Information Circular
Number 6

University of Wisconsin

GEOLOGICAL AND NATURAL HISTORY SURVEY

George F. Hanson, State Geologist and Director

CAMBRO-ORDOVICIAN STRATIGRAPHY OF SOUTHWEST WISCONSIN

by

M. E. Ostrom
Assistant State Geologist

Prepared as a Guidebook
for the
29th Annual Tri-State Field Conference

WISCONSIN
ILLINOIS 1933 IOWA

October 9 and 10, 1965

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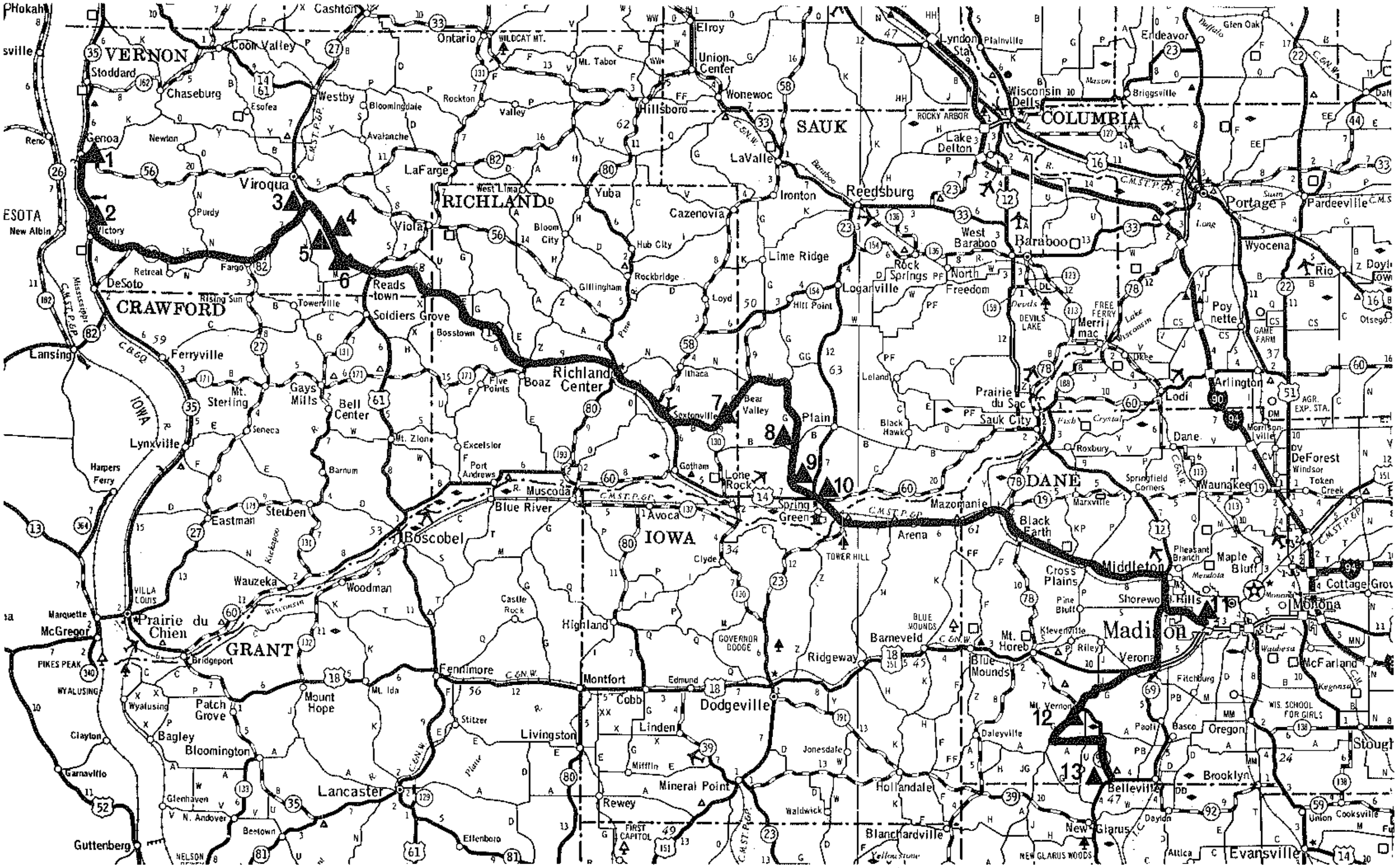

VERNON
CRAWFORD
RICHLAND
SAUK
COLUMBIA
IOWA
GRANT
DANE
1
2
3
4
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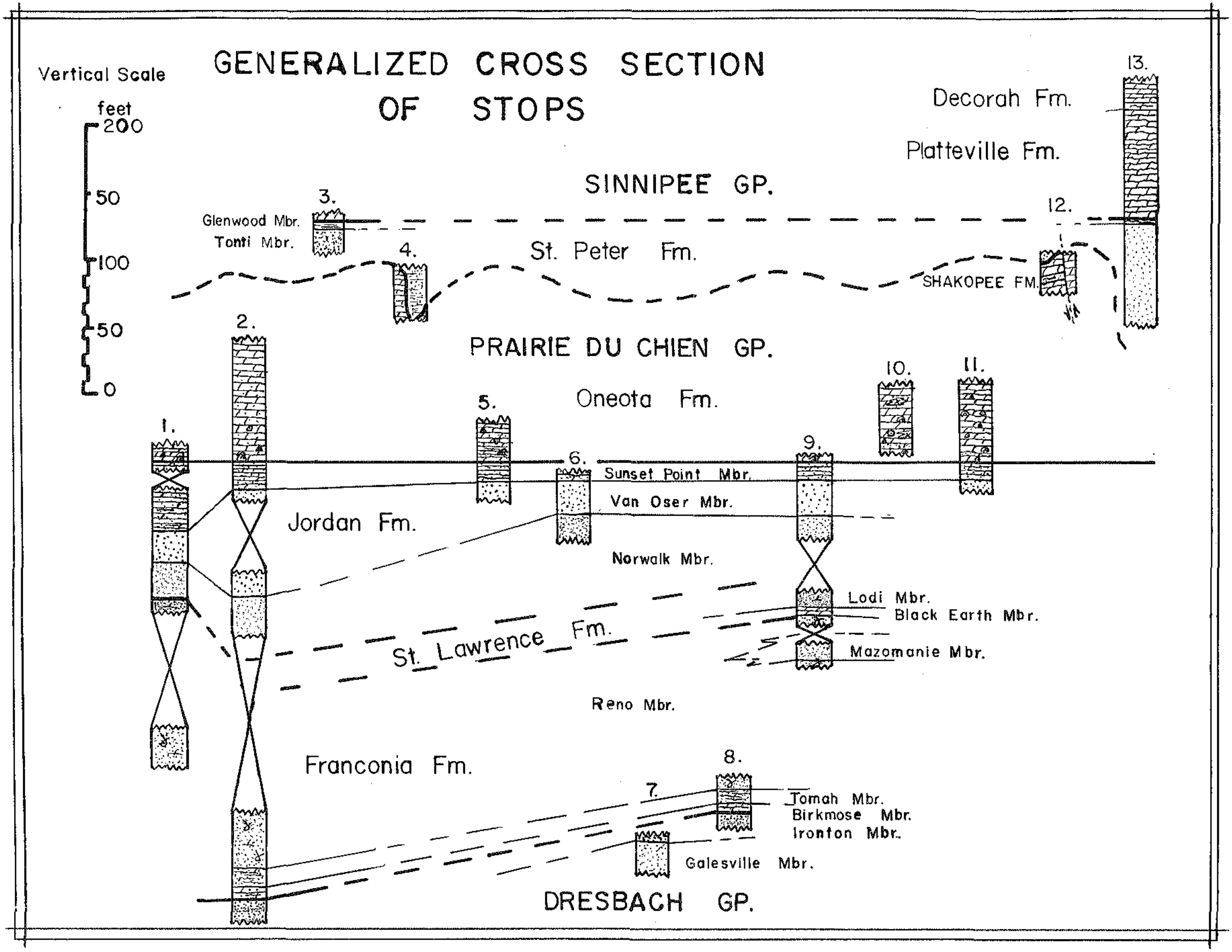
12
13
Genoa
Stoddard
Chaseburg
Coon Valley
Westby
Viroqua
Newton
Purdy
Victory
DeSoto
Fargo
Retreat
Rising Sun
Towerville
Readstown
Soldiers Grove
Viola
LaFarge
Ontario
Cashton
Rockton
Valley
Avalanche
West Lima
Yuba
Bloom City
Hub City
Rockbridge
Gillingham
Boaz
Richland Center
Cazenovia
Ironton
LaValle
Lime Ridge
Loyd
Hill Point
Loganville
Reedsburg
Hillsboro
Wonewoc
Union Center
Elroy
Rock Springs
North Freedom
West Baraboo
Baraboo
Devils Lake
Merrimac
Lake Delton
Wisconsin Dells
Lyndon Sta.
Portage
Pardeeville
Wyocena
Rio
Poynette
Arlington
Lodi
Dane
DeForest
Waunakee
Prairie du Sac
Sauk City
Roxbury
Mazomanie
Black Earth
Cross Plains
Middleton
Shorewood Hills
Madison
Maple Bluff
Monona
Cottage Grove
McFarland
Verona
Fitchburg
Oregon
Paoli
Belleville
Brooklyn
New Glarus
Evansville
Mt. Horeb
Blue Mounds
Barneveld
Ridgeway
Dodgeville
Arena
Spring Green
Tower Hill
Plain
Bear Valley
Sextonville
Lone Rock
Gotham
Avoca
Muscoda
Blue River
Boscobel
Woodman
Wauzeka
Steuben
Eastman
Mt. Sterling
Gays Mills
Bell Center
Ferryville
Lynxville
Seneca
Barnum
Mt. Zion
Excelsior
Port Andrews
Five Points
Prairie du Chien
Bridgeport
Patch Grove
Bagley
Bloomington
Mount Hope
Mt. Ida
Fennimore
Montfort
Livingston
Cobb
Linden
Mineral Point
Rewey
Highland
Castle Rock
Clyde
Hollandale
Blanchardville
Lancaster
Ellenboro
Glenhaven
N. Andover
Beetown
Guttenberg
McGregor
Marquette
Clayton
Garnavillo
Lansing
Harpers Ferry
New Albin
Wyalusing
Stitzer
Dalevill
Jonesdale
Waldwick
Edmund
Mifflin
Union
Cooksville
Stoughton



GENERALIZED CROSS SECTION OF STOPS
Vertical Scale
feet
200
50
100
50
0
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
Decorah Fm.
Platteville Fm.
SINNIPEE GP.
Glenwood Mbr.
Tonti Mbr.
St. Peter Fm.
SHAKOPEE FM.
PRAIRIE DU CHIEN GP.
Oneota Fm.
Sunset Point Mbr.
Van Oser Mbr.
Jordan Fm.
Norwalk Mbr.
Lodi Mbr.
Black Earth Mbr.
St. Lawrence Fm.
Mazomanie Mbr.
Reno Mbr.
Franconia Fm.
Tomah Mbr.
Birkmose Mbr.
Ironton Mbr.
Galesville Mbr.
DRESBACH GP.

Generalized Geologic Column for Southwestern Wisconsin

Ordovician System

Cincinnatian Series

Maquoketa Shale Formation

Champlainian Series

Sinnipee Group

Galena Dolomite Formation
- Dubuque Member
- Stewartville Member
- Prosser Member

Decorah Shale Formation
- Ion Member
- Guttenberg Member
- Spechts Ferry Member

Platteville Limestone Formation
- Quimby's Mill Member
- MacGregor Member
- Pecatonica Member

Ancell Group[1]

St. Peter Sandstone Formation
- Glenwood Member
- Tonti Member

---- erosional unconformity ----

Canadian Series

Prairie du Chien Group

Shakopee Formation
- Willow River Dolomite Member
- New Richmond Sandstone Member

?---- erosional unconformity ----?

Oneota Dolomite Formation

Cambrian System

St. Croixan Series

Trempealeau Group

Jordan Sandstone Formation
Sunset Point Member
Van Oser Member
Norwalk Member

?---- erosional unconformity ----?

St. Lawrence Formation
Lodi Siltstone Member
Black Earth Dolomite Member

Franconia Formation
Reno Member
Mazomanie Member
Tomah Member
Birkmose Member
Ironton Member[2]

Dresbach Group

Galesville Sandstone Formation[2]

?---- erosional unconformity ----?

Eau Claire Formation

Mt. Simon Sandstone Formation

---- erosional unconformity ----

1 Modified from classification proposed by Illinois Geological Survey (Templeton & Willman, 1963).

2 Propose combining Ironton with Galesville as members of a single formation.

TWENTY-NINTH ANNUAL TRI-STATE GEOLOGICAL
FIELD CONFERENCE

ACKNOWLEDGMENTS

Arrangements for this trip would have been impossible were it not for the help of many persons. I am deeply grateful to George F. Hanson, State Geologist, for many discussions and a review of the trip.

Adeline Colvin, Beth Czerwonka, and Sue Buchen of the Survey staff saw to the typing and final compilation of the field guide.

Special thanks to operators of the Davis and Richardson Stone Quarry of Spring Green for permission to visit their property.

Saturday Morning, October 9, 1965

GENERAL DISCUSSION

The Cambrian and Ordovician rocks of the Upper Mississippi Valley area have been subjected to what at one time would have been considered "exhaustive study". However, in the light of results of recent investigations of modern sediments and sedimentation the "classic" explanations for these rocks have had to be reexamined. The purpose of this year's field conference is to reexamine certain of these rocks, their large and small scale features and their interrelationships, to determine if the classical interpretations of geologic history and of the constitution and persistence of rock units can still be held valid.

The Cambrian and Ordovician rocks of this area have long been recognized as "cyclic", that is they occur as a sequence of alternating layers of orthoquartzitic sandstone and of carbonate rocks. However, the beginnings and ends of the cycles, their components, and their similarities and differences went unnoticed or at least unrecorded. It is these features that must now be examined.

When selecting the beginning of a cycle one can go to the "beginning" or base of the rock section to be studied. At the base of the rock section in the Upper Mississippi Valley area is an erosional surface developed on Precambrian rocks. It is believed that this surface formed during a time when the sea had withdrawn far from Wisconsin, possibly beyond or at least to the geographic vicinity of the modern Appalachian mountains on the southeast and equally as far to the south and southwest. The disposition of the sea in areas to the north is unknown for that time.

Over the erosion surface there was deposited a layer of orthoquartzitic sandstone. This sandstone is evenly-bedded, may be medium- to massive-bedded, is cross-bedded, is coarse- and medium-grained, and is moderately well-sorted to well-sorted. It is believed to have formed in the beach-nearshore environment of an encroaching sea. The age of this layer of sand is given as Early Cambrian in Tennessee (the Erwin Sandstone) and as Late Cambrian in Wisconsin (the Mt. Simon Sandstone) which would tend to indicate transgression.

