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Number 18

UNIVERSITY EXTENSION
The University of Wisconsin

Geological and Natural History Survey
George F. Hanson, State Geologist & Director

Preliminary Report On

RESULTS OF PHYSICAL AND CHEMICAL TESTS OF WISCONSIN SILICA SANDSTONES

by

Meredith E. Ostrom

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Preliminary Report on

RESULTS OF PHYSICAL AND CHEMICAL TESTS OF WISCONSIN SILICA SANDSTONES

by

Meredith E. Ostrom*

INTRODUCTION

Silica sand is a raw material that has been concentrated by natural processes into a nearly pure deposit of quartz (silica). Wisconsin has vast reserves of such sand in geologic formations of Cambrian and Ordovician ages which crop out extensively in the southern part of the state. The uses of these sands are determined by their physical and chemical properties, namely that the grains are hard, durable and rounded, they may occur in a nearly pure chemical state, and they are chemically very stable. The purpose of this investigation was to develop information on the physical and chemical properties of Wisconsin's silica sandstones to aid industry in their search for new deposits to supply increasing demands.

The study was initiated by the Wisconsin Geological and Natural History Survey as a broad program to examine the silica sandstone resources of the state. 296 size analyses and 90 chemical analyses were completed on samples collected from 199 exposures. Samples were collected and tested over a period of twelve years mainly by Survey staff including J. Steuerwald, J. Wendt, J. Tyler, and M.E. Ostrom. In addition, 26 exposures located between LaCrosse and Hudson in western Wisconsin were sampled by J. Melby as a part of a project sponsored by the University-Industry Research (U-IR) program and co-directed by the Survey and the departments of Minerals and Metals, and of Geology and Geophysics, of the University of Wisconsin. Size analyses of Melby's samples were done by the Survey and they were analyzed chemically by Ali I. Aktay, doctoral candidate in the Department of Minerals and Metals, under the direction of that

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department and with financial support of the Survey and of U-IR. Portions of the U-IR project were used in the preparation of theses by both Melby (1968) and Aktay (1968).

PRODUCTION AND MARKETS

In 1968 silica sand was produced in Wisconsin near Portage (Columbia County), Klevenville (Dane County), Bay City (Pierce County) Hanover (Rock County), Green Lake (Green Lake County), and Berlin (Green Lake and Winnebago counties). The sand is used chiefly for industrial purposes including foundry (molding), glass manufacture, sand blasting, traction (engine), filtration and hydrafrac (oil).

The value and production figures for industrial silica sand sold or used by producers in 1966, 1967, and 1968 are given in Table I (Olson, 1966, 1967, and 1968).

Table I.

	1966		1967		1968	
Use	Short Tons	Thousands of dollars	Short Tons	Thousands of dollars	Short Tons	Thousands of dollars
Blast	W	W	37	$ 131	34	$ 125
Molding	1,076	$2,953	995	2,859	812	2,209
Other*	193	247	160	202	102	153
Totals	+1,269	+$3,200	1192	$3,192	948	$2,487

*Includes hydrafrac, traction, filtration, glass, railroad ballast, and other construction sand.
W-Withheld

CLASSIFICATION

High silica sandstone contains more than 95 percent SiO_2 and less than 0.2 percent Fe_2O_3 with no beneficiation besides washing. Murphy (1960, in Industrial Minerals and Rocks, p. 763-772) suggested the classification of high silica sand based on use which is given below.

1. ABRASIVE USES. Use potential is controlled chiefly by physical properties of shape and sorting. Uses include blasting sand, glass-grinding sand and stone-sawing and rubbing sand. Murphy (op. cit.) defines these sands as follows:

"Blasting sand is a sound closely-sized (commonly on two sieves) quartz sand which, when propelled at high velocity by air, water, or controlled centrifugal force, is effective for such uses as cleaning metal coatings, removing paint and rust or renovating stone veneer". Sands used for blasting fall in the size frequency of from 4 mesh to 100 mesh or finer (Table I).

"Glass-grinding sand is clean, sound, fine to medium-grained silica sand, free from foreign material and properly sized for either rough grinding or semifinal grinding of glass plate." Sands used for glass-grinding have a size frequency distribution which chiefly passes through 30 mesh and is retained on 100 mesh.

"Stone-carving and rubbing sand is relatively pure, sound, well-sorted, coarse-grained, silicious material free from flats and fines used for sawing and rough-grinding dimension stone." Sands used for stone-sawing and rubbing have a size frequency distribution which chiefly passes through 12 mesh and is retained on 100 mesh.

2. GLASS AND CHEMICAL USES. Potential for this use is controlled chiefly by chemical quality and grain size frequency distribution.

The chemical quality specifications for glass according to the American Ceramic Society in conjunction with the Bureau of Standards (Ries, 1949) range from First Quality which requires at least 99.8% ($\pm$0.1%) SiO_2, 0.1% ($\pm$0.05%) Al_2O_3, 0.02% ($\pm$0.005%) Fe_2O_3, and 0.1% ($\pm$0.05%) CaO and MgO to Ninth Quality which requires at least 95.0% ($\pm$1.0%) SiO_2, 4.0% ($\pm$0.5%) Al_2O_3, 1.0% ($\pm$0.1%) Fe_2O_3, and 0.5% ($\pm$0.1%) CaO and MgO.

Size frequency distribution of quartz sand used for glass manufacture can vary only slightly and the sand must essentially all pass through a 30 mesh sieve, and in the Mid-West, less than 2 percent can pass through the 140 mesh sieve.

