinson	Atkinson	40	Limestones.	
			Clermont	Clermont	15	Shales.	
	Elgin	Elgin	75	Shales.			
	Mid	Mohawkian	Galena	Galena	225	Dolomites.	
Decorah			Decorah	30	Shales.		
Plattville	Plattville	100	Limestones.				
Early	Minnesotan	Glenwood	Glenwood	15	Shales.		
		St. Peter	St. Peter	100	Sandstones.		
		Interval		Unconformity.			
Cambric	Late	Ozarkian	Shakopee	Shakopee	75	Dolomites.	
			New Richmond	New Richmond	25	Sandstones.	
			Oneota	Oneota	150	Dolomites.	
	Mid	Croixan	Jordan	Jordan	100	Sandstones.	
			St. Lawrence	St. Lawrence	50	Dolomites.	
Dresbach	Dresbach	150	Sandstones.				
Interval		Unconformity.					
Azole	Huronic	Late	Siouan		200	Quartzites.	

For their usage here three groups of names need perhaps some little explanation. The terms applied to the terranes of the Niagaran series, the Senecan series and the Cretacic period have never been specifically defined. Soon after the organization of the Geological Survey of the State, when I had charge of

the general stratigraphic work, studies bearing upon the subdivision of these special sequences of strata were at once instituted.

The Niagaran section was finally turned over to Professor A. G. Wilson, of Lenox college. His delimitation* upon faunal grounds, of four subdivisions I am inclined to accept without material modification. The terranes as thus made out are recognizable over wide areas. Since the subdivisions are so well defined it seems proper that they should be designated by geographical names. The titles are taken from well-known Iowa localities where good sections are open to observation.

In the case of the Senecan series (Cedar Valley limestones, etc., of many of the county reports) the detailed sequence of faunas was made out as long ago as 1887, when I was a resident of Iowa City, and was engaged in making a special study of the Devonian section. Essentially as then determined Calvin has since adopted and described† in his report on Johnson County the several sections. It is only necessary to attach to them geographic names to complete their definition. These titles are taken from well-known localities in Johnson county where the best exposures are presented. The subdivisions are widely recognizable through the adjoining counties.

Much confusion has long existed concerning the recognition and nomenclature of the several members of the Cretacic section of northwestern Iowa. In all of the early reports of the present Iowa Geologic Survey the Crill chinks and limestones were mistaken for the Niobrara formation. The only exception was my own determination of the chinks which rest directly upon the Sioux quartzite.

The subdivisions of the Coloradan here recognized have all been well defined, but the names applied to the several terranes are those of the Rocky Mountain region. With no intervening exposures for a distance of 600 miles it appears very doubtful whether we are yet justified in the inference that the sections of such widely separated localities are identical. The western nomenclature is therefore not used. In its place are proposed names of localities on the Bix Sioux river where good outcrops finely display each. With slight restriction below, the Woodbury shales of White becomes a useful and available name. Indeed, I am not sure but that the meaning here given to the title is not the one originally intended by White himself.

The Dakotan series of the vicinity of Sioux City is now completely known from deep-well borings. The lower sandstone is traceable down the Nebraskan side of the Missouri river to the exposures of undoubted Nishnabotna sandstone of White. The Sergeant shales and Ponca sandstone have been repeatedly delimited near Sioux City and up the Missouri river to Ponca and beyond. The latter is No. 4 of Bain's standard sections of Woodbury county‡; and the former includes the same author's numbers 1 and 2 down to the massive sandstone beneath.

The usage of several other terranal names should be perhaps briefly explained. Spergen appears to have priority over Salem, which has been sometimes used. Until recently the latter title was only a trade-name with no scientific definition whatever; the former title has been in common use for more than half a century.

*American Geologist, Vol. XVI, p. 275, 1895.

†Iowa Geological Survey, Vol. VII, p. 71, 1897.

‡Iowa Geological Survey, Vol. V, p. 260, 1896.

Swallow's name, Marias des Cygnes coal-formation, was early and accurately defined, and has priority over Pleasanton, and all other names given to the uppermost division of the Des Moines series.

Until quite recently the division of Saverton shales has not been recognized in Iowa—the section being commonly merged with the Hannibal shales under the title of Kinderhook shales.

For reasons stated elsewhere the age of the Dodge gypsum is still assigned to the Cretacic period. The accompanying reddish or pink shales outcrop in Iowa farther north than Fort Dodge. Similar shales are exposed in numerous localities in the adjoining counties of Minnesota. From the latter localities Lesquereux has described a number of Dakotan plant remains. The known geographical extent of Permian deposition in this country almost completely militates against the possibility of these shales being of Paleozoic age, as argued by Wilder. The latter's evidence in support of his contention is very inclusive.

At the time that Bain named the Riverside sands of Woodbury county and showed that they were delimited both above and below by a notable unconformity they were thought to belong to the glacial deposits. Recent comparisons with similar deposits occurring a little further to the west, in Dixon county, Nebraska, indicate that these sands are in all likelihood the eastward outlying extensions of the Arikaree formation of Miocene age. It is also probable that over large areas they underlie the thick drift deposits of northwestern Iowa and South Dakota. White, clear-grained, pebbleless sands penetrated in many wells seem to belong to this formation rather than to the till-sheets, with which they have been usually associated.