In Wisconsin the basal sandstone unit, namely the Mt. Simon, consists in its upper 20' to 40' of alternating beds of poorly-sorted, argillaceous and silty sandstone with abundant vertical burrows and of moderately well- to well-sorted medium- to coarse-grained, medium- and thin-bedded sandstone. It is postulated that this lithology developed seaward of the beach-nearshore environment in an area where less sediment was in transport, where available wave and/or current energy was high, and where the bottom was reworked by either animals or by storms and/or currents. Modern deposits of similar character are described as forming in the "nondepositional" environment of the shelf in the Gulf of Mexico (van Andel, 1960).

These deposits are succeeded by argillaceous and calcareous, fossiliferous, fine- and very fine-grained generally thin-bedded and cross-bedded, sandstone that may be glauconitic, or by calcareous, fossiliferous, sandy and silty shale, namely the Eau Claire Formation. The Eau Claire Formation is thought to have formed in what van Andel (1960) referred to on the Gulf of Mexico shelf as the "depositional" environment which is located generally seaward of the nondepositional environment in an area of relatively low available energy compared to more landward environments.

In southern Wisconsin the Eau Claire contains a carbonate unit in its upper part which when traced southward to northeastern Illinois (Buschbach, 1964) and into Missouri is considered to be at least in part the lithostratigraphic equivalent of the Bonneterre Dolomite Formation. The carbonate lithology is believed to have developed in areas of the shelf where conditions conducive to carbonate precipitation and animal and plant life existed. On the present shelf in the Gulf of Mexico these areas are widely scattered in the nondepositional and depositional environments so that no continuous layer has as yet formed. However, where such deposits are permitted to grow and expand they would eventually coalesce and form such a layer of interrelated reef, offreef, and bank materials.

We have so far established that in the broadest terms four major lithotopes can be recognized in these rocks, namely the basal orthoquartzitic sandstone lithotope succeeded by the poorly-sorted sandstone lithotope, the argillaceous lithotope, and finally the carbonate lithotope. Are there more?

As we proceed upwards in the geologic section the next unit is the Galesville Sandstone Formation. The Galesville consists of moderately well-sorted to well-sorted, generally medium-grained, medium- to massive-bedded, cross-bedded, quartz sand. Except for the grain-size, which is generally finer than in the Mt. Simon, the Galesville and Mt. Simon sandstones are similar in all important aspects including texture, sedimentary structures and composition. They are dissimilar in that supposedly there is no erosion surface beneath the Galesville.

Two thoughts need to be pursued at this point; namely, what does the Galesville represent in terms of geologic history, and is the Galesville unconformable with older rocks? In order to interpret the depositional history of the Galesville Sandstone it is helpful to refer first to the oldest lithologic unit in the sequence having similar textural, compositional, and structural properties, namely the Mt. Simon Sandstone.

If the assumption is correct that the Mt. Simon Sandstone formed in the beach-nearshore environment, as is described above, then one can assume because of similarities of texture, composition, sedimentary structures, and stratigraphic relationships that the Galesville formed in a similar environment of deposition. What must then be determined is whether these deposits of the beach-nearshore environment were formed when the sea regressed or when it transgressed.

One might expect that if the sea regressed, then materials newly deposited in the beach-nearshore environment would be exposed to subaerial erosion with each new measure of regression. It would be unusual if in this erosion process materials in the newly exposed beach-nearshore deposits would not be eroded and transported to the retreating shoreline. In fact, under conditions of regressions deposits of this environment would be expected to be thin when deposited and if preserved.

If the Galesville Sandstone formed during transgression, then one could expect to find conditions similar to those which occur with the Mt. Simon Sandstone, namely a basal erosional unconformity, variable thickness due to irregularities of the basal contact surface, an even upper contact, and similar textural, compositional, and sedimentary structural features. Of all these characters the only one that has not been confirmed beyond a reasonable doubt is the basal erosional unconformity.

The Galesville Formation can be shown to vary from about 20 feet to over 160 feet in thickness in Wisconsin. When one considers the basal contact of the Galesville and the relationship of the Galesville to older rock units there are certain peculiarities that are difficult to explain except by post-Eau Claire/pre-Galesville regression of the sea and erosion. For example, Twenhofel, Raasch, and Thwaites (1935) pointed out that as one proceeds from west to east across Wisconsin the Eau Claire lithology "blends" into sandstones of the Mt. Simon and Galesville "aspect". They also point out that the Eau Claire can be divided into two faunal zones and that as one proceeds from west to east the Eau Claire thins and the upper fossil zone first disappears, and then the lower fossil zone, which suggests progressively greater truncation from west to east. Add to this the observation that there is a coarse conglomerate about 10 feet thick at the base of rocks considered to be the Galesville in the Northern Peninsula of Michigan (Chapel Rock Member of the Munising Formation: Hamblin, 1958) and that this is underlain by a quartz sandstone suspected of being equivalent to the Mt. Simon and there is even greater reason to consider the Galesville as having developed during transgression.

There are four more cycles with lithotopes similar to and in the same order as those which occur in the basal cycle which contains the Mt. Simon Sandstone. This is important because it illustrates the fact that whether or not the history presented here is true or even approaches the truth there was a repetition of environments and events in the geologic history of this area.

The discussion presented here applies equally to each of the cycles and their parts and is intended to provide food-for-thought.

A summary of the cycles and lithotopes is given in the table below:

		Lithotopes			
		Ortho-quartzitic Sandstone	Poorly-sorted Sandstone	Argillaceous Sandstone	Carbonate
		Environment*			
Cycle	Geologic Unit	Beach-Nearshore	Nondepositional Shelf	Depositional Shelf	Reef, inter-reef &/or bank
5	Sinnipee				X
	Glenwood		X	X	
	Tonti	X			
				Erosion surface	
4	Willow River				X
	New Richmond	X	X	X	
				Truncation	
3	Oneota				X
	Sunset Point		X	X	
	Van Oser/Norwalk	X			
				Erosion surface	
2	St. Lawrence				X
	Franconia			X	
	Ironton		X		
	Galesville	X			
				Erosion surface	
1	"Bonneterre"				X
	Eau Claire			X	
	Upper Mt. Simon		X		
	Lower Mt. Simon	X			
				Erosion surface	

*van Andel, Tj. H., 1960, and van Andel, Tj. H., and Curray, 1960.

Mileage

STOP #1

0.0 Road cut at north side of County Trunk Highway K about 1 mile northeast of Genoa in the NE$\frac{1}{4}$, SW$\frac{1}{4}$, Sec. 22, T.13N., R.7W., Vernon County. Refer to Stoddard 15' quadrangle. Mileage is recorded beginning at the base of the Oneota Formation.

This section is best studied from bottom to top. The lithologic changes which occur in this exposure are interpreted to indicate transgression - regression - transgression.

The Franconia Formation outcrops at the base of the exposure. It consists of glauconitic fine-grained, calcareous, thin- to medium-bedded, cross-bedded sandstone. The Franconia is believed to have developed on an open and shallow shelf located seaward of the beach area, the depositional shelf area of van Andel (1960) and van Andel and Curray (1960).

The Franconia is overlain by the St. Lawrence Formation which consist of two members, the Black Earth Member consisting of dolomite locally containing abundant cryptozoa, and the Lodi member which is a thin- to medium-bedded dolomitic, sandy siltstone. The Black Earth Member is conventionally described as the lowest member but Nelson (1956) has shown that it thins northward to a tongue that is enclosed by the Lodi Member. At this stop the Black Earth Member is covered. The environment of deposition of the St. Lawrence Formation is believed to have been an area of the shelf that received a minor amount of land derived sediment, to have been located seaward of the area of Franconia development and to have possessed the necessary conditions for development of carbonate deposits. The Franconia and St. Lawrence are believed to represent the close of the transgressive phase of a cycle. The lower part of the cycle will be seen at Stop 2.

The Lodi is overlain by the Norwalk Member of the Jordan Sandstone Formation. The contact is selected at the upward change from calcareous siltstone or silty very fine-grained sandstone to a fine-grained slightly calcareous sandstone which contains only a trace or no silt. The basal 6 inches consists of materials ranging in grain size from granules down to silt and is locally iron-enriched. The Norwalk and succeeding Van Oser members are believed to have developed in a beach-nearshore environment. This requires that the sea regressed after deposition of the St. Lawrence carbonates and readvanced to deposit the Norwalk and Van Oser.

The Norwalk is succeeded by the Van Oser Member. The two members are distinguished on the basis of grain size and bedding character. The contact between them is selected at the upward change from thin and/or medium-bedded, fine-grained, sandstone to massive-bedded, medium- to coarse-grained, sandstone.

Above the Norwalk is the Sunset Point Member (the Madison Sandstone of Wanenmacher, Twenhofel, and Raasch, 1934; Twenhofel, Raasch, and Thwaites 1935; Ulrich, 1936). The Sunset Point consists of argillaceous and dolomitic sandstone, of dolomite "conglomerate", and of thin beds of dolomite.

Raasch examined the overlying Oneota Formation in this area, subdivided the Oneota into 4 members, and described it as being unconformable with the Sunset Point. Maximum thickness assigned to the Sunset Point was 24 feet. It is distinguished from the Oneota by its lack of chert, oolites, and cryptozoa. On this basis approximately 54 feet are assigned to the Sunset Point at this exposure. The Sunset Point is believed to have developed seaward of the beach-nearshore environment, in an area usually hospitable to life and development of carbonate deposits but into which neighboring environments often encroached at times of higher energy which caused shifts in sediment distribution patterns.

The Sunset Point is succeeded by the Oneota Dolomite Formation of Ordovician age. The contact is selected at the upward change from argillaceous and sandy dolomite having a "reworked" appearance locally, to a dolomite that may be conglomeratic in its base and which contains oolites, chert, and cryptozoa. The Oneota is believed to be the product of an environment of carbonate deposition and local reef development.

Portions of this same sequence of rocks will be seen at stops 5, 6, 9, 10, and 11. It will be noted that each unit persists and that as we approach the Wisconsin arch each unit thins. Only the upper unit, the Sunset Point, shows any obvious tendency toward lithologic change, namely a decrease in clastic content.

The subdivisions of the Jordan Formation noted here were recognized by Ulrich (1936) and more recently by Ahlen (1952) in a Master's thesis study of the Jordan Formation. Although Ahlen did not recognize the upper unit as the Sunset Point he did show each unit to thin toward the arch. The lower unit, the Norwalk, was shown to be irregular in thickness varying from 20 to 60 feet, with some indication of thinning toward the arch, even to disappearance. The other units are all shown to thin in rather uniform manner onto the arch. Another significant point made by Ahlen is that the subdivisions of the Jordan overlap in the direction of the arch. It is unfortunate that he did not cross the arch in his study. If he had done so he might have recognized the position of the Sunset Point in his classification. The first stop Sunday morning, Stop #11, will be at the type section of Raasch's Sunset Point Member.

Outcrop description for Stop #1

Ordovician System
Prairie du Chien Group
Oneota Formation - +12.0 feet

		Thickness
1. Dolomite, gray, slightly to very sandy, massive, locally conglomeratic in basal 6". Cryptozoan beds ± 6' above base; oolites in bed 5' above base; first chert ± 12' above base	+12'	0'-12'

Cambrian System
Trempealeau Group
Jordan Formation
Sunset Point Member - 53.6 feet

			Thickness
2.	Sandstone, light yellow brown, medium- and fine-grained, very dolomitic, cross-bedded, uneven base.	1.5' ±0.5'	12' -13.5'
3.	Sandstone, light gray, coarse- and very coarse-grained with some clasts from underlying unit; uneven base.	0.7' ±0.3'	13.5'-14.2'
4.	Sandstone, ledge, reddish brown, medium- to very fine-grained, very dolomitic, cross-bedded. Scattered fine grained dolomite clasts.	1.2'	14.2'-15.4'
5.	Sandstone, light gray, coarse- and very coarse-grained.	0.3'	15.4'-15.7'
6.	Same as #4.	1.3'	15.7'-17.0'
7.	Sandstone, gray, fine- to coarse-grained, with dolomite and green clay. Very rough surface texture.	1.5'	17.0'-18.5'
8.	Sandstone, light yellow gray, fine- and medium-grained, very dolomitic, with clasts.	1.0'	18.5'-19.5'
9.	Sandstone, gray, fine- and very fine-grained.	0.5'	19.5'-20.0'
10.	Sandstone, light yellow brown, fine- and very fine-grained, very dolomitic.	0.4'	20.0'-20.4'
	COVERED INTERVAL	±10.0'	20.4'-30.4'
11.	Sandstone, light yellow brown, fine- and medium-grained, thoroughly reworked, appears massive.	3.0'	30.4'-33.4'
12.	Sandstone, pale green, fine- and very fine-grained with little medium, argillaceous, with dolomite stringers.	0.8'	33.4'-34.2'
13.	Sandstone, same as #11, only medium-bedded with locally undulating beds.	3.0'	34.2'-37.2'

		Thickness	
14.	Sandstone, reentrant, light green gray, medium- and fine-grained, argillaceous with green shale stringers.	0.5'	37.2'-37.7'
15.	Sandstone, light yellow brown, fine- and medium-grained, thoroughly reworked; appears massive. Beds in base locally appear stromatolitic. Some beds locally slightly sandy.	7.0'	37.7'-44.7'
16.	Sandstone, light green gray, medium- and fine-grained, argillaceous, with thin green shale stringers, laterally discontinuous dolomite stringers up to 3" thick, and abundant clasts.	2.0'	44.7'-46.7'
17.	Sandstone, light yellow gray to light yellow brown, fine- and very fine-grained with little medium, medium-bedded to massive-bedded, very dolomitic. Few horizontally discontinuous silty partings.	3.0'	46.7'-49.7'
18.	Sandstone, light green gray, medium- and fine-grained, argillaceous, with some thin green shale stringers and laterally discontinuous dolomite stringers up to 3" thick.	0.9'	49.7'-50.6'
19.	Sandstone, light yellow gray to light yellow brown, fine- and very fine-grained with little medium, medium-bedded at base to massive-bedded at top, dolomitic, with few horizontally discontinuous silty stringers. Upper 6" locally shows signs of reworking.	4.0'	50.6'-54.6'
20.	Sandstone, very light green gray, medium- and fine-grained, with abundant thin green shale stringers, locally has clasts of dolomitic sandstone.	1.3'	54.6'-55.9'
21.	Sandstone, light red brown, coarse- and medium-grained, very dolomitic, with abundant fine-crystalline dolomite pebbles in basal 10", medium- and thick-bedded, cross-bedded, poorly sorted.	3.5'	55.9'-59.4'
22.	Sandstone, very light yellow brown, poorly sorted, grains range in size from granules down to silt with abundant green clay stringers massive, cross-bedded. Basal 0' to 1' lacks fines and weathers as reentrant.	2.5'	59.4'-61.9'