3. REFRACTORY USES (Foundry). Use potential is determined chiefly by melting point which is a measure of heat resistance (refractoriness) which for silica sand is high. Other factors are grain size frequency distribution, strength and durability. Uses include core sand, furnace bottom sand, ganister mix, processed molding sand and runner sand. Murphy (op. cit.) defines these sands as follows:

"Core sand is washed and graded silica sand low in clay substance and of a high permeability, suitable for core-making in ferrous and nonferrous foundry practice.... A satisfactory particle size distribution ranges from 30 to 140 mesh with 90 percent or better lying between the 40 and 100 mesh sieves."

"Furnace bottom sand (also Fire sand) is unwashed and partially aggregated silica sand suitable for lining and patching open hearth and electric steel furnaces which use an acid process." A good size frequency distribution ranges from 3 mesh down to clay. The sand should contain enough clay to provide cohesiveness and enough fines and iron oxide to promote rapid fusion as the bottom is run in.

"Ganister mix (also Semi-silica or Cupola daub) is a self-bonding, ramming mixture composed of varying proportions of crushed quartzose rock or quartz pebble and plastic fire clay, suitable for lining, patching, or daubing hot metal vessels and certain types of furnaces." It may be a naturally-occurring mixture or is prepared by mixing quartz grains with plastic fire clay.

"Processed molding sand is washed and graded quartz sand which, when combined with appropriate bonding agents in the foundry, is suitable for use for cores and molds in ferrous and nonferrous foundry practice.

"Runner sand is crude coarse-grained silica sand, moderately high in natural clay bond, used to line runners and dams on the casting floor of blast furnaces. Runner sand is also used in the casting of pig iron.

4. MISCELLANEOUS USES. The miscellaneous use potential of silica sand is controlled by a variety of properties including density, homogeniety of mineral composition, roundness, clay content, and grain size frequency distribution. Miscellaneous uses include coal-washing, filtering, hydrafrac, standard testing, and traction (engine). Murphy (op. cit.) provides the following definitions for these sands:

"Coal-washing sand is a washed and graded quartz sand of constant specific gravity used in a flotation process for cleaning anthracite and bituminous coal." Specific gravity should be not less than 2.64 and the particle size distribution should range between 30 mesh and 100 mesh, with a medium size of about 50 mesh, and 5 percent tolerance at either end.

"Filter media sand consists of washed and graded quartzose.... sand produced under close textural control, for removal of turbidity and bacteria from municipal and industrial water supply systems." It is used as the fine filtering medium consisting of material less than 2.0 mm in diameter which is placed above a gravel filter layer. Composition and texture are critical. The sand shall be free of clay, silt, and organic matter and iron and manganese content will be low enough not to affect the water to be filtered. In addition, there are rather rigid specifications on grain size distribution controlled primarily by effective size and uniformity coefficient. Filter sands customarily fall into 3 groups in the 0.35 mm to 0.55 mm effective sizes.

"Hydraulic-fracturing sand (also Hydrafrac or Sandfrac sand) is a sound rounded light-colored quartz sand free of aggregated particles and possessing high uniformity in specified size ranges which, when immersed in a suitable carrier and pumped at great pressure into a formation, increases fluid production by generating greater effective permeability." The desired size frequency distribution of grains is 100 percent between 16 mesh and 60 mesh with 80 percent between 20 mesh and 40 mesh and preferably between the 20 and 30 mesh sieves. There are also restrictive roundness, density, and compressive strength requirements. Also the sand must be "... clean, sound, inert and contain no clay, silt, or organic matter that would affect the viscosity of the carrier or cause dust in handling..." and it should have a "... minimum of compound grains."

"Standard testing sand is washed and dried quartz sand of selected shape characteristics, prepared to exact size specifications for use in research or any testing work involving a comparison of methods or materials." The specification of testing sands are established by the American Society for Testing Materials.

"Traction sand (also Engine sand) is sound well-sorted free-flowing medium-grained silica sand with a minimum of soft rock fragments, used to increase the tractive effort of locomotives on slippery rails.... A clean, washed sand which is composed essentially of quartz, which is uniformly graded so that excessive segregation will not take place in the sand box, which will not cake upon being dried, is not dusty, and will flow freely, is suitable for this purpose.... Desirable size frequency distribution ranges between the 20 and 70 mesh sieves, ..." but nearness of source tends to affect specifications by making lesser quality useable if it can be obtained nearby.

Table II. Wentworth grade scale, Tyler sieve openings and mesh, and corresponding mesh of U.S. sieve series.

Wentworth Grade Scale, mm. (1 mm. = approx. 0.04 inch)	Tyler screens		U.S. sieve series mesh
	Mm.	Mesh	
4mm. Granule	3.96 3.33 2.79 2.36	5 6 7 8	5 6 7 8
2mm. Very coarse sand	1.98 1.65 1.40 1.17	9 10 12 14	10 12 14 16
1mm. Coarse sand	0.991 0.833 0.701 0.589	16 20 24 28	18 20 25 30
0.500(½)mm. Medium sand	0.495 0.417 0.351 0.295	32 35 42 48	35 40 45 50
0.250(¼)mm. Fine sand	0.246 0.208 0.175 0.147	60 65 80 100	60 70 80 100
0.125(1/8)mm. Very fine sand	0.124 0.104 0.088 0.074	115 150 170 200	120 140 170 200
0.062(1/16)mm. Silt	0.061	250	230

OCCURRENCE OF SILICA SAND IN WISCONSIN

In Wisconsin high silica sand occurs chiefly in formations of Cambrian and Ordovician age, namely the Galesville, Jordan, and St. Peter sandstones, (Figure 1). The older Mt. Simon Sandstone, which occurs in the base of the Cambrian section, commonly has a high feldspar content which ranges from 7 percent to 40 percent, and averages 20 percent (Asthana, 1968), so that it qualifies only locally as a silica sandstone.

These sandstones crop out in a series of arcuate belts around the southern part of the state (Figure 2) and are separated from each other by formations composed chiefly of dolomite, impure sandstone, and shale as is shown in the geologic column (Figure 1). They dip at low angle outward from the central area of the state, the oldest rocks occurring near the center and the youngest rocks occurring at the outer edges.

The Eau Claire Sandstone and the Tunnel City Group of sandstones generally contain too much feldspar, carbonate, and other impurities to qualify as silica sandstones.

The Precambrian Bayfield Group of sandstones of Bayfield and Ashland counties in northwestern Wisconsin are older than the rocks shown in Figure 1 and would appear below the Mt. Simon Formation. They tend to be too high in feldspar content with the possible exception of the uppermost unit of this group which has a silica content of 98.36 percent (sample number Ba8).

The approximate areas of sandstone occurrence at the bedrock surface can be determined from the geologic map (Figure 2). Occurrence of the St. Peter Sandstone at the bedrock surface coincides with the distribution of the Ancell Group as shown on the geologic map. The St. Peter Sandstone varies from zero to over 350 feet in thickness. The Jordan Sandstone formation, which ranges in thickness from about 20 feet to over 60 feet in outcrop areas occurs beneath the Prairie du Chien Group and its occurrence at the bedrock surface coincides approximately