		Thickness	
23.	Sandstone, red brown, medium- and coarse-grained, very dolomitic, with steeply dipping cross-beds. Conglomeratic in some beds, notably in base, with ripclasts of finer texture and lighter color. Finer grained at top.	3.5'	61.9-65.4'
24.	Sandstone, slight reentrant, light yellow brown, medium-grained with clasts of lighter color. Locally slightly argillaceous.	0.2'	65.4'-65.6'

Van Oser Member - 22.5 feet

25.	Sandstone, light gray, coarse- and medium-grained, massive-bedded, cross-bedded, with numerous pea-sized sandstone concretions. Top even. Variable thickness. Grades laterally into top of unit #25.	3.0'±3.0'	65.6'-68.6'
26.	Sandstone, very light yellow gray, coarse- and medium-grained with little very coarse, massive, cross-bedded, with some finer textured clasts in basal 4 feet. Some small pockets of very coarse sand and granules. Upper 6 feet grades laterally into bed #25.	15'±3'	68.6'-83.6'
27.	Sandstone, light yellow brown, medium- and coarse-grained with little fine and very coarse, massive- to medium-bedded, cross-bedded, dolomite cement. Base irregular. Bed laterally discontinuous.	1.5'±1.5'	83.6'-85.1'
28.	Sandstone, white, medium- and fine-grained, massive, cross-bedded. Upper 6" dolomite cemented.	3'	85.1'-88.1'

Norwalk Member - 27.5 feet

29.	Sandstone, brown, medium- and fine-grained, cross-bedded, irregular medium beds. Locally has a ripclast at base. Some coarse sand in top.	3'	88.1'-91.1'
30.	Mostly covered. Some hard ledges, but mostly slumped. Appears to be a medium- and fine-grained, gray, friable sandstone.	4'	91.1'-95.1'

		Thickness	
31.	Sandstone, very light yellow brown, very fine- and fine-grained, dolomitic, reworked. Scattered small openings that may be fossil molds. Some hard ledges. Medium and regular beds.	18'	95.1'-113.1'
32.	Sandstone, very light yellow gray, very fine- and fine-grained, cross-bedded, massive-bedded.	2'	113.1'-115.1'
33.	Sandstone, very light gray, poorly sorted, grains range in size from granules to silt. Some local iron enrichment.	0.5'±	115.1'-115.6'

St. Lawrence Formation
Lodi Siltstone Member - +11.0 feet

34.	Sandstone, light yellowish brown mottled pink, very fine- and fine-grained, very silty, very dolomitic, with abundant burrows and trails. Beds medium (10"). Top slightly uneven.	7.5'	115.6'-123.1'
35.	Sandstone, light yellow brown, predominantly fine- and very fine-grained with trace medium, mostly thin-bedded, very silty.	3.0'	123.1'-126.1'
36.	Sandstone, light yellow brown, predominantly medium-grained, silty, very dolomitic, massive-bedded.	1.0'	126.1'-127.1'

Long covered interval to near base of hill at west.

Franconia Formation - +30 feet.

37.	Sandstone, fine-grained, glauconitic, interbedded with glauconitic sandstone containing clasts of clean fine-grained sandstone.	30'±	

BASE OF SECTION.

Mileage

0.2 Top of St. Lawrence Formation exposed in roadcut on right (north).

0.5 Small quarry to right (north) in Franconia Formation.

0.8 STOP SIGN. Junction with Highway 56. Turn right (west), <u>caution left</u>.

1.2 Enter village of Genoa.

Mileage

1.3 STOP SIGN. Turn right (north), caution left.

1.7 STOP SIGN. Junction with Highway 35. DANGER. Turn left (south).

2.3 Outcrop of Franconia Formation on left. Dam on right.

2.8 Outcrop of Franconia Formation on left behind historical monument. Monument recognizes dam as one of many on Mississippi River.

3.1 Dairyland Power Cooperative nuclear power plant on right.

4.2 Outcrop of Franconia Formation at road level and of the Jordan Sandstone Formation and the Oneota Dolomite Formation above.

6.4 Cross Bad Axe River.

STOP #2

8.4 Pull off as far as possible on right (west) side of highway. Exit from right side of vehicles. Use extreme caution when crossing highway to outcrop.

Rock is exposed in roadcut and bluff located at left (east) side of Highway 35 at north edge of village of Victory in SW$\frac{1}{4}$, NE$\frac{1}{4}$, Sec. 21, T.12N., R.7W., Vernon County. Refer to Ferryville 15' topographic quadrangle.

At Stop #1 we saw the upper part of this section. For this reason we will examine only the lower portion of the section exposed in the road cut which includes portions of the Ironton Member and the Franconia Formation.

The Ironton Member was originally assigned to the Franconia Formation by Thwaites (1923). Thwaites defined the Ironton as a few feet of hard calcareous coarse-grained sandstone forming the basal member of the Franconia in southwestern Wisconsin. The next year Ulrich (1924) described it as being composed mainly of reworked, washed, and relatively coarse residual grains of Dresbach Sandstone the surface of which had been previously subjected to subaerial leaching and erosion. He further stated that the Ironton extends downward to the lowest plane indicating reworking and redeposition of the weather-loosened top sands of the underlying Dresbach and that to make sure of identification one should search for its characteristic fossils, namely the Camaraspis (Elvinia) fauna.

Ulrich's definition stood until 1954 without change. In that year Berg made a detailed study of the Franconia lithology in southwestern Wisconsin and southeastern Minnesota and proposed a lithostratigraphic subdivision in which he replaced the name Ironton with Woodhill. Berg justifies the name change with the belief that the term Ironton Member has become synonymous with Elvinia zone in which case it is a biostratigraphic subdivision. The name Woodhill was thus proposed by Berg as one which has no faunal connotation.

It is proposed here that the name Ironton Member as originally proposed and defined by Thwaites, who excluded mention of a fauna, be retained for this unit. It is believed that little or no benefit is gained by changing the name when the main part of the original definition refers specifically to lithology and when the name in its lithologic sense has been used for many years by field geologists. It is further suggested that there is justification for separating the Ironton from the overlying Franconia "greensands" on the basis of lithology and that the Ironton be placed in the same lithostratigraphic unit as the underlying Galesville Sandstone from which it can be separated only with difficulty on the outcrop and seldom in the subsurface. It is obvious at this Stop that the Ironton is markedly different from the overlying greensands in texture, composition, and outcrop expression. The contact of these two in the subsurface is one of the easiest to determine. Although we cannot see the Galesville-Ironton contact at this stop we will have the opportunity provided there is sufficient time to see it at Stop #7 this afternoon. At Stop #7 there is very little difference between the Ironton and Galesville.

In support of this realignment of lithostratigraphic units there are the results of recent work done by Grover Emrich at the Illinois Geological Survey (1962) and by John Andrew of the University of Wisconsin (1965). Emrich studied the Ironton-Galesville in the Upper Mississippi valley area and concluded that the two could be separated only with difficulty in the outcrop and in the subsurface. Andrew made a detailed physical and heavy mineral study of six widely spaced exposures of this interval in southwestern Wisconsin and reached the same conclusion with the suggestion that the Ironton and Galesville should be combined.

Traced eastward onto the arch the Ironton thins. South of the Wisconsin River, in Iowa County near Lone Rock, there is no or less than 6 inches of Ironton and near Lake Delton there is less than 1 foot of Ironton. There is some indication that the Ironton thickens east of the arch as, for example, near Tower Hill State Park where over 3 feet of Ironton is present and at the American-Marietta Quarry south of Portage, Columbia County, where about 6 feet of Ironton is present.

Above the Ironton Member at Stop #2 are the Franconia "greensands". Berg subdivided this rock unit on the basis of lithostratigraphy, in ascending order, into the Birkmose, Tomah, Reno, and Mazomanie members. All but the Mazomanie, which is a facies member, are represented here. The Birkmose Member consists of 7.1 feet of glauconitic dolomite and dolomitic sandstone and of ripclast conglomerate with a glauconitic sand matrix. Traced eastward the Birkmose thins as, for example, near Lake Delton where it is about 1 foot thick and as will be seen at Stop #8 where it is only 3 feet thick.

The overlying Tomah and Reno members are not known to thin eastward nor does their lithologic character change markedly from what is seen at this exposure. Of particular note are the numerous intraformational conglomerates in the Reno. These are interpreted to indicate short periods of high energy as might result from storms over a broad shallow and open shelf area.

The Mazomanie Member does not occur in southwestern Wisconsin. It appears midway in the Reno Member at about Richland Center and thickens eastward until in the vicinity of Mazomanie it comprises the majority of the Franconia. Berg (1954) reported it as a southwestward pinching wedge. Driscoll (1959) and Hamblin (1961) also showed this to be the case. Investigation in progress at the Wisconsin Geological and Natural History Survey suggests that the Mazomanie is in reality a tongue that has a very irregular outer limit and which occurs within the greensands, that it is thickest over the Wisconsin dome and arch and thins outward, and that it has a southward extension off of the Wisconsin dome into the Madison area. It is believed to represent deposits formed in a shallow water near-shore environment that shifted position in response to fluctuations of sea-level and, thus, indicates that there was a minor retreat of the sea from the Wisconsin dome during the Franconia depositional interval. We will see the Mazomanie at Stop #9.

The description provided below is a composite of those made by G. O. Raasch(Kansas Geol. Soc. Guidebook to 9th. Annual Field Conference, 1935, Stop #17, pp. 430-31), R. W. Tillman (M.S. thesis, Univ. Wisc., 1960, Section #37, pp. 175-176), and M.E. Ostrom (September 1961 and May 1965) with modifications by Ostrom. At the time of Raasch's description a complete section including the lower 93.5 feet of the Oneota Dolomite down to the base of the Birkmose Member of the Franconia Formation was exposed. All of the lower calcareous beds of the Trempealeau Group, namely the St. Lawrence Formation, and most of the upper part of the Franconia Formation is now covered. The Birkmose and underlying Ironton have since been exposed.

<u>Outcrop description for Stop 2.</u>

Ordovician System
Prairie du Chien Group
Oneota Formation - 93.5 feet.

		Thickness	
1.	Dolomite, gray, crystalline, granular, porous, weathers rough, massive- and thick-bedded, irregular chert bodies at some horizons; cavities filled with calcite.	18.0'	0'-18.0'
2.	Dolomite, light buff, compact and finest in grain in lower part becoming coarser and porous above, undulatory laminations; thick-bedded, +4'	12.8'	18.0'-30.8'
3.	Dolomite, white, fine-crystalline, compact, dull luster, thinly laminated, medium-bedded (3'). Abundant dendrites and druses of quartz arranged in bands in lower part.	8.2'	30.8'-39.0'
4.	Dolomite, buff, earthy, well-bedded, thin- and medium-bedded (6"-12"), fucoids (overgrown with brush).	22.5'	39.0'-61.5'

		Thickness	
5.	Exposed in steep bluff. Dolomite, light gray, sandy, with an oolitic zone a few feet above base. Near the top is a cryptozoochiton zone below which is about 1 foot of dense but rather fine-crystalline oolitic dolomite, thin layers of sandstone, and green-shale speckled beds. Lower 5 ft. is conglomeratic.	32.0'	61.5'-93.5'

Cambrian System
Trempealeau Group - 166.2'
Jordan Formation
Sunset Point Member - 19.2'

6.	Sandstone, very light yellow gray, medium-grained, dolomitic, rather thin-bedded; 4 ft. above base is a conglomerate with flat pebbles of fine-grained sandstone; horizontal borings in some layers.	17.5'	93.5'-111.0'
7.	Sandstone, light yellow gray, cross-bedded, poorly-sorted, medium- to very fine-grained, with stringers of green shale.	2.0'	111.0'-113.0'

Van Oser Member - 26.0'

8.	Sandstone, light yellow gray, numerous pea-sized sand concretions, coarse- to fine-grained, cross-bedded, slightly calcareous.	3.0'	113.0'-116.0'
9.	Sandstone, light yellow gray, medium-grained, massive-bedded, cross-bedded.	6.0'	116.0'-122.0'
10.	Covered - Described by Raasch as sandstone, white and brown, medium- and coarse-grained, coarsest at top, friable, massive-bedded, cross-bedded in upper 20 feet.	52.0'	122.0'-174.0'
11.	Sandstone, white to light yellow gray, medium-grained, massive, cross-bedded in lenticular units of varied inclination, numerous borings.	17.0'	174.0'-191.0'

Norwalk Member - 34.2 feet

12.	Sandstone, very light yellow gray, fine-grained, horizontally laminated.	11.5'	191.0'-202.5'

Covered interval. Described by Raasch (1935) as

a.	Sandstone, light brown, fine-grained, horizontally and cross-laminated; 18" bed 0.5' above this has great number of borings.	1.0'	202.5'-203.5'

			Thickness
b.	Dolomite, gray, sandy, massive, rough weathering; contains undulatory structures like cryptozoa.	5.8'	203.5'-209.3'
c.	Sandstone and siltstone, interlaminated, fine-grained, yellow to brown gray, fucoidal markings, fragments of fossils.	8.8'	209.3'-218.1'
d.	Sandstone, buff, dolomitic, very fine-grained, partings of siltstone, abundant Saukiella.	13.'	218.1'-219.4'
e.	Dolomite, sandy, gray, mostly thin-bedded.	5.8'	219.4'-225.2'
f.	Dolomite, glauconitic, gray; conglomeratic with pebbles like bed below; <u>Eurekia</u> <u>eos</u> zone.	0.6'	225.2'-225.8'

St. Lawrence Formation
Lodi Member - 29.4 feet.

g.	Sandstone, fine-grained, and siltstone, dolomitic yellow.	19.5'	225.8'-245.3'
h.	Sandstone, fine-grained, micaceous, thin-bedded, marcasitic, few fossils including "<u>Dikelocephalus</u> near <u>norwalkensis</u>."	6.0'	245.3'-251.3'
i.	Siltstone, dolomitic, very fine-grained, dark gray, non-fissle with interlaminated fine sandstone bands toward top; meristomes.	3.9'	251.3'-255.2'

Black Earth Member - 8.0'

j.	Dolomite, firm, rather thin-bedded, gray, glauconitic.	8.0'	255.2'-263.2'

Franconia Formation - 131.2 feet
Reno Member

k.	Conglomerate, pebbles ellipsoidal, of greensand and yellow dolomite like underlying beds; matrix, calcareous greensand; no pebbles in upper beds.	6.6'	263.2'-269.8'
l.	Greensand, much glauconite, somewhat micaceous, laminated. <u>Dikelocephalus</u> sp.	3.8'	269.8'-273.6'
m.	Greensand, highly glauconitic, laminated, interlaminated with siltstone, dolomitic, yellow gray; contacts marked by large fucoids; a few bands of fine, yellow, micaceous, sandstone; a few inches of greensand conglomerate at base; silt mainly in upper part. <u>Saukiella</u> <u>minor</u>.	20.3'	273.6'-293.9'

		Thickness	
n.	Greensand, thick-bedded, some beds now laminated, blotched with blue and yellow siltstone, other beds laminated, much cross-lamination; partings of green-gray siltstone; near base; _Prosaukia_ and _Irvingella_.	58.0'	293.9'-351.9'
o.	Interbedded greensand, dirty, streaked and mottled with blue-gray siltstone and sandstone, fine, laminated, pinkish brown and light green somewhat glauconitic and with thin beds of greensand without silt; partings of siltstone with fucoids occur at some levels; laminated part of the sandstone is fossiliferous but has no fauna in lower 8 ft.; _Ptychaspis striata_ faunule, including _P. striata_, _Idahoia wisconensis_ var., _Pseudoagnostus Josepha_, var., "_Conaspis_" _antina_ or a new species, _Ellipsocephalus curtus_.	13.0'	351.9'-364.9'

Base of covered interval.