STRATIGRAPHIC NOMENCLATURE

WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

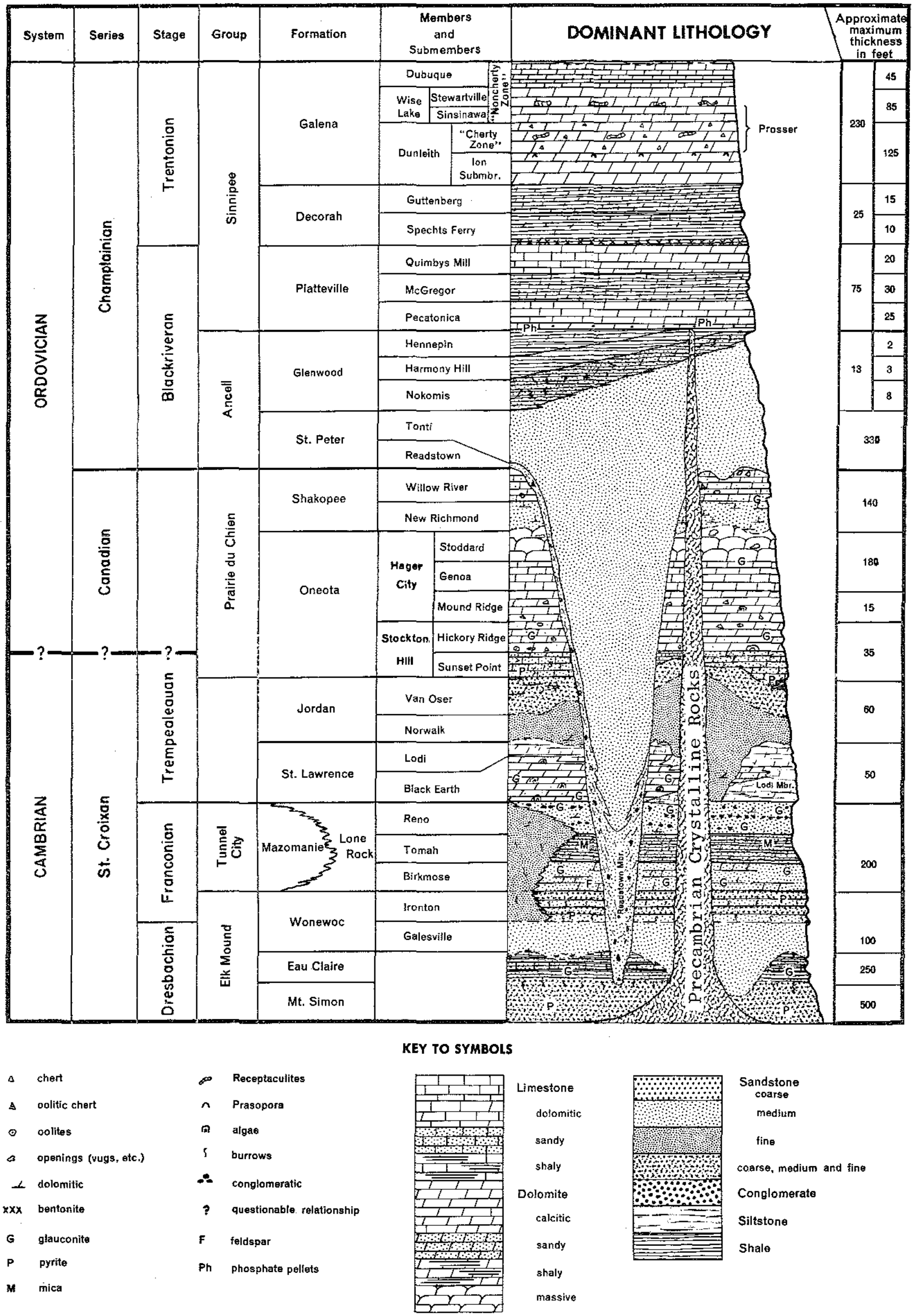


Figure 1

with the contact of the Upper Cambrian Formations with the Prairie du Chien Group. The Wonewoc Sandstone which may be from 60 to over 100 feet thick in outcrop areas occurs 150 to 200 feet below the Prairie du Chien Group, and is the major bluff - former of the sand plains area of central Wisconsin. The Mt. Simon Sandstone is the oldest Cambrian formation in Wisconsin and it rests directly on the Precambrian surface. The Lake Superior sandstones occur in northwestern Wisconsin in the area designated "Upper Keweenawan Formations" in Figure 2. Among these the Bayfield Sandstone has the highest silica content and it is restricted to the northern part of that area.

Unconsolidated deposits of gravel, sand, silt, and clay up to 350 feet thick mantle the bedrock formations in the glaciated area of eastern and northern Wisconsin (Figure 2). There the topography is controlled chiefly by various glacial deposits. The southwest and west central areas of the state have thin overburden, locally deeply incised valleys, and abundant outcrops. They were unaffected or only mildly affected by glaciers although glacial meltwaters probably played a significant role in shaping and otherwise modifying the land surface.

Each silica sandstone formation is postulated to have formed as an irregular mass of coalescing beaches and offshore bars which were deposited on a submerged uneven erosion surface by an advancing sea (Ostrom, 1964, 1970). Thicknesses of the formations may vary markedly because of the unevenness of these surfaces. For example, the St. Peter Sandstone was deposited on an erosion surface with over 350 feet of relief locally. Thus, where there were topographic highs on the erosion surface the St. Peter may be thin or lacking entirely and where there were deep valleys there may be over 350 feet of sandstone. The Jordan, Galesville, and Mt. Simon sandstones formed by a similar process but in the case of the Jordan and Galesville the erosion surfaces on which they were deposited were less pronounced hence the thickness is less variable.