13.	Sandstone, very glauconitic, slightly dolomitic, fine- and very fine-grained with trace medium, thin-bedded, interbedded with few ripclast conglomerates.	29.0'	364.9'-393.9'
14.	Greensand conglomerate; pebbles of white sandstone and of dolomite in a greensand matrix.	0.5'	393.9'-394.4'

Tomah Member

15.	Sandstone, in two 3" beds, very light gray on weathered surface, fine- and very fine-grained, slightly calcareous.	0.5'	394.4'-394.9'
16.	Sandstone, yellow brown and green gray, fine-grained with little very fine and trace medium thin-bedded, dolomitic, abundant glauconite, laminated with green gray micaceous shale partings.	14.5'	394.9'-409.4'

Birkmose Member - 9.1 feet

17.	Sandstone, yellow brown, medium-grained with little coarse and fine, trace very coarse; little silt and glauconite, massive, cemented with limonite and dolomite.	0.7'	409.4'-410.1'

		Thickness	
18.	Dolomite, green gray, finely crystalline, much glauconite, little medium and fine sand, conglomeratic; contains abundant clasts of finer-grained sandy material. Contains some structures that may be algal in origin.	1.4'	410.1'-411.5'
19.	Conglomerate with clasts of sandstone and dolomite in a matrix of greensand.	0.8'	411.5'-412.3'
20.	Conglomeratic dolomite, green gray, finely-crystalline with abundant medium and fine sand grains, much glauconite, some algal structures, and sandstone clasts.	0.7'	412.3'-413.0'
21.	Sandstone, yellow brown and red brown, fine- and medium-grained with trace very fine. Abundant glauconite. Thin-bedded and irregularly-bedded. Locally conglomeratic.	2.5'	413.0'-415.5'
22.	Conglomerate: varies in thickness from 3.0' down to 2". Consists of clasts of underlying sandstone in matrix of greensand. Where thin the lithology is that of thinly-laminated silty shale. Well-exposed about 50 yards south of north end of exposure.	3.0'	415.5'-418.5'

Ironton Member - +19.7 feet

23.	Sandstone, red brown, medium-grained with trace of coarse, well-cemented with dolomite and limonite, massive- and medium-bedded, abundant brachiopods.	2.4'	418.5'-420.9'
24.	Sandstone, yellow brown, medium- and coarse-grained with little fine, well-cemented with dolomite and limonite, uneven bedding planes, medium-bedded, abundant brachiopods.	2.0'	420.9'-422.9'
25.	Sandstone, light yellow brown, medium- and coarse-grained with little fine, massive-bedded and cross-bedded. Note pinnacle weathering forms around vertical limonite-cemented burrows. Scattered brachiopods.	2.0'	422.9'-424.9'
26.	Sandstone, yellow gray, medium-grained with little coarse and fine, massive-bedded and cross-bedded, weathered surface moderately pitted. Few brachiopods, most abundant near top.	8.0'	424.9'-432.9'

			Thickness
27.	Sandstone, yellow gray, medium-grained with little coarse, fine and very fine, trace silt, poorly-sorted, massive; "burrowed" bed.	0.3'	432.9'-433.2'
28.	Sandstone, yellow gray, coarse-grained with little medium and fine, trace silt, massive-bedded, weathered surfaces pitted.	0.3'	433.2'-433.5'
29.	Sandstone, light gray, medium-grained with coarse, fine and very fine, little silt, poorly-sorted, massive-bedded; "burrowed" bed.	0.5'	433.5'-434.0'
30.	Sandstone, yellow gray, coarse-grained with little medium and fine, trace silt, massive-bedded and cross-bedded, pitted in top.	0.6'	434.0'-434.6'
31.	Sandstone, light gray, coarse-grained with much medium and fine, little very fine, little silt, massive; "burrowed" bed.	1.2'	434.6'-435.8'
32.	Sandstone, yellow gray, medium-grained with little coarse and fine, trace very coarse and very fine, massive-bedded, weathered surface pitted.	0.7'	437.5'-438.2'

BASE OF EXPOSURE AT ROAD LEVEL

Mileage

8.8 Enter village of Victory

9.2 Turn left (east) on County Trunk "UU". DANGER.

11.0 Roadcut in Sunset Point Member and quarry in overlying Oneota Dolomite.

13.0 St. Peter Sandstone exposed in roadcut on left (north).

13.8 STOP SIGN. Junction with Highway 82. Turn left (east). Caution.

17.2 Stay left at "Y" in road.

17.7 Quarry in Oneota Dolomite.

20.7 Enter village of West Prairie. Caution.

22.6 St. Peter Sandstone exposed at left (north).

24.6 STOP SIGN. Junction of highways 27 and 82 at Fargo. Turn left (north). Danger from right.

Mileage

26.6 St. Peter Sandstone exposed on left (north) of highway.

28.2 Enter village of Liberty Pole. Caution.

29.0 St. Peter Sandstone exposed in roadcut on right (south).

29.3 Abandoned quarry in Platteville Formation on both sides of road.

30.9 Junction with County Highway "J"; continue straight ahead on highway 82-27.

31.7 Stay to right on highway 27-82.

STOP #3

31.9 Roadcut on north side of highway 27-82 about 0.1 mile west of junction with U. S. Highway 14 located 1.5 miles southeast of Viroqua in the NW$\frac{1}{4}$, NW$\frac{1}{4}$, Sec. 16, T.12N., R.4W., Vernon County. Refer to Viroqua 15' topographic quadrangle.

At Stop #3 a lithologic sequence similar to that of Stop #1 can be seen. It begins at the base with orthoquartzitic sandstone believed to be the Tonti of Templeton and Willman (1963) and to be lithologically analagous with the Van Oser of Stop #1. This is overlain by a discontinuous and thin layer of poorly-sorted sandstone which is succeeded by 4.5 feet of greenish gray shale. At this stop the poorly-sorted sandstone and the shale are distinct units whereas at Stop #1 the two lithologies were interbedded. The overlying 4.0 feet of the Pecatonica Member of the Platteville Formation is lithologically analagous with the basal Oneota of Stop #1.

The poorly-sorted sandstone and the shale of Stop #3 is assigned to the Glenwood lithic unit. The poorly-sorted sandstone attains a maximum thickness of nearly 8 feet near Beetown in southwestern Wisconsin and eastward toward New Glarus it thins irregularly due to an uneven basal surface. Its upper contact with the shale is even. In western Wisconsin the shale can be separated into a lower non-calcareous greenish-gray portion and an upper calcareous grayish-brown shale (Templeton & Willman, 1963). The shale and its two subdivisions thin to disappearance eastward to New Glarus, the lower shale persisting the furthest. In the New Glarus area the shale is absent and the poorly-sorted sandstone is in direct contact with the overlying Pecatonica Dolomite Member of the Platteville Formation. The basal bed of the Pecatonica has been assigned the name Chana by Templeton and Willman. This bed attains a maximum thickness of 20 inches in Wisconsin and consists of sandy dolomite with scattered phosphate pellets in its base. Its occurrence is coincident with the Pecatonica Dolomite.

Although the Glenwood has been assigned to the Platteville by many investigators the reasoning behind such an assignment is questionable. Briefly it can be said that neither lithology nor persistence of beds justify its assignment to the Platteville. Hopefully separation of the Glenwood from the overlying carbonate sequence and assignment to the St. Peter will meet with broad acceptance.

Outcrop description for Stop #3

Ordovician System
Platteville Formation
Pecatonica Member - +4 feet

1.	Dolomite, light yellowish brown, fine- and medium-crystalline, dense, thin- and medium-bedded. Sandy with phosphate pellets in base (Chana member of Templeton & Willman, 1963).	4'	0' - 4'

St. Peter Sandstone Formation
Glenwood Member - 6.4 feet

2.	Shale, brownish green, slightly dolomitic, silty.	1.5'	4' -5.5'
3.	Shale, greenish-gray.	4.5'	5.5' -10.0'
4.	Iron-cemented sandstone and/or iron-rich shale.	0.2'±0.2'	10.0'-10.2'
5.	Sandstone, poorly-sorted, with grains from very coarse sand down to silt.	0.2'±0.2'	10.2'-10.4'

Tonti Member - +15 feet.

6.	Sandstone, light yellowish gray, medium- and fine-grained, massive-bedded, cross-bedded.	+15'	10.4'-25.4'+

BASE OF EXPOSURE AT ROAD LEVEL

Mileage

32.1 STOP SIGN. Junction with Highway 14. Turn right (south). Caution from left.

33.4 Oneota Dolomite exposed in roadcut on left (east). Note that we are going down the rock section, that we are losing altitude and that we had St. Peter Sandstone at the top.

34.4 Quarry in Oneota Dolomite on left (east).

34.7 Stream cut on right in St. Peter Sandstone.

Mileage

STOP #4

34.9 Pull off to right (west) as far as possible. Road cut on left side of Highway 14 about 4.5 miles southeast of Viroqua in the C, NE¼, Sec. 27, T.12N., R.4W., Vernon County. Refer to Gays Mills 15' topographic quadrangle.

At this stop a St. Peter "channel" is exposed. Here the St. Peter Sandstone can be seen to fill what is believed to have been a stream erosion channel cut in the surface of the Oneota Dolomite at a time when the sea had retreated far to the southeast. The sand filling the channels is believed to have been deposited when the sea once again advanced over the land. Each new advance of the sea is marked by the deposition of quartz sand. In the case of this outcrop the erosion surface is an obvious feature because it developed in a resistant rock having a lithology much different from the sandstone deposited on it. In other instances, as for example at Stop #1, the lack of an obvious erosion surface can be explained as the result of that surface having been cut in silts and sands not markedly different from the sands being deposited by the advancing sea. In this case it would be difficult if not impossible to identify the surface as being one of erosion.

FROM HERE WE WILL WALK DOWN HIGHWAY TO STOP #5

STOP #5

Roadcuts on both sides of Highway 14 about 4.8 miles southeast of Viroqua in the NW¼, SE¼, Sec. 27, T.12N., R.4W., Vernon County. Refer to Gays Mills 15' topographic quadrangle.

This stop differs from Stop #1 in that the Sunset Point Member is thinner by three quarters. On the other hand it is nearly identical in detail with that at the first stop Sunday morning which will be the abandoned Sunset Point Quarry in Hoyt Park, Madison, Wisconsin, the type section for the Sunset Point Member. The name Sunset Point was proposed by Raasch (1952) as a replacement for the name Madison which was previously used for this unit. The exposure here is significant because supposedly the Madison Sandstone does not extend beyond the Madison area. Raasch recognized the Sunset Point in Vernon County and assigned it this name because he believed the name Madison to be preempted for use elsewhere.

<u>Outcrop description for Stop #5.</u>

Ordovician System
Prairie du Chien Group
Oneota Formation - +32.6 feet

	Thickness	
1. Dolomite, gray, finely-crystalline, slightly porous, has "chiton" zones 8" and 20" above base; also scattered white oolitic chert nodules.	3.0'	0'-3.0'

			Thickness
2.	Dolomite, gray, finely-crystalline, dense, thickness varies from 5" to 8"; locally appears to contain cryptozoa.	0.7'	3.0'- 3.7'
3.	Dolomite, massive, gray, medium- and coarsely-crystalline, dense, oolotic, little oolitic white chert 6" above base. Oolites abundant in base and rare in top.	2.6'	3.7'- 6.3'
4.	Dolomite, very light brownish gray, medium- and coarsely-crystalline, dense to slightly porous, medium- to thin-bedded and irregularly-bedded, otherwise massive.	3.0'	6.3'- 9.3'
5.	Dolomite, light gray, medium-crystalline, slightly sandy, massive, with porosity that may be due to fossils (first ledge below top of bluff west side of road). Upper surface has algal structures although this does not show at edges.	1.8'	9.3'-11.1'
6.	Dolomite, light gray, medium-crystalline, very sandy, has white discontinuous chert bed through midportion. Very sandy 8" below top.	2.8'	11.1'-13.9'
7.	Dolomite, light gray, finely-crystalline, massive, very oolitic.	1.4'	13.9'-15.3'
8.	Dolomite "breccia".	0.3'	15.3'-15.6'
9.	Algal dolomite.	0.8'	15.6'-16.4'
10.	Dolomite, brownish gray, medium-crystalline, dense, with much green clay in top.	0.6'	16.4'-17.0'
11.	Sandstone, very dolomitic, few oolites, some "green speckled" beds (clay). Has some clay and finely-crystalline dolomite clasts. Locally much green clay.	0.7'	17.0'-17.7'
12.	Sandstone, light gray streaked yellowish brown, poorly-sorted, predominantly medium-grained with much fine and very little coarse, silty, trace green clay.	0.5'	17.7'-18.2'
13.	Dolomite, light gray, medium-crystalline, massive, slightly porous, appears to contain cryptozoa; clastic in upper 6".	1.5'	18.2'-19.7'