Figure 2

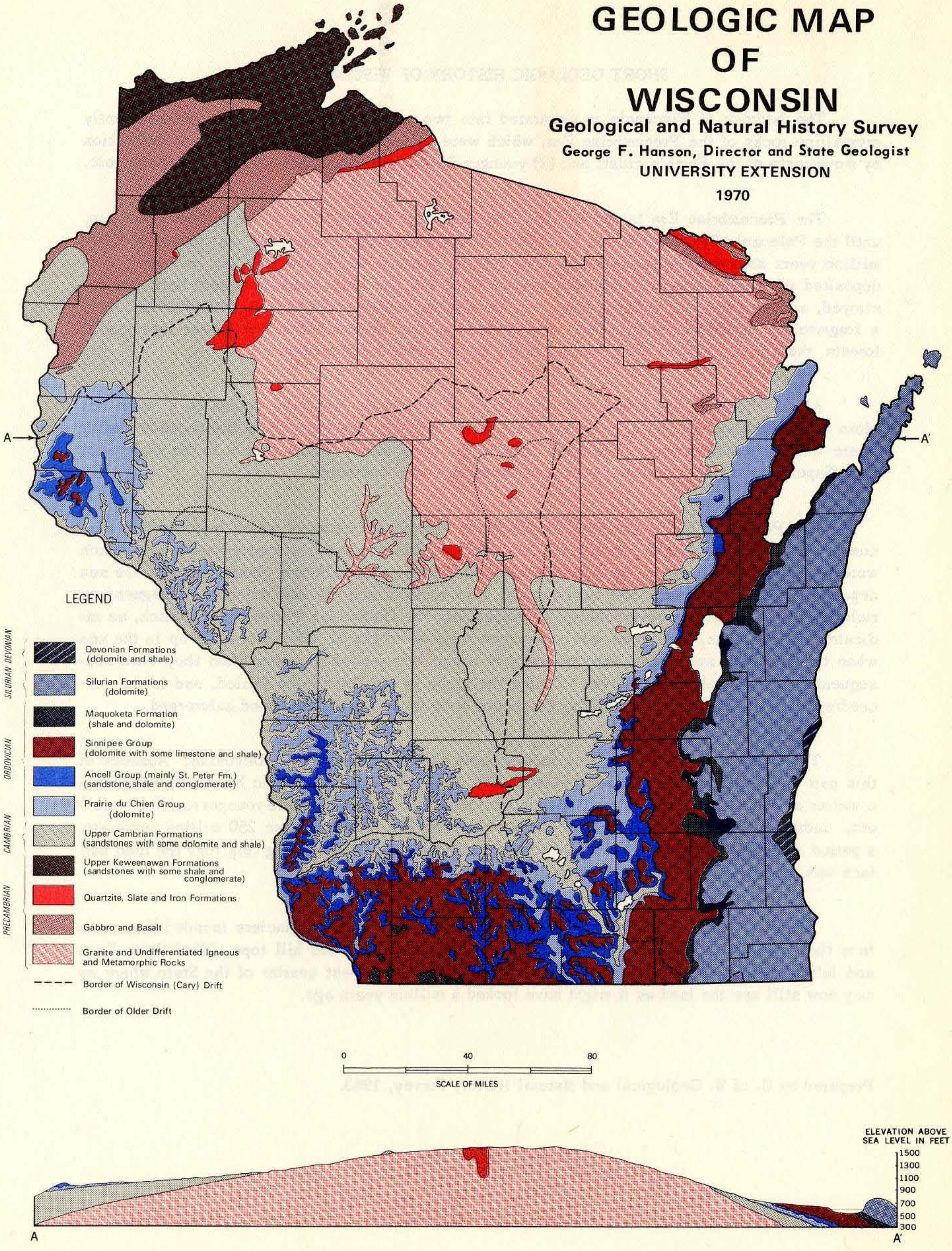
GEOLOGIC MAP OF WISCONSIN

Geological and Natural History Survey

George F. Hanson, Director and State Geologist

UNIVERSITY EXTENSION

1970



SHORT GEOLOGIC HISTORY OF WISCONSIN

The bedrock of Wisconsin is separated into two major divisions: (1) older, predominantly crystalline rocks of the Precambrian Era, which were extensively deformed after their deposition by movements of the Earth's crust; and (2) younger flat-lying sedimentary rocks of the Paleozoic.

The Precambrian Era lasted from the time the earth cooled, over 4,000 million years ago, until the Paleozoic Era which began about 500 million years ago. During this vast period of 3,500 million years sediments, some of which were rich in iron and which now form our iron ores, were deposited in ancient oceans, volcanoes spewed forth ash and lava, mountains were built and destroyed, and the rocks of the upper crust were invaded by molten rocks of deep-seated origin. Only a fragmentary record of these events remains but, as tree stumps attest the former presence of forests, the rocky roots tell the geologist of the former presence of mountains.

At the close of the Precambrian Era most of Wisconsin had been eroded to a rather flat plain upon which stood hills of more resistant rocks as those now exposed in the Baraboo bluffs. There were still outpourings of basaltic lava in the north and a trough formed in the vicinity of Lake Superior in which great thicknesses of sandstone were deposited.

The Paleozoic Era began with the Cambrian Period, the rocks of which indicate that Wisconsin was twice submerged beneath the sea. Rivers draining the land carried sediments which were deposited in the sea to form sandstones and shales. Animals and plants living in the sea deposited calcium carbonate and built reefs to form rocks which are now dolomite—a magnesium-rich limestone. These same processes continued into the Ordovician Period during which, as indicated by the rocks, Wisconsin was submerged three more times. Deposits built up in the sea when the land was submerged were partially or completely eroded at times when they were subsequently elevated above sea level. During the close of the Ordovician Period, and in the succeeding Silurian and Devonian periods, Wisconsin is believed to have remained submerged.

There are no rocks outcropping in Wisconsin that are younger than Devonian. Absence of this part of the rock record makes interpretation of post-Devonian geologic history in Wisconsin a matter of conjecture. Available evidence from neighboring areas, where younger rocks are present, indicates that towards the close of the Paleozoic Era, perhaps some 250 million years ago, a period of gentle uplift began which has continued to the present. During this time the land surface was carved by rain, wind and running water.

The final scene took place during the last million years when glaciers invaded Wisconsin from the north and sculptured the land surface. They smoothed the hill tops, filled the valleys and left a deposit of glacial debris over all except the southwest quarter of the State where we may now still see the land as it might have looked a million years ago.

Prepared by U. of W. Geological and Natural History Survey, 1963.

METHODOLOGY

Sandstone samples were taken at 5-foot intervals by channeling the face where possible and at smaller spacings if there was a noticeable change in lithology. The channeling method involves collecting a sample from a uniform channel cut in the outcrop face perpendicular to the plane of bedding. Where channeling was impractical due to tight cementing of the grains representative fist-sized pieces were collected from each foot. Where there were two or more sandstone units of different texture or composition in a single exposure each was sampled and analyzed separately.

Samples were combined proportionally by weight and disaggregated using a rubber-headed pestle in a porcelain mortar with gentle pressure. Where this was inadequate the samples were passed through a jaw crusher set at a minimum opening of $\frac{1}{2}$ inches and then disaggregated as described above. If this technique was ineffective the sample was abandoned.

Examination with a binocular microscope indicated that grain breakage using the rubber-headed pestle was rare due to the very friable character of the sandstones and to the resistance of individual grains to breakage.

Representative samples of approximately 200 grams weight obtained by quartering were used for sieve tests and for chemical analyses. Sieving was done on a Ro-Tap for a period of 10 minutes.

DISCUSSION OF RESULTS

The results of this study indicate that Wisconsin has numerous sources of high silica sand in a broad range of grain sizes which will provide subrounded to subangular quartz grains suitable for a wide variety of industrial uses.

Twenty of 73 samples analyzed in the unwashed condition (with the exception of company analyses which were done on washed samples) yielded more than 99 percent silica; 36, or about one-half of the samples analyzed, yielded more than 98 percent silica.

Based on the chemical analyses it is inferred that the St. Peter Sandstone has the highest SiO_2 values followed by the Wonewoc Formation, the Jordan Sandstone, the Lake Superior sandstone and the Mt. Simon Sandstone. Of 13 St. Peter samples 9 (70%) yielded SiO_2 values greater than 98% and 6 had values over 99%. Of 25 samples of Wonewoc Sandstone 13 (over 50%) yielded SiO_2 values greater than 90% and 6 had values over 99%. Of 25 samples of Jordan Sandstone 10 (or 40%) yielded SiO_2 values over 97% and 5 had values over 99%. Analyses of the Mt. Simon Sandstone and the Lake Superior sandstones are too sparse to be meaningful.