		Thickness	
14.	Dolomite, very light yellowish brown, medium-crystalline, dense, very oolitic, thin- and medium-bedded where weathered, horizontally streaked with thin brown closely spaced and crinkly partings. Lower 2" no oolites.	2.0'	19.7'-21.7'
15.	Sandstone ripclast, very light yellowish gray to light gray, poorly-sorted, very fine to very coarse clasts of finely-crystalline dolomite and of green shale.	0.8'	21.7-22.5'
16.	Dolomite, light yellowish brown, medium-crystalline, very sandy, contains oolitic chert, massive-bedded.	2.0'	22.5'-24.5'
17.	Sandstone ripclast with clasts of dolomitic sandstone and of sandy oolitic dolomite.	0.8'	24.5'-25.3'
18.	Sandstone, very pale light greenish gray, medium- and fine-grained, massive-bedded, many fucoidal (?) markings. Very argillaceous in basal 6". Upper contact uneven and has very sandy dolomite deposited in depressions.	0.8'	25.3'-26.1'
19.	Dolomite, light grayish brown, sublithographic to very finely-crystalline, dense, much very fine sand. Beds uneven.	1.5'	26.1'-27.6'
20.	Sandstone, same as in #18.	1.5'	27.6'-29.1'
21.	Dolomite, gray, massive- to thin-bedded, discontinuous beds, sandy (locally a dolomitic sandstone). Appears brecciated and has considerable distortion of bedding. Highly silicified and brecciated in basal 3" to 12". Laterally beds are even, medium- to thin-bedding, and continuous. (Top of lower ledge west side of road)	3.5'	29.1'-32.6'

Cambrian System
Trempealeau Group
Jordan Formation
Sunset Point Member - 13.2 feet

22.	Sandstone, light gray, medium-grained, massive-bedded and cross-bedded with some green clay along cross beds.	12.' +0.2'	32.6'-33.8'

		Thickness	
23.	Dolomite, gray, finely-crystalline, massive-bedded, sandy, some porosity along bedding planes. Very sandy at base - slightly sandy at top.	1.0'	33.8'-34.8'
24.	Sandstone, light yellowish gray, medium- and fine-grained with little coarse, poorly-sorted, silty, very dolomitic, scattered clasts.	1.2'	34.8'-36.0'
25.	Sandstone ripclast; coarse sand matrix, sandy dolomite pebbles, with scattered specks of green clay. Pebbles are flattened and rounded.	2.5'	36.0'-38.5'
26.	Sandstone, very light gray, coarse- to fine-grained with trace very coarse, poorly-sorted, trace green clay, massive, slightly dolomitic; good reference bed.	1.1'	38.5'-39.6'
27.	Sandstone, mottled brown and light yellowish brown, fine- to coarse-grained, poorly-sorted, locally cross-bedded.	0.7'	39.6'-40.3'
28.	Sandstone, light yellowish gray, very fine-grained, dolomite, streaked light brown.	0.5'	40.3'-40.8'
29.	Sandstone ripclast; same as #25.	0.8'	40.8'-41.6'
30.	Sandstone, light yellowish brown, medium- and fine-grained with some coarse, poorly sorted, cross-bedded, becomes finer-grained upward.	3.5'	41.6'-45.1'
31.	Sandstone, brown and yellowish brown, fine- to coarse-grained, poorly-sorted, very argillaceous, iron-enriched in base, scolithic.	0.2'±0.1'	45.1'-45.3'
32.	Sandstone, light gray, very coarse- to very fine-grained, trace silt, poorly-sorted, conglomeratic.	0.5'±0.2'	45.3'-45.8'

Van Oser Member - +15.0 feet

33.	Sandstone, light yellowish gray to light yellowish brown, medium-grained, with some fine and trace of coarse, well-sorted, massive-bedded and cross-bedded.	+15.0'	45.8'-60.8'

BASE OF EXPOSURE

Mileage

35.4 Stream cut on right (west) exposing Oneota Dolomite, Sunset Point Member and Van Oser Member.

35.7 Roadcut on left (east) in Sunset Point Member, Van Oser Member, and Norwalk Member. (Will be seen after lunch.)

STOP #6

36.1 LUNCH STOP.

Junction with county Highway "J" opposite rest stop. Park past junction at right side of Highway 14. Pull off as far as possible to right (west).

There are two exposures to be seen at this stop. The first was passed at mileage 35.7. The second is located just south of the rest stop on the left (east) side of Highway 14 opposite its junction with County Highway "J".

The first outcrop is located at the east side of Highway 14 at trip mileage 35.7 about 0.4 miles north of rest stop in SE$\frac{1}{4}$, SE$\frac{1}{4}$, Sec. 27, T.12N. R.4W. Refer to Gays Mills 15' topographic quadrangle. Description begins at base of Sunset Point Member which forms prominent ledge at top of exposure.

Outcrop description for Stop #6.

Cambrian System
Trempealeau Group
Jordan Formation
Van Oser Member - 23.5 feet

		Thickness	
1.	Sandstone, light yellowish brown, medium- and coarse-grained, some poorly-sorted, especially in upper 0" to 8". Weathers as a reentrant. Cross-bedded.	4.0'	0'- 4.0'
2.	Sandstone, light gray, medium-grained with little coarse, massive-bedded. Upper 1" contains rounded sandstone concretions that have both siliceous and calcareous cement. Commonly iron-enriched in upper few inches. Shows evidence of burrowing in upper part. Cross-bedded. Discontinuous shale partings throughout.	12.0'	4.0'-16.0'
3.	Sandstone, pink, dolomitic, medium- and fine-grained with little coarse; ledge former.	0.5'	16.0'-16.5'
4.	Same as #3, with less cement and only a trace of coarse sand, massive, forms reentrant.	7.0'	16.5'-23.5'

Thickness

Norwalk Member - +20.0 feet

5. Sandstone, very light yellowish brown to light yellowish gray, fine-grained, thin- and medium-bedded, horizontally laminated with very low-angle cross-beds. In lower 8' sandstone is fine- and very fine-grained, silty, thin- and medium-bedded and has some burrowed beds.	20.0'$\pm$	23.5'-43.5'

BASE OF EXPOSURE

The second outcrop is located at the east side of Highway 14 opposite its junction with County Highway "J" just south of the rest area in the NE$\frac{1}{4}$ NE$\frac{1}{4}$, Sec. 34, T.12N., R.4W., Vernon County. Refer to the Gays Mills 15' topographic quadrangle.

At this outcrop the Norwalk Member of the Jordan Formation and underlying Lodi Member of the St. Lawrence Formation are exposed. The contact of the two members is about 3 feet above road level and is marked by the change downward from very fine-grained sandstone with minor silt and very little calcareous cement to siltstone that is calcareous and which contains very fine sand and thin beds of gray dolomite. There is a transition zone of about 4 feet which is assigned to the Norwalk. Estimated thickness of the Norwalk in this area is 35 feet.

Mileage

36.9 Contact of Trempealeau Group with Franconia Formation in roadcut on left (east).

38.0 Franconia Formation exposed in roadcut on left (east).

38.6 Franconia Formation exposed in roadcut on left (east). Note green beds of glauconitic sandstone.

40.0 Enter village of Readstown. Caution. Stay on Highway 14.

40.4 Franconia Formation exposed in roadcut on left (east). Note green color due to presence of glauconite. Cross Kickapoo River, a violent Spring flooder.

41.9 Franconia Formation exposed in roadcut on left (east).

42.8 Franconia Formation exposed in roadcut on left (east).

43.0 Franconia Formation exposed in roadcut on right (west).

43.7 Jordan Formation exposed in roadcut on right (west).

44.3 Oneota Formation exposed in roadcuts and quarries.

45.4 Oneota Formation exposed in roadcut on left.

Mileage

48.9 Oneota Formation exposed in roadcuts.

50.3 Bosstown roadcut. Stratigraphic units exposed include the St. Peter Sandstone, Oneota Dolomite, Sunset Point Member, Van Oser Member and Norwalk Member.

51.5 Enter village of Bosstown.

53.5 St. Lawrence Formation exposed in roadcut on right (southwest). Bluffs in area all have an Oneota Dolomite cap.

57.5 Enter village of Boaz.

59.7 Quarry high in hill to left. Platteville Formation over St. Peter Sandstone.

60.9 Franconia Formation exposed in roadcut on right (south).

60.3 St. Peter Formation (?) exposed in roadcut on left (north).

60.9 Jordan Sandstone exposed in roadcut on right (south).

61.1 Roadcut on left in which Jordan Formation is believed to rest unconformably on the Franconia Formation. There is 1 foot of ripclast conglomerate in the base of what is believed to be the Jordan.

61.3 Franconia Formation exposed in roadcut on right (south).

61.6 Franconia Formation exposed in roadcut on right (south). Note green color imparted by glauconite.

64.6 Enter city of Richland Center. <u>Use extreme caution while passing through city</u>.

64.8 Cross Pine River bridge. Proceed two blocks past the bridge and turn right (south) on Orchard Street. <u>Caution</u>. Go south for 9 blocks to <u>Stop Sign</u> on Seminary Street.

65.7 STOP SIGN on Seminary Street. <u>Caution</u>. Turn left (east) on Seminary Street and proceed two blocks to Stop Sign on Main Street.

65.8 STOP SIGN on Main Street. <u>Caution</u>. Turn right (south)on Main Street (Truck Route 14) and proceed 5 blocks to Gage Street (at railroad tracks).

66.2 Turn left on Gage Street at railroad tracks.

66.3 STOP SIGN. Junction with Highway 14. <u>Caution</u>. Turn right (south).

70.3 Continue on Highway 14. Junction with Highway 58.

Mileage

72.3 Turn left (east) on County Trunk "B". Follow "B" straight east through Sextonville to County Trunk "E".

72.4 Enter village of Sextonville. Caution.

73.1 DANGER. Unprotected road crossing. Proceed straight ahead.

73.2 Turn left (north) on black top.

73.4 Turn right. Caution. Unprotected T-road.

75.4 Mazomanie Member of the Franconia Formation exposed in roadcut.

75.7 Franconia Formation exposed in quarry pit on left (north).

77.0 STOP SIGN. Junction with Highway 130. Caution. Turn left (north).

STOP #7

77.5 Outcrop on gravel farm road left (west) of Highway 130 and 0.5 miles north of its junction with County Highway "B" on NW$\frac{1}{4}$, NW$\frac{1}{4}$, Sec. 11, T.9N., R.2E., Richland County. Refer to Plain 15' topographic quadrangle.

Beginning with this stop and continuing through Stop #10 we will proceed upward in the geologic section. At this stop the Galesville Sandstone Formation and the Ironton Member, which has been included in the overlying Franconia Formation, are exposed.

This is intended to be a short stop. It is important to note the lithologic character of the Galesville Sandstone and how it compares with the Van Oser Member of the Jordan Sandstone and with the St. Peter Sandstone seen earlier, and with which it is believed to be historically analogous.

It will also be noted that the Galesville and overlying Ironton cannot easily be distinguished. The Ironton was seen at Stop #2. As the Ironton is traced eastward it thins. At this stop it is something in excess of 7 feet thick. Twenty miles to the north at the type section the Ironton is about 8 feet thick. Seven miles to the south near Lone Rock, the Ironton is absent or very thin. East of Lone Rock it reappears it outcrops near Tower Hill State Park and at Portage in Columbia County far to the east.

As will be noted at Stop #8, the Ironton Member is easily distinguished from overlying glauconitic and shaly sandstones of the Franconia Formation. On the other hand it is very difficult, in fact locally impossible, to distinguish the Ironton from the underlying Galesville Sandstone on the outcrop and even more so in the subsurface. The characteristics used for this differentiation are the coarser sand grain size of the Ironton, the bedding character of the Ironton which is medium-bedded and even-bedded whereas the Galesville is massive, and the presence of "worm-burrowed" beds in the Ironton and their absence from the Galesville. In addition the Ironton may contain small to trace amounts of glauconite, pyrite, carbonate, or phosphatic brachiopod shell fragments, and in upper one foot molds of the trilobite Camaraspis.

The problem to be considered is whether or not in a lithostratigraphic classification the Ironton should be combined with the glauconitic fine-grained shaly sandstones of the Franconia or if it should be combined with the Galesville, the two units to rank as members of a larger formation characterized by a quartz sand content of over 95 percent.

Outcrop description for Stop #7.

Cambrian System
Franconia Formation
Ironton Member - +7.0 feet

	Thickness	
1. Sandstone, light yellowish brown and light yellowish gray, grains range in size from granules down to very fine sand but predominantly coarse to fine; cross-bedded, medium-bedded. Contact fairly sharp. Some of the granules appear to be Baraboo Quartzite.	+7'	0'-7'

Dresbach Group
Galesville Formation - +25.0 feet

2. Sandstone, very light yellowish gray and white, fine- and medium-grained, with abundant thin discontinuous green shale seams along cross beds and bedding planes, cross-bedded, massive-bedded. Local concentrations of coarse sand grains.	+25'	7'-32'

BASE OF EXPOSURE AT ROAD LEVEL

Mileage

78.2 Sunset Point Member and Van Oser Member exposed in bluff to left (west).

78.5 St. Killians Church.

80.2 Enter village of Bear Valley. Caution.

81.2 Y-junction of Highway 130 with County Highway N. Take N to the right (east).

82.4 Galesville Sandstone exposed in roadcut on left (north).

82.7 Franconia/Ironton contact exposed behind barn on left (north).

83.8 Franconia Formation exposed in "shale pit" on left (north).

Mileage

84.8 Oneota/Jordan contact exposed in road cut on left (north).

85.2 STOP SIGN. Junction with County Highway G. Turn right (south) Caution to left.

87.4 Bear Creek Town Hall.

89.5 "Pre-St. Peter" conglomerate exposed in roadcut on right (west).

89.7 Jordan Formation exposed on left.

89.9 Jordan/St. Lawrence (Lodi Member) contact exposed on right (west).

90.3 Franconia Formation exposed on left (east).

STOP #8

90.8 Pull off road on right. Roadcut on right (west)side of County Highway G opposite farm house 0.8 miles north of junction with County Highway B in the NW$\frac{1}{4}$, NW$\frac{1}{4}$, Sec. 14, T.9N., R.3E., Sauk County. Refer to Plain 15' topographic quadrangle.

At Stop #8 the contact between the Ironton Member and the glauconitic fine-grained sandstones of the Franconia Formation is well exposed. As was pointed out at Stop #7 this contact is easily identified in both surface exposures and in the subsurface.

The problem of lithostratigraphic classification of these units should now be obvious. However before any reclassification can occur one of the important items that must be considered is the widely accepted name Franconia. Briefly the name Franconia has assumed biostratigraphic stature as a stage of the St. Croixan Series, a designation of international significance and acceptance. Unfortunately the biostratigraphic limits of the Franconia do not coincide with easily recognized lithostratigraphic limits as we have seen. What, then, must be done with the name Franconia?

It is suggested that the name Franconia be reserved for stage use in the biostratigraphic classification of the St. Croixan Series and that it be dropped from usage in lithostratigraphic classification. It is further suggested that the Ironton Member should be combined with the Galesville into a single formation.

<u>Outcrop description for Stop #8</u>.

Cambrian System
Franconia Formation
Reno Member - 15.0 feet (est.)

		Thickness	
1.	Sandstone, very light yellowish brown, fine- and very fine-grained, glauconitic, thin- and medium-bedded, cross-bedded.	15'(est.)	0'-15'
Tomah Member - 12.0 feet (est.)			
2.	Sandstone, very light yellowish gray, very fine- and fine-grained, very thin- and uneven-bedded, shaly, silty, micaceous, with abundant markings on bedding planes. Rare brachiopods.	12'(est.)	15'-27'
Birkmose Member - 3.0 feet			
3.	Ripclast; clasts of fine-grained sandstone and dolomitic fine-grained sandstone in matrix of glauconitic fine-grained sandstone. Thickness variable.	0.4'	27'-27.4'
4.	Greensand with rare clasts, thin-bedded with glauconite concentrated along bedding planes; dolomitic.	1.6'	27.4'-29.0'
5.	Ripclast; clasts of fine-grained sandstone and dolomitic fine-grained sandstone in matrix of glauconitic fine-grained sandstone. Locally has coarse-grained sandstone matrix in lower 6". Much iron cement and feldspar, especially in base. Dolomitic. Thickness variable. Locally has granules of Baraboo Quartzite in lower 6".	1.0'	29.0'-30.0'
Ironton Member - +12.0 feet			
6.	Sandstone, very light gray weathers light yellowish brown, coarse- and medium-grained with little very coarse and scattered granules, appears massive, cross-bedded, with locally some pale green clay seams along cross beds and bedding planes.	+12.0'	30.0'-42.0'

BASE OF EXPOSURE AT ROAD LEVEL

Mileage

91.2 Roadcut and pit on right (west) exposing same section as was seen at Stop #8.

91.6 STOP SIGN. Junction with County Highway B. Turn right (west) and follow County Highway G.

91.7 Turn left (south) on County Highway G.

93.9 Horseshoe Road. Turn left (east).

Mileage

94.4 Galesville Sandstone exposed in outcrop in left (north) distance.

STOP #9

95.7 This stop and stop #10 will be made provided there is sufficient time. Includes roadcuts on right (south) of Horseshoe Road, and those on Highway 27, 0.5 miles to east (mileage 96.2), and those in quarry (Stop #10) about 0.9 miles to the south (mileage 97.5). Location is the SE$\frac{1}{4}$, SE$\frac{1}{4}$, Sec. 25, T.9N., R.35E., Sauk County. Refer to Spring Green 15' topographic quadrangle.

Stop #9 is intended to show the lithology of the Mazomanie Member of the Franconia Formation, the contact of the Franconia Formation with the Black Earth Dolomite Member of the St. Lawrence Formation, the contact of the Lodi and Black Earth members of the St. Lawrence Formation, and the fact that the various members of the Jordan Formation persist at least this far eastward from Stop #1.

Outcrop description for Stop #9.

Ordovician System
Oneota Dolomite Formation - +4.0 feet

	Thickness	
1. Dolomite, light gray, medium- and fine-crystalline, conglomeratic with some cryptozoa.	+4'	0'-4'
Cambrian System Trempealeau Group Jordan Formation Sunset Point Member - 14.0 feet		
2. Dolomite, sandy and argillaceous, and sandstone, dolomitic, argillaceous, mostly covered.	14'	4'-18'
Van Oser Member - 26.0 feet		
3. Sandstone, light yellowish gray mottled yellowish brown, predominantly medium-grained with little fine and coarse, with scattered green shale seams. Numerous pea-sized concretions in upper 0' to 7'. Massive-bedded and cross-bedded.	26'	18'-44'
Norwalk Member - +18.0 feet		
4. Sandstone, very light yellowish brown, fine- and very fine-grained, medium- and thin-bedded.	+18'	44'-62'
CONCEALED INTERVAL	+37'	62'-99'

St. Lawrence Formation
Lodi Member - +13.0 feet

	Thickness	
5. Siltstone, dolomitic, much very fine sand, and dolomite, very silty, little very fine sand, light yellowish brown, thin-bedded. Beds even in lower 6'; above this beds are thin and discontinuous. Clay abundant as shale seams and coatings on bedding planes and as clay disseminated throughout rock.	+13'	99'-112'
Black Earth Member - 6.0 feet		
6. Dolomite, reddish brown weathered pinkish brown sandy, glauconitic, finely-crystalline, slightly porous, medium- and thin-bedded, even-bedded. Grades upwards through upper 1' to the Lodi Member.	6'	112'-118'
Franconia Formation Reno Member - +8.0 feet		
7. Ripclast; clasts of fine-grained sandstone and dolomite in matrix of dolomite and glauconitic sandstone.	1'	118'-119'
8. Sandstone, very glauconitic, fine-grained, with silty seams in upper 6". Thin-bedded and cross-bedded.	+7'	119'-126'+
CONCEALED INTERVAL	±10'	126'-136'
Mazomanie Member - +15 feet		
9. Sandstone, very light yellowish gray, very fine- and fine-grained with little medium, little glauconite, thin- and medium-bedded, cross-bedded locally has shale seams and may be dolomitic.	+15'	136'-151'
Reno Member - +5.0 feet		
10. Sandstone, very light yellowish gray to light gray, fine- and very fine-grained, glauconitic, thin-bedded, some cross-bedded.	+5'	151'-155'+

BASE OF EXPOSURE OF ROAD LEVEL

Mileage

96.2 STOP SIGN. Junction with highway 23. Turn right (south). Caution from left.

Mileage

96.6 Provided there is sufficient time we will make this stop. Turn left (south) on gravel quarry road. Caution. St. Lawrence and Jordan formations exposed on right (west) side of gravel road.

STOP #10

97.5 Davis and Richardson Stone Quarry located in the Wisconsin River bluff about 1 mile north of Spring Green in the SE$\frac{1}{4}$, SW$\frac{1}{4}$, Sec. 31, T.9N., R.4E., Sauk County. Refer to Spring Green 15' topographic quadrangle.

We are not here so much to examine the stratigraphic succession as we are to examine certain red clay bodies which occur in the Oneota Dolomite Formation and which do not appear to have a preference for special stratigraphic zones.

These clay bodies are similar to those which occur in the Oneota Dolomite elsewhere and which have been explained to be fillings of solution cavities in the dolomite. Clay mineral analyses of the clay indicates that it consists predominantly of mixed-layer expansible varieties and that it compares favorably with analyses reported for residual clays supposedly developed as soils on the top of the dolomite throughout much of southwestern Wisconsin (M.L. Jackson, personal communication). Supposedly the residual clays are circulated downward in groundwaters and redeposited in the solution cavities.

The clay bodies in this quarry raise some serious questions with regard to this hypothesis. If examined closely it can be seen that certain non-calcareous layers in the dolomite, namely chert, sandy or silty beds, or glauconitic clay beds, persist through the clay bodies. This is difficult to explain in terms of cavity filling.

As an alternative it is suggested that the clay bodies form by a process of replacement in the dolomite and that the residual soils at the surface form as a lag concentrate developed as the carbonate is leached away.

If it is true that this clay actually is forming by a replacement process in the dolomite, then closer examination may provide a clue as to the mode of formation of other clays, such as bauxite, in carbonate rocks.

Outcrop description of Stop #10.

Ordovician System
Prairie du Chien Group
Oneota Formation - +52.5 feet

	Thickness	
1. Dolomite, massive, light reddish brown, medium-crystalline, slightly porous, with locally abundant white chert.	+7'	0'- 7'
2. Same as #1, but has no chert.	2.5'	7'- 9.5'

		Thickness	
3.	Dolomite, light yellowish gray, finely-crystalline, dense with green clay along bedding planes especially in upper 1'. Abundant dendrites. Sandy near base. Locally fine- and medium-crystalline. Medium-bedded becoming thin-bedded to top. Beds persistent and gently undulating.	6.0'	9.5'-15.5'
4.	Dolomite, gray mottled and streaked light yellowish brown, medium-crystalline, slightly porous, appears massive but is medium- and thin-bedded. Upper contact sharp and even.	5.0'	15.5'-20.5'
5.	Dolomite, brown, fine- and medium-crystalline, moderately porous, irregular thickness, with large subspherical bodies (12") of white chert with gray centers. No oolites detected in chert. Upper contact irregular. Some reddish brown clay bodies. Base of upper quarry ledge.	2'±1'	20.5'-22.5'
6.	Dolomite, grayish brown mottled pale orange, massive, with abundant chert. Top of lower quarry ledge.	10'	22.5'-32.5'
7.	Dolomite, gray mottled light yellowish brown, porous, stromatolitic.	3'	32.5'-35.5'
8.	Sandstone, light yellowish gray, very dolomitic, fine- and medium-grained, dense, blocky fracture.	0.2'±0.1'	35.5'-35.7'
9.	Dolomite, brownish gray mottled light yellowish brown, fine- and medium-crystalline, dense to slightly porous, persistent lateral beds, somewhat irregular beds. Upper 18" very oolitic.	4'	35.7'-39.7'
10.	Dolomite, gray mottled brownish gray and moss green, sandy and glauconitic, slightly conglomeratic, in top of bed #11.	0.1'±0.1'	39.7'-39.8'
11.	Dolomite, gray mottled light yellowish brown, medium- and finely-crystalline, very porous, appear to be semi-vertical tubes (algal structures), with laterally persistent thin (1") beds of sandy and glauconitic dolomite and of siltstone. Appears to have altered in some areas to reddish brown waxy clay except for thin glauconitic and sandy layers which persist through the clay.	2.5'	39.8'-42.3'

		Thickness	
12.	Dolomite, gray mottled and streaked pale reddish brown, dense to slightly porous, single bed, appears dark on weathered surface with moss-green clay, very sandy.	0.7'	42.3'-43.0'
13.	Sandstone with siliceous cement, moderately well-cemented, coarse- to medium-grained, massive, with abundant white specks and stringers. Few relict oolites.	0.9'±0.3'	43.0'-43.9'
14.	Sandstone with siliceous cement, coarse- to medium-grained, white, scattered oolites, varies from hard to soft.	0.2'±0.1'	43.9'-44.1'
15.	Sandstone, light yellowish gray, medium- and fine-grained with little coarse and very fine, silty, poorly-sorted, dolomitic, trace glauconite. Massive with irregular blocky fracture. Thin green shale stringers in top.	0.9'	44.1'-45.0'
16.	Dolomite, massive, fine- and medium-crystalline, porous, stromatolitic with thin laminae. Occurs as single bed.	1.1'	45.0'-46.1'
17.	Dolomite, light gray, medium- and finely-crystalline, dense, very sandy, interbedded with sandstone, white, fine- and medium-grained with somewhat discontinuous beds.	12.'+0.3'	46.1'-47.3'
18.	Dolomite, gray mottled brownish gray, finely-crystalline, dense, slightly porous in top, massive.	1.1'	47.3'-48.4'
19.	Chert, white, oolitic.	0.3'	48.4'-48.7'
20.	Dolomite, brownish gray, weathers light yellowish gray on surface, massive, irregular fracture, slightly porous. Upper part very oolitic. Oolites are light yellowish brown. Conglomeratic.	1.6'	48.7'-50.3'
21.	Dolomite, light brownish gray, very finely-crystalline, dense, cryptozoa with convoluted thin laminae. Surface weathers very light yellowish gray. Upper 3" very conglomeratic.	1.2'	50.3'-51.5'

		Thickness	
22.	Dolomite, brownish gray, fine- and medium-crystalline, dense, medium- and thin-bedded, regularly-bedded, very oolitic. Oolites light yellowish brown.	+1.0'	51.5'-52.5'+

BASE OF EXPOSURE AT QUARRY FLOOR.

Mileage

98.4 Stop Sign. Gravel quarry road rejoins Highway 23. Turn left (west). Caution left.

98.5 Roadcut on left (south) exposes Oneota Formation down to Black Earth Member of St. Lawrence Formation.

98.7 Franconia Formation exposed in roadcut on left (east).

100.4 Stop Sign. Junction with Highway 14. Turn left east. Caution. PROCEED TO MADISON ON HIGHWAY 14.

102.6 Cross Wisconsin River.

116.8 Enter village of Mazomanie. Caution.

117.4 Mazomanie Member of Franconia Formation exposed in roadcut on right (south).

120.6 Enter village of Black Earth. Caution. Note quarry north of town. Jordan Formation rests on Black Earth Dolomite Member. Black Earth from this quarry is used as a building stone.

121.8 Oneota Formation down to Franconia Formation exposed in outcrop on left (north).

122.7 Contact of St. Lawrence with Franconia in roadcut on left (north).

124.6 Contact of Jordan with St. Lawrence in roadcut on left (north).

124.8 Contact of St. Lawrence with Franconia in roadcut on left (north).

126.0 Enter village of Cross Plains. Caution.

128.2 Contact of Jordan with St. Lawrence (Lodi) in roadcut on left (north).

128.9 Gravel pit on left is outwash deposit and marks eastern edge of "Driftless" area.

130.4 Contact of Oneota with Jordan in roadcut on left (north). Starke (1949) estimated that approximately 40 feet of Oneota and the Sunset Point is missing at this exposure.

133.8 Highway crosses part of bed of Glacial Lake Middleton. Ice advanced from the northeast and blocked the channel of an eastward flowing tributary to the ancestral Yahara River. The tributary valley filled with water to form the lake which drained westward, up the valley, toward Black Earth.

WARNING

134.3 Turn left (north) before underpass (highway 14-East).

From this point on follow the Madison City map for route to the Dane County Fairgrounds (See general instructions).

ROAD LOG FOR SUNDAY

October 10, 1965

Mileage

STOP #11

0.0 Cars will form in caravan at the curb of Du Rose Terrace, South of Bluff Street and at the northwest corner and below Hoyt Park in the city of Madison in the NE$\frac{1}{4}$, SE$\frac{1}{4}$, Sec. 20, T.7N., R.9E., Dane County. Refer to Madison 15' or Madison West 7.5' topographic quadrangle.

This is the type section of the Sunset Point Member of the Jordan Formation, formerly the Madison Sandstone. The Madison Sandstone was initially believed to be limited in occurrence to the Madison area. Raasch was one of the early investigators who shared in this belief. In 1952 he described it as occurring in Vernon County, the area of Stops nos. 1 through 5, and renamed it the Sunset Point Sandstone (1952). Recent subsurface and surface mapping done by the Wisconsin Geological and Natural History Survey indicates that the Sunset Point is widespread in occurrence and that it is absent in Wisconsin in the area of the Wisconsin arch. It is believed to be at least in part the lithostratigraphic equivalent of the Eminence Dolomite Formation of Missouri and Illinois.