Although specific data are lacking preliminary tests suggest that at least in some cases impurities such as iron oxide and clay can be removed by scrubbing because microscopic examination of the sand grains indicates that where these ingredients are present they occur chiefly as film-like coatings on the grain surfaces. In preliminary tests treatment with warm sulfuric acid removed practically all of the surface color caused by the coatings and it is believed scrubbing would produce similar but perhaps not as complete results.

Locations, brief descriptions of exposures sampled, and results of grain size analyses are given in Table III and chemical analyses are given in Table IV. All analyses with the exception of those provided by companies were made in the unwashed condition.

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Table III. Locations, descriptions, and results of grain size analyses of samples of Wisconsin silica sandstones.

Counties and Sample Numbers	Location						Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
	Sec.	Twn.	Range	¼	¼	¼						
ADAMS (Ad)												
Ad-3	30	18	6E		SW	NE	Friendship	Elk Mound	Mound	Basal 250'	250'	Roche A Cri State park
Ad-4	30	18	6E		NE	SE	Friendship	Wonewoc	Mound	40' to 96' above base	56'	Roche A Cri State park
Ad-5b	7	16	6E		NE	NW	Adams	Wonewoc	Bluff	20' to 82' below top	62'	NE end of S. mound
Ad-6	22	14	6E		SW	SW	Wisconsin Dells	Wonewoc	Bluff	20' to 53' below top	33'	SE end of bluff
Ad-7	7	15	6E		SE	NW	" "	Gelsville	Roadcut	10' to 23' below top	13'	
BARRON(Br)												
Br-3	20	32	12 W		NW	SE	Ridgeland	Wonewoc	Roadcut	Total thickness	4'	
BAYFIELD(Ba)												
Ba-8	18	52	4W		NE	SW	Red Cliff	Devil's Island	Wave cut cliff	Basal 20' to 35'face	20'	CCA (98.36)
Ba-14	24	51	7W			NE	Cornucopia	Bayfield	Wave cut cliff	Total thickness	13'	At end of Bark Pt.
Ba-15	31	51	6W		SE	NW	Cornucopia	Bayfield	Wave cut cliff	Total thickness	18'	
Ba-16	34	52	5W		SE	NE	Red Cliff	Bayfield	Wave cut cliff	Total thickness	18'	On Sand Pt. in Indian Reservation
Ba-17	28	52	4W		NW	NE	Sand Bay	Bayfield	Wave cut cliff	Total thickness	12'	On Detour Pt. in Indian Reservation
Ba-18	31	52	4W		SW	NE	Sand Bay	Bayfield	Wave cut cliff	3' to 22' below top of 36'	19'	In Indian Reservation
Ba-19	22	49	4W		SE	NW	Washburn	Bayfield	Quarry (abandoned)	5' to 20' below top of 20'	15'	
BUFFALO(Bf)												
Bf-1a	24	22	12 W			NW	Alma	Jordan	Roadcut on Hyw"N"	Upper 10'	10'	PCA:Much silica cement

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
ADAMS (Ad)																						
3			0.2			28.4			29.7		25.8	6.9				8.5			0.6			
4							30.7		28.2		29.2		9.3		1.6		0.6		0.4			
5b							24.4		34.6		28.3		9.8		2.2		0.5		0.3			
6							17.6		36.4		30.2		11.0		3.2		1.0		0.6			
7							17.5		27.1		34.9		15.2		3.4		1.3		0.6			
BARRON(Br)																						
3						0.3		1.1		15.3		55.0		21.3		6.4		0.4	0.2			
BAYFIELD(Ba)																						
8			—			0.3			12.6		47.4	15.4				20.2			4.0			
14			1.7	3.9		11.2		42.3		27.5		6.1		2.8		1.5		0.8	2.2			
15			0.9	1.6		5.3		23.7		42.1		15.7		4.3		2.0		1.0	3.4			
16							12.1		25.3		38.9		17.6		2.7		1.3		2.1			
17			16.6	14.4		20.0		22.4		11.1		6.2		3.1		2.3		1.2	3.1			
18			18.0	14.9		20.3		21.2		15.0		3.9		1.9		1.4		0.8	2.6			
19			10.7	9.1		15.7		29.0		19.0		7.3		3.1		2.1		1.0	3.0			
BUFFALO(Bf)																						
1a			8.2	3.2		6.9		13.2		19.8		23.6		13.9		6.4		2.1	2.7		0.5	

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Bf-1b	24	22	12 W			NW	Alma	Jordan	Roadcut on Hyw"N"	Upper 10'	10'	PCA; much silica cement
Bf-1c	24	22	12 W			NW	Alma	Jordan	Roadcut on Hyw"N"	Lower 18'	18'	PCA (89.87); little carbonate cement locally
Bf-2a	13	23	13 W			SW	Urne	Jordan	Roadcut on Hyw"D"	Upper 20'	20'	PCA (96.254)
Bf-2b	13	23	13 W			SW	Urne	Jordan	Roadcut on Hyw"D"	20' to 40' below top	20'	PCA
Bf-2c	13	23	13 W			SW	Urne	Jordan	Roadcut on Hyw"D"	Lower 2'	2'	PCA
Bf-3	14	20	11 W			S½	Fountain City	Jordan	Roadcut	Total thickness	38'	PCA(98.41); little silica cement in U. 5'
CHIPPEWA (Ch)												
Ch-1	23	30	9W		NW	NW	Bloomer	Mt. Simon	Roadcut	Total thickness	20'	CCA(92.74); PCA(96.84)
Ch-4	14	30	9W		NE	SW	Bloomer	Mt. Simon	Hillside	Total thickness	25'	
Ch-5	15	30	9W		SE	SE	Bloomer	Eau Claire	Roadcut	Total thickness	20'	
Ch-6a	3	28	9W		NW	NW	Chippewa Falls	Mt. Simon	Hillside	0' to 14' below top	14'	
Ch-6b	"	"	"		"	"	"	"	"	20' to 41' below top	21'	
Ch-7	23	30	9W		SW	NW	Bloomer	Mt. Simon	Hillside	Total thickness	10'	
Ch-8	22	30	9W		NE	NE	Bloomer	Mt. Simon	Hillside	Total thickness	9'	
Ch-9	14	30	9W		NE	SW	Bloomer	Mt. Simon	Roadcut	Total thickness	26½'	
Ch-10a	31	29	8W		SW	NE	Chippewa Falls	Mt. Simon	Stream cut	8' to 19' below top	11'	
Ch-10b	"	"	"		"	"	"	"	" "	22' to 27' below top	5'	
Ch-10c	"	"	"		"	"	"	"	" "	27' to 39' below top	12'	

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
1b			4.2	3.4		4.2		5.5		9.5		19.5		25.1		18.4		5.3	4.9		1.3	
1c			10.4	4.2		3.8		4.9		5.5		6.9		9.6		19.1		18.0	17.7		2.1	
2a			3.6	8.9		13.5		22.7		18.0		8.5		6.3		10.7		4.2	3.6		0.9	
2b			0.8	3.4		9.4		21.3		28.3		18.8		10.0		5.5		1.2	1.3		0.3	
2c			0.1	0.2		0.8		3.7		8.9		15.5		25.7		34.9		8.7	1.5		0.8	
3			3.7	17.3		30.1		30.8		12.4		4.4		1.1		0.2		0.1	0.1		0.3	
CHIPPEWA																						
1			10.4			47.0			17.6		9.8	3.3				10.5			1.5			
4			4.9			27.1			28.0		15.0	3.3				18.2			3.5			
5			1.1			22.7			20.0		13.8	5.1				31.9			5.1			
6a			3.6	14.7		20.0		19.3		15.0		7.4		6.0		8.2		3.6	2.2			
6b			6.7	13.2		16.4		17.7		11.6		10.9		9.7		10.2		2.7	0.9			
7			3.7	13.3		18.1		16.8		12.5		11.5		10.0		10.4		2.9	0.8			
8			5.0	6.2		8.7		16.4		17.6		17.0		11.4		13.7		3.2	0.8			
9			6.7	9.5		15.8		21.1		14.3		13.0		8.1		8.0		2.4	1.1			
10a			26.9	14.4		13.7		15.9		13.1		8.7		4.7		2.0		0.3	0.3			
10b			13.7	7.3		9.1		16.5		21.4		19.9		8.3		2.8		0.6	0.4			
10c			22.6	5.4		10.1		18.6		19.3		15.9		6.9		0.9		0.2	0.1			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location						Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
	Sec.	Twn.	Range	¼	¼	¼						
CLARK (Ck)												
Ck-1	30	23	3W		NE	SW	Merrillan	Wonewoc	Mound (Bruce)	Total thickness	150'	PCA
Ck-2	25	24	4W		NE	SE	Humbird	Wonewoc	Pit (in Wildcat Mound)	Total thickness	15'	
Ck-3	25	24	4W		SE	SE	Humbird	Wonewoc	Mound (Wildcat)	Total thickness	37½'	
Ck-4	4	24	2W		SW	NW	Neillsville	Wonewoc	Mound (Neillsville)	Basal 11'	11'	
Ck-5a	30	23	3W		NW	NW	Merrillan	Wonewoc	Mound (Bruce)	Upper 11'	11'	
Ck-5b	"	"	"		"	"	"	"	" "	20' to 36' below top	16'	
Ck-5c	"	"	"		"	"	"	"	" "	42' to 69' below top	27'	
COLUMBIA (Co)												
Co-1	6	11	9E		SE	SE	DeKorra	Wonewoc	Roadcut	Total thickness	10'	
Co-2	22	11	9E		C	SW	Poynette	Wonewoc	Quarry	Total thickness	12'	CCA (96.00)
Co-3	26	12	9E			NW	Portage	Wonewoc	Quarry	8' to 33' below top	25'	East side of quarry
Co-4	"	"	"			"	"	"	"	Lower 50'	50'	South side of quarry
Co-5	"	"	"			"	"	"	"	Upper 35'	35'	South side of quarry
Co-7	"	"	"			"	"	"	"	Total thickness	70'	East side of quarry
Co-8b	26	12	9E		NE	NW	Portage	Wonewoc	Quarry	Total thickness	66'	North side of quarry
Co-9	21	10	8E		NE	NW	Lodi	Jordan	Quarry (abandoned)	Total thickness	16'	
Co-10	27	12	9E				Portage	Wonewoc	Quarry	Quarry run		Sample No. 866 of Geol. Survey Bull. 69