The contact of the Van Oser Member with the Sunset Point Member as exposed in this quarry was thought by Ulrich (1924) to be a major unconformity separating the Cambrian from his Ozarkian System. In truth the surface of separation is mildly uneven and there is a quartz granule "conglomerate" in the base of the Sunset Point Member. However, this contact can as easily be explained as a lag deposit developed by subaqueous reworking of the underlying sand in an environment receiving minor sand from the near shore and beach environment. It is interpreted as representing the change from the near-shore environment to one located further seaward.

Fossils collected from the Sunset Point Member by Raasch are identified as Cambrian in age and include Tellurina, Saukia, and Scolithes.

Outcrop description of Stop #11.

Ordovician System
Prairie du Chien Group
Oneota Formation - 63.2 feet

	Thickness	
1. Dolomite, light gray mottled and streaked very light yellowish brown, fine- and medium-crystalline, thin- and regularly-bedded, with abundant very fine sand and scattered very fine glauconite pellets in basal 1" to 12". Abundant dendrites on horizontal surfaces. Bedding planes locally coated with green clay. Uneven base.	+10'	0'-10'

		Thickness
2. Dolomite, gray mottled pale orange, in semi-regular beds, fine- and medium-crystalline, alternating dense and porous beds. Red-cored non-oolitic, white chert occurs in basal portion scattered and along bedding planes. No algae. Has few beds of sublithographic, thin- and medium-bedded dolomite near base.	12'	10'-22'
3. Dolomite, very light yellowish brown, very finely-crystalline, dense, silty. Basal contact very irregular with relief of as much as 7" over lateral distance of 1 foot. Bedding is thin and regular. Fracture is blocky and imparts a yeast-like appearance. Contains abundant red cored white chert. No oolites detected. Dendrites on horizontal surfaces.	1.0'±0.3'	22'-23'
4. Dolomite, light gray mottled very light yellowish brown, gray is fine-grained and yellowish brown is medium- and coarse-grained; porous, conglomeratic, massive. Basal 1" to 6" is dense, light gray, fine-grained, dolomite. No cryptozoa.	4'	23'-27'
5. Dolomite, massive, gray mottled pale orange, medium- and finely-crystalline, porous with laminae due to cryptozoa in upper 6". Has white chert in irregular masses along bedding planes. Much of chert is red-cored. Red chert contains angular fragments and appears to be oolitic. White chert is chalky. Upper part has less chert, is coarse- and medium-crystalline, and has weathered surface due to intricate cryptozoa. Base is irregular and porous with reddish silty clay locally. No oolites. Beds colored gray on weathered surface.	4'	27'-31'
6. Dolomite, brownish gray, finely-crystalline, dense, irregular small bodies of oolitic white chert with gray centers and locally abundant oolitic white chert with red centers. Abundant cryptozoa.	0.8'±0.2'	31'-31.8'
7. Dolomite, light gray mottled pale orange, fine- and medium-crystalline, porous, especially toward top; appears to be conglomeratic.	2.4'	31.8'-34.2'

		Thickness	
8.	Dolomite, pale orange, finely-crystalline, dense, with scattered sand grains, massive, slightly porous, top uneven with 4" local relief. Oolitic in top.	1.4'±0.2'	34.2'-36.6'
9.	Sandstone, very light yellowish gray, mottled shades of green, very fine- and fine-grained, silty, weathers brown and yellowish brown, with thin shale laminae; locally forms a re-entrant.	0.4'	36.6'-37.0'
10.	Dolomite, pale orange, finely-crystalline, slightly porous, with obvious algal laminae. Bed persistent and uniform. Locally forms ledge. Persistent light-colored bed.	0.6'	37.0'-37.6'
11.	Dolomite, very light yellowish brown, finely-crystalline, irregularly porous, appears to be conglomeratic. Bed persistent but irregular in thickness.	0.4'±0.2'	37.6'-38.0'
12.	Dolomite, gray mottled yellowish brown, fine- and medium-crystalline, dense, with small white discontinuous oolitic chert bodies locally in base. Sandy in top.	1'	38.0'-39.0'
13.	Dolomite, light gray mottled light yellowish brown, medium-crystalline, irregular porosity, appears to be conglomeratic, cryptozoa in base where there is locally little green-clay and scattered silicified oolites.	3'	39.0'-42.0'
14.	Dolomite, light yellowish brown, fine- and medium-crystalline, dense, oolitic, uneven basal contact with relief of 3" locally. Thinly-laminated with shale and siltstone pebbles in basal part.	1.5'	42.0'-43.5'
15.	Dolomite, brown mottled gray, finely-crystalline, dense, irregular bed, appears to be conglomeratic.	0.7'±0.2'	43.5'-44.2'
16.	Dolomite, light yellowish brown, fine- to medium-crystalline, dense, in one thick bed, locally thin-bedded where weathered. Thin beds are blocky and persistent. Scattered sand grains in zones parallel to bedding. Slightly porous in lower part which is transitional with underlying unit.	1.5'	44.2'-45.7'

		Thickness	
17.	Dolomite, light gray, massive- or thick-bedded, porous. Random pores in base and vertical pores in top. Medium-crystalline. Scattered oolites.	5'	45.7'-50.7'
18.	Dolomite, gray mottled light yellowish brown pale green, fine- and very fine-crystalline, dense; locally all light yellowish brown dolomitic siltstone.	1.2'	50.7'-51.9'
19.	Dolomite, very light reddish brown mottled gray and green, fine- and medium-crystalline, dense. "Green-speckled" bed. Oolites present but indistinct. Locally is a very finely-crystalline and silty, glauconitic dolomite.	0.3'	51.9'-52.2'
20.	Dolomite, grayish brown, very fine-crystalline, dense, very oolitic. Locally pink. Contains discontinuous beds of white, red-cored, oolitic chert. Somewhat shaly and green-colored near top which is marked by reentrant.	0.4'	52.2'-52.6'
21.	Dolomite, grayish brown, very fine-crystalline, dense, very oolitic. Locally pink. Contains discontinuous beds of white, red-cored, oolitic chert. Somewhat shaly and green-colored near top which is marked by reentrant.	5.0'	52.6'-57.6'
22.	Chert, white with reddish brown core, oolitic.	0.2'	57.6'-57.8'
23.	Dolomite, conglomeratic and sandy. Sand is medium, coarse and very coarse. Contains pebbles up to $\frac{3}{4}$" consisting of very finely-crystalline dolomite. Thin-bedded. Base is well-marked reentrant. Oolitic in top.	0.6'	57.8'-58.4'
24.	Dolomite, yellowish brown, very finely-crystalline, silty, thin- and evenly-bedded to locally massive-bedded.	0.7'	58.4'-59.1'
25.	Sandstone, yellowish gray, variable texture in different beds from $\frac{1}{4}$" to 12" thick and from dolomitic siltstone to dolomite pebble conglomerate with dolomitic sandstone matrix. Beds discontinuous. "White speckled bed", 10" thick, in top. Upper part of this bed contains abundant coarse oolites. Top is marked by a discontinuous bed of gray oolitic chert with maximum thickness of 3". Top is well-marked whitish reentrant.	2.2'	59.1'-61.3'

		Thickness	
26.	Dolomite, light brown, very finely-crystalline, many "pits", stromatolitic, conglomeratic; occurs as single, massive, persistent bed.	1.7'	61.3'-63.0'
27.	Sandstone, very dolomitic, and dolomite, very sandy, grains very coarse, coarse and medium. Occurs as single well-defined bed. Locally consists of a carbonate pebble conglomerate. Little glauconite.	0.2'	63.0'-63.2'

Cambrian System
Trempealeau Group
Jordan Formation
Sunset Point Member - 12.0 feet

28.	Sandstone, light yellowish brown, medium- and fine-grained, very dolomitic; and dolomite, finely-crystalline, with abundant medium and fine sand grains; medium- and thin-bedded, evenly-bedded. Locally beds may be "pitted". Some beds thinly and irregularly laminated and locally contains abundant thin horizontal green shale partings. Becomes more dolomitic and very fine-grained and silty and thicker-bedded toward top. Abundantly and irregularly burrowed.	11.0'	63.2'-74.2'
29.	Sandstone, light greenish gray, very coarse- and coarse-grained, "conglomeratic", basal contact uneven with up to 18" of relief over 50 feet horizontal distance and a local variation of up to 12". Locally contains pebbles of siltstone and shale.	±1.0'	74.2'-75.2'

Van Oser Member - +9.3 feet

30.	Sandstone, very light yellowish gray, very fine- and fine-grained, massive, with large scale and nearly horizontal cross-laminae. Interbedded with layers of sandstone, fine- and very fine-grained, silty, light yellowish brown, with abundant orange-colored shale pebbles. These beds are worm-burrowed, up to 14" thick, and interbedded with clean sand beds up to 7" thick. Burrows are filled with silty and/or dolomitic material. Clean sand beds are cross-bedded. Contacts between beds are gently irregular.	4.0'	75.2'-79.2'

		Thickness	
31.	Sandstone, very light pale brown, massive, fine- and very fine-grained with trace medium; basal 6" coarse and medium-grained with abundant thin horizontal green shale partings. Whole of unit weathers yellowish brown. Silty in some layers with scattered shale pebbles.	1.3'	79.2'-80.5'
32.	Sandstone, white, massive, cross-bedded, fine- and medium-grained with little coarse; few thin green shale partings. Found at street intersection.	+4.0'	80.5'-84.5'+

BASE OF EXPOSURE AT STREET LEVEL

Mileage

0.1 Stop. Junction with Blackhawk Drive. Turn left (south).
0.2 Turn right (west) on Regent Street.
0.25 Turn left (south) on Owen Drive.
0.7 STOP SIGN. Junction with Mineral Point Road. Danger from left. Turn right (west).
0.9 STOP LIGHT. Continue straight ahead (west).
4.8 STOP SIGN. Junction with Beltline Highway, routes 12 and 14. DANGER. Continue straight ahead (west) on Mineral Point Road.
5.0 Turn left (south) on County Trunk M.
8.4 Turn right (west) on County Trunk PD.
9.8 Turn left (south) on Nine Mound Road.
11.8 STOP SIGN. Junction with Highway 151 and 18. DANGER. Turn right (west).
13.0 Cross from Cary moraine to earlier drift.
13.3 Turn left (south) on County Trunk G. DANGER.
15.3 St. Peter Sandstone exposed in roadcut on right (north).
16.8 Cross County Trunk J.
17.7 St. Peter Sandstone exposed in roadcut on left (south).
18.7 Oneota Dolomite exposed in roadcut on right (north).
19.1 STOP SIGN. Junction with Highway 92. DANGER from right. Turn left (south) and enter Village of Mt. Vernon.
19.3 Turn right (west) on County Trunk G.
19.5 Quarry in Oneota Dolomite on right (north).
19.7 STOP #12.

STOP #12

Roadcut on County Highway G, 0.2 miles west of village of Mt. Vernon in the NW$\frac{1}{4}$, NW$\frac{1}{4}$, Sec. 3, T.5N., R.7E., Dane County. Refer to New Glarus 15' topographic quadrangle.

This exposure presents an excellent opportunity for comparing the Oneota and Shakopee formations, for examining the contact of the New Richmond and Willow River members of the Shakopee Formation (Richard Davis, personal communication) for seeing the pre-St. Peter erosion surface, and for seeing a good example of faulting on the edge of the "stable" Wisconsin dome.

Generalized diagrams of exposures on each side of the highway and a plan view, are shown on the next page. Close examination will reveal many faults of minor displacement now shown on the diagram.

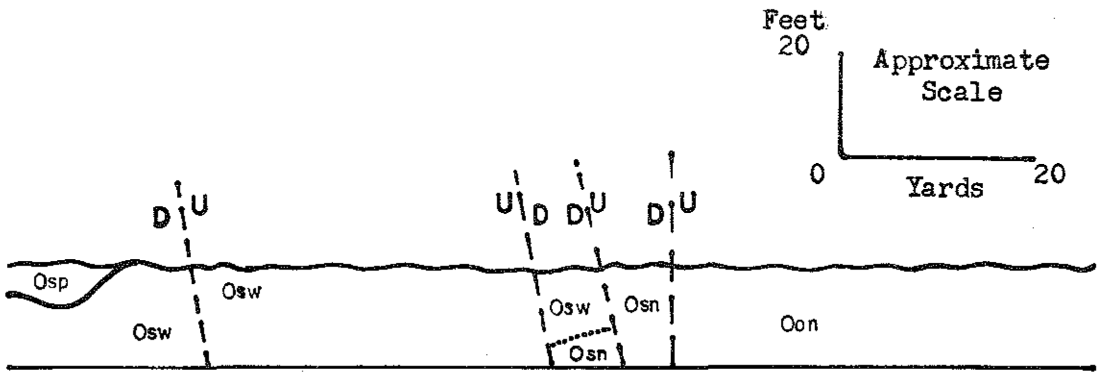
Some of the characteristics which distinguish the Oneota Formation from the Shakopee Formation include:

1. Bedding: Oneota is massive- or thick-bedded; Shakopee is thin- or medium-bedded.
2. Texture: Oneota is commonly medium-crystalline and coarser textured whereas the Shakopee is finely-crystalline.
3. Impurities: Oneota has less sand and clay than the Shakopee, especially in its upper part.
4. Sedimentary structures: bedding planes in the Shakopee are commonly marked with worm trails and shrinkage cracks.
5. Fossils: With rare exception the only fossils noted in the Oneota are cryptozoa, whereas gastropods, algae, and locally brachiopods may be common in the Shakopee. Fossils are rare at this exposure.

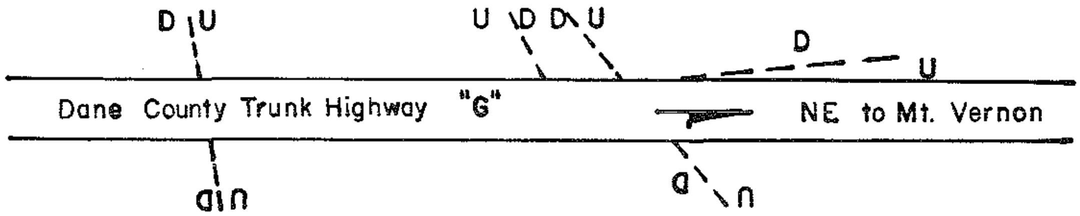
Although it cannot be seen clearly at this exposure the contact of the New Richmond Sandstone Member of the Shakopee Formation with the underlying Oneota Dolomite Formation is one of marked truncation. This truncation can be seen in the outcrop area of the Prairie du Chien Group between Bagley, Grant County, Wisconsin, and Hager City, Pierce County, Wisconsin. (Davis, 1965). Ulrich (1924) considered this truncation sufficient to establish the existence of the Canadian System. Thus, the list of systems present in the Upper Mississippi Valley area according to Ulrich would include the Cambrian (Mt. Simon through Van Oser), Ozarkian (Sunset Point through Oneota), Canadian (the Shakopee), and Ordovician (St. Peter through Maquoketa).

In Wisconsin the New Richmond Sandstone rarely approaches the "purity" of the Tonti Member of the St. Peter Formation or the Van Oser Member of the Jordan Formation and when it does it is very thin. However, in southeastern Minnesota the New Richmond Sandstone attains outcrop thicknesses of nearly 50 feet and consists of over 95 percent quartz sand. It commonly has a thin bed of green shale or argillaceous and silty sandstone on its top which is considered to be the approximate historical analogue of the Glenwood Shale or the Franconia "greensands".

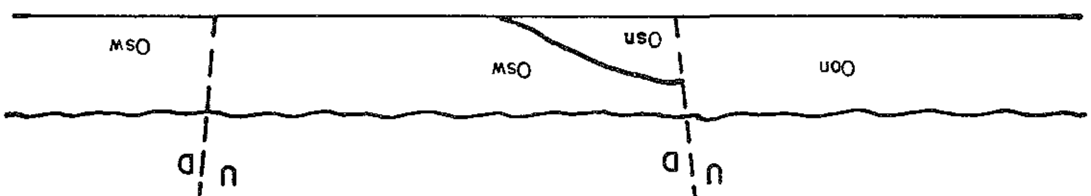
If the assumption is correct that the Tonti and Van Oser members which are moderately well-sorted massive quartz sandstones, were deposited in a beach-nearshore environment, then it can also be assumed that where the New Richmond has a similar character it was deposited in a similar environment. It also follows that because at this outcrop there is no "clean" quartz sandstone in the New Richmond that the beach-nearshore environment did not extend into this area.



A. Outcrop in northwest roadcut.



B. Plan view.



C. Outcrop in southeast roadcut (turn upside down to read).

Diagrammatic sketch of roadcuts on Dane County Trunk Highway "G" west of Mt. Vernon at Stop #12. Oon, Oneota Formation; Osn, New Richmond Member of Shakopee Formation; Osw, Willow River Member of Shakopee Formation; Osp, St. Peter Formation.

Mileage

20.1 Bear left (south) on Primrose Center Road.
20.6 St. Peter Sandstone exposed in road cut.
20.9 St. Peter Sandstone exposed in road cut.
21.4 St. Peter Sandstone exposed in road cut.
21.8 STOP SIGN. Caution. Turn left (east) on Oak Grove Road.
22.6 STOP SIGN. Junction with County Trunk U. Caution. Turn right (south). Note St. Peter Sandstone exposed in road cut.
23.5 Turn left on County Trunk A.
25.1 STOP SIGN. Junction with Highway 92. Caution. Turn right (south).
26.3 St. Peter Sandstone exposed in roadcut.
28.2 STOP SIGN. Junction with Highway 69. Caution. Turn right (southwest).
28.6 STOP #13.

STOP #13

Road cut on State Highway 69, 3.5 miles north of New Glarus and 4.5 miles west of Brooklyn in the SW$\frac{1}{4}$, SW$\frac{1}{4}$, Sec. 36, T.5N., R.8E., Green County. Refer to New Glarus 15' topographic quadrangle.

This exposure shows the effect of the Wisconsin arch on the Glenwood Member and is an excellent place at which to observe the Platteville Formation.

The Glenwood Member has been traced from near Beetown in southwestern Wisconsin to New Glarus. It has an apparent truncation at the top from west to east. Throughout the area it is overlain by a sandy dolomite bed which is from 6" to 22" thick and which contains phosphate pellets in its base (The Chana Member of the Illinois Geological Survey) and which marks the base of the Pecatonica Member. This contact is even and there is no sign of reworking such as a conglomerate. The angular relationship is believed to be depositional in origin and the contact to represent a subaqueous diastem or cessation of deposition.

The contact of the Glenwood Member with the Pecatonica Member is easily recognized because of the basal phosphatic and sandy dolomite bed in the Pecatonica whereas that at the base of the Glenwood is very difficult to determine especially in the subsurface. Above the Glenwood Member individual thin stratigraphic units can be traced over broad areas (Templeton & Willman, 1963) whereas below it the units are limited in extent. Furthermore, the contact marks the change from rocks composed predominantly of non-calcareous clastic material to rocks composed of carbonate.

For this reason the Wisconsin Geological and Natural History Survey is considering removing the Glenwood Member from the Platteville Formation and assigning it instead to the St. Peter Formation. This would separate the predominantly non-calcareous clastic rocks from the carbonate rocks, it would provide for an easily recognizable and mappable contact on the outcrop as well as in the subsurface, and it would be a practical division for economic mapping purposes.

An additional proposal under consideration by the Survey is the grouping of all the rocks now referred to as the Galena-Platteville, or as rocks of Mohawkian age, etc., under a single name. Although the name Ottawa Megagroup has been proposed (Swann & Willman, 1963) for these rocks this name has certain unacceptable qualities. First, the name as originally applied referred to those rocks above the St. Peter, Simpson, Glenwood, or Aylmer clastics and below the Maquoketa Shale Formation. However, it has since been used to include the Glenwood Member (Templeton and Willman, 1963). Second, the name Ottawa in the upper Mississippi Valley area connotes silica sandstone mined at Ottawa, Illinois (the St. Peter Sandstone of Ordovician age), and at Ottawa, Minnesota (the Jordan Sandstone of Cambrian age). Third, its designation as a megagroup rather than as a super group or group does not conform to recommendations of the Code on Stratigraphic Nomenclature so is unlikely to meet with broad acceptance. And fourth, the name Ottawa was taken from Ottawa, Canada, which is far removed from the Upper Mississippi Valley area wherein all other names applied to subdivisions of these rocks have their derivation and is, therefore, of scant reference use to geologists working in the area.

The name under consideration is Sinnipee Group taken from Sinnipee Cemetery which is located at the top of the bluff north of the mouth of Sinnipee Creek in Grant County, Wisconsin. In this bluff nearly all of the rocks from the top of the Glenwood Member into the Stewartville Member of the Galena Formation are exposed. The missing part of the Stewartville Member, the overlying Dubuque Member, and the contact of the Dubuque Member with the overlying Maquoketa Formation are exposed less than 6 miles away near Dubuque, Iowa.

<u>Outcrop description of Stop #13</u>.

Ordovician System
Sinnipee Group (tentative name)
Decorah Formation
Ion Member - +15 feet

	Thickness	
1. Dolomite, light gray mottled and streaked very light yellowish brown, medium-crystalline, medium- to thin-bedded, with green shale in partings and disseminated throughout rock. Abundant fossils, many large, especially on bedding planes. Porous zone of brachiopod molds 12" above base.	+15'	0'-15'

Guttenberg Member - 8.7 feet

2. Dolomite, gray mottled and streaked light yellowish brown, fine- and medium-crystalline, dense, thin- and regularly-bedded, with brown shale and argillaceous dolomite partings. Very fossiliferous; note especially the large brachiopods. Upper few feet becomes thick-bedded with persistent ½" green shale

parting at top: upper few feet have rougher texture than lower part.		15'-23.7'
Spechts Ferry Member - 1.0 feet		
3. Dolomite, light yellowish brown and gray, medium-crystalline, appears massive but is thin-bedded. Upper 3" gray mottled light yellowish brown with abundant phosphate pellets and fragments.	0.7'	23.7'-24.4'
4. Dolomite, light yellowish brown, fine- and medium-grained, thin- and irregularly-bedded, argillaceous.	0.2'±0.1'	24.4'-24.6'
Platteville Formation Quimby's Mill Member - 15.2 feet		
5. Dolomite, light gray, very finely-crystalline, dense, medium- and thick-bedded, regularly-bedded, moderately fossiliferous (well exposed contact in NW cut 15 yards NE of warning sign at S. side of road). Few chert nodules.	14.7'	24.6'-39.3'
6. Dolomite, light yellowish brown, fine- and medium-crystalline, dense, thin- and irregularly-bedded, trace of green clay.	0.5'	39.3'-39.8'
McGregor Member - 46.0 feet		
7. Dolomite, light gray, fine- and medium-crystalline, dense, medium-bedded, laterally persistent beds, fossiliferous, upper few feet appear to be burrowed. Locally quite vuggy.	11.5'	39.8'-51.3'
8. Dolomite, very light yellowish gray, fine- and medium-crystalline, dense, very irregular and thin beds which appear nodular due to nonpersistence of beds. Locally reddish brown, thin and irregularly-bedded dolomite in basal 6" to 1'. Fossils locally abundant, especially well-preserved on bedding planes.	34.5'	51.3'-85.8'
Pecatonica Member - 20.0 feet		
9. Dolomite, very light yellowish brown mottled yellowish brown, medium- and fine-crystalline medium- and thick-bedded, weathers to thin beds, dense with few fossil molds. Weathered surface appears to be shaly.	19.2'	85.8'-105.0'

			Thickness
10.	Dolomite, light yellowish gray mottled very light yellowish brown, fine- and medium-crystalline, massive-appearing but weathers to thin and irregular beds. Sandy in base with rare phosphate pellets. Few fossils. Uneven base may be due to solution.	0.7'±0.5'	105.0'-105.7'

St. Peter Formation
Glenwood Member - 1.7 feet

11.	Argillaceous bed: basal 3" is sandstone, poorly-sorted, grains from coarse to fine size, very argillaceous; overlain by 3" to 9" of reddish brown clay; overlain by less than 3" of very light yellowish brown dolomitic clay and argillaceous dolomite. Upper contact shows marked relief which appears to be due to chemical alteration and solution of the overlying dolomite.	0.7'±0.2'	105.7'-106.4'
12.	Sandstone, reddish brown, coarse- and medium-grained, massive-bedded, locally cross-bedded, poorly-sorted, locally cemented with iron-oxide. Contains abundant pebbles and cobbles that appear to have been derived from the underlying Tonti Member (ripclasts). Base slightly uneven.	1.0'±0.2'	106.4'-107.4'

Tonti Member - +80.0 feet

13.	Sandstone, very light yellowish brown to white, medium- and fine-grained, massive-bedded, cross-bedded, well-sorted, grains rounded and subrounded,	+80'	107.4'-184.4'

BASE OF EXPOSURE AT ROAD LEVEL

LIST OF REFERENCES

Ahlen, J. L., 1952, "The Regional Stratigraphy of the Jordan Sandstone in West Central Wisconsin", unpub. M.S. thesis, Univ. of Wis.

Andrew, John A., 1965, "Size Distribution of Sand and Heavy Minerals in Ironton Sandstone (Franconian Stage) of Western Wisconsin. Unpub. Master's Thesis, Univ. of Wis.

Berg, R. R., 1954, "Franconia Formation of Minnesota and Wisconsin," Bull. Geol. Soc. Amer., Vol. 65, pp. 857-82.

Buschbach, T. C., 1964, "Cambrian and Ordovician Strata of Northeastern Illinois," Ill. Geol. Survey Rept. Inv. 218. 90 pp.

Calvert, Warren L., 1962, "Sub-Trenton Rocks From Lee County, Virginia, to Fayette County, Ohio," Ohio Geological Survey Report Invest. No. 45. 57 pp.

Driscoll, Egbert, G., 1959, "Evidence of Transgressive-Regressive Cambrian Sandstones Bordering Lake Superior," Jour. Sed. Petrol., Vol. 29, No. 1, pp. 5-15.

Emrich, Grover H., 1962, "Geology of the Ironton and Galesville Sandstones of the Upper Mississippi Valley," unpub. Ph.D. Thesis, Univ. Illinois. 109 pp.

Hamblin, William K., 1961, "Paleogeographic Evolution of the Lake Superior Region from Late Keweenawan to Late Cambrian Time," Geol. Soc. Amer. Bull., Vol. 72, pp. 1-18.

Nelson, C. A., 1956, "Upper Croixan Stratigraphy," Bull. Geol. Soc. Amer., Vol. 67, No. 2, pp. 165-84.

Raasch, Gilbert O., 1935, "Stratigraphy of the Cambrian Systems of the Upper Mississippi Valley," Kansas Geol. Soc. Guidebook 9th Ann. Field Conf., pp. 302-15.

Raasch, Gilbert O., 1952, "Oneota Formation, Stoddard Quadrangle, Wisconsin" Ill. Acad. Science Trans., Vol. 45, pp. 85-95.

Starke, G. W., 1949, "Persistent Lithologic Horizons of the Prairie du Chien Formation From the Type Section Eastward to the Crest of the Wisconsin Arch," unpub. M.S. Thesis, Univ. of Wis.

Swann, David H., and Willman, H. B., 1961, "Megagroups in Illinois," Bull. Amer. Assoc. Petrol. Geol., Vol. 45, No. 4, pp. 471-83.

Templeton, J. S., and Willman, H. B., 1963, "Champlainian Series (Middle Ordovician) in Illinois," Ill. Geol. Survey Bull. 89. 260 pp.

Thwaites, F. T., 1923, "The Paleozoic Rocks Found in Deep Wells in Wisconsin and Northern Illinois," Jour. Geol. Vol. 31, No. 7, pp. 529-35.

Tillman R. W., 1960, "The Stratigraphy and Areal Geology of the Ferryville Wuadrangle, Wisconsin," unpub. M.S. Thesis, Univ. of Wis., 20 pp.

Twenhofel, W. H., Raasch, G. O., and Thwaites, F. T., 1935, "Cambrian Strata of Wisconsin," Bull. Geol. Soc. Amer., Vol. 46, pp. 1687-1743.

Ulrich, E. O., 1911, "Revision of the Paleozoic Systems," Geol. Soc. Amer. Bull., Vol. 22, p. 281-680.

Ulrich, E. O., 1924, "Notes on New Names in the Table of Formations and on Physical Evidence of Breaks Between Paleozoic Systems in Wisconsin," Trans. Wis. Acad. Sci., Arts and Letters, Vol. 21, p. 106.

van Andel, Tj. H., 1960, "Sources and Dispersion of Holocene Sediments, Northern Gulf of Mexico," in "Recent Sediments, Northwest Gulf of Mexico", pp. 34-55. Amer. Assoc. Petrol. Geol., Tulsa.

van Andel, Tj. H., and Curray, Joseph R., 1960, "Regional Aspects of Modern Sedimentation in Northern Gulf of Mexico and Similar Basins, and Paleogeographic Significance," in "Recent Sediments, Northwest Gulf of Mexico," pp. 345-64. Amer. Assoc. Petrol. Geol., Tulsa.

Wanenmacher, J. M., Twenhofel, W. H., and Raasch, G. O., 1934, "The Paleozoic Strata of the Baraboo Area, Wisconsin," Amer. Jour. Sci., Vol. 228, pp. 1-30.