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
CLARK																						
1			0.4			26.9			32.2		32.1	4.8				3.5			0.2			
2			6.3			38.7			21.9		15.5	2.7				12.3			2.5			
3			2.1	3.4		10.6		20.7		25.8		24.5		10.4		2.1		0.2	0.2			
4			1.8	8.9		10.9		12.2		14.8		20.2		18.0		10.1		2.2	0.9			
5a			0.2	2.8		14.9		31.6		32.3		15.7		2.2		0.1		0.1	0.1			
5b			0.1	0.8		6.1		19.8		46.2		24.0		2.6		0.2		0.1	0.1			
5c			0.9	6.0		15.9		24.3		26.6		19.2		6.0		0.9		0.1	0.1			
COLUMBIA																						
1			0.2			11.9			38.3		35.0	6.3				7.9			0.5			
2			3.9			32.2			18.4		18.4	6.2				20.2			0.7			
3			0.1			23.7			27.0		24.3	7.2				17.2			0.6			
4			0.2			20.0			32.0		29.6	6.1				11.1			1.0			
5			0.9			27.2			25.7		21.3	6.0				17.8			1.1			
7			0.5			18.1			30.2		27.9	5.5				17.0			0.9			
8b							27.6		23.9		25.4		15.9		5.5		1.4		0.3			
9						26.8			37.0		25.5		8.7		1.3		0.3		0.4			
10			0.1			3.8				0.9		85.2		5.7		1.7		1.0	0.3			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location						Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
	Sec.	Twn.	Range	¼	¼	¼						
COLUMBIA (Co)												
Co-11	27	12	9E				Portage	Wonewoc	Quarry	Crushed product		Sample No. 867 of Geol. Survey Bull. 69
Co-12	28	10	8E				Lodi	Jordan	Hilltop			Sample No. 899 of Geol. Survey Bull. 69
CRAWFORD (Cr)												
Cr-1	12	7	6W		SE	NW	Prairie du Chien	St. Peter	Roadcut	Total thickness	20'	
Cr-3	5	8	6W		SW	NE	Lynxville	Jordan	Roadcut, Hyw 35	Total thickness	37'	
Cr-4	12	7	6W		SE	NW	Prairie du Chien	St. Peter	Roadcut	Total thickness	18'	
Cr-5	5	8	6W		SW	SW	Prairie du Chien	Jordan	Roadcut, Hyw 35	Lower 32' of 48'	32'	
DANE (Dn)												
Dn-1	3	6	7E		C	NE	Klevenville	St.Peter	Quarry	Total thickness	110'	
Dn-6	1	5	8E		NE	SW	Verona	St. Peter	Bluff(on Sayles Rd.)	Total thickness	25'	
Dn-7	6	6	11E		SW	SE	McFarland	St. Peter	Hilltop	Total thickness	10'	
Dn-8	20	9	11E		NW	NE	Sun Prairie	St. Peter	Near hilltop	Total thickness	7'	
Dn-9b	6	6	9E		SE	SW	Verona	St. Peter	Quarry	Lower 41' of 47'	41'	
Dn-10	35	7	9E		SW	NE	Madison	Jordan	Excavation for building	Lower 30' of 37'	30'	
Dn-11	27	8	10E		NW	NW	Madison	Jordan	Excavation for building	Lower 13' of 16'	13'	
Dn-12	25	8	6E		SE	SW	Black Earth	Lone Rock	Bluff, N. of Hyw. 14	Lower 11'	11'	
Dn-13	10	7	7E		SE	NW	Cross Plains	Jordan	Hillside	Total thickness	15'	

Sample Number	Percent By Weight Retained On Sieves*																					Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
COLUMBIA																						
Co-11		—	0.1			5.8				0.8		78.7		8.4		2.5		1.6	0.6			
Co-12		—	—			2.3				50.5		31.4		9.8		1.8		0.6	0.3			
CRAWFORD																						
Cr-1			—			10.3			18.0		28.8	10.6				30.9			1.4			
Cr-3			0.1			6.7			20.8		50.9	8.4				11.3			1.9			
Cr-4			0.1	1.6		16.1		18.0		21.1		23.6		15.5		3.2		0.3	0.4			
Cr-5							8.4		10.6		45.9		23.8		7.3		2.1		1.9			
DANE																						
Dn-1			—			13.7			24.6		35.7	7.5				17.8			0.8			
Dn-6			0.3	2.5		13.3		24.5		24.3		21.5		9.7		2.4		tr	1.6			
Dn-7			0.6	1.2		4.6		13.7		27.9		37.1		12.5		1.3		0.3	0.8			
Dn-8							31.2		26.8		26.6		11.2		2.3		0.9		1.0			
Dn-9b							14.1		26.7		36.9		16.8		2.9		2.3		0.3			
Dn-10			0.4	1.4		4.7		11.4		31.9		33.3		13.7		2.4		0.4	0.5			
Dn-11							3.5		5.5		10.5		21.9		22.9		20.8		14.9			
Dn-12							26.4		7.7		17.7		32.6		10.0		2.7		2.9			
Dn-13							15.4		21.0		25.6		21.6		9.4		4.7		2.3			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location						Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
	Sec.	Twn.	Range	¼	¼	¼						
DANE (Dn)												
Dn-14	16	8	6E		SW	NE	Mazomanie	Mazomanie	Bluff, S.of Hyw.14	Total thickness	40'	
Dn-15a	3	6	7E	SE	NW	NW	Klevenville	St.Peter	Quarry	12' to 60'below top	48'	
Dn-15b	"	"	"	"	"	"	"	"	"	60' to 85'below top	25'	
Dn-15c	"	"	"	"	"	"	"	"	"	Lower 16'	16'	
Dn-16	23	6	12E				Rockdale	"				Sample No. 901 of Geol. Survey Bull. 69
DUNN (Du)												
Du-1	6	29	14W		C	S½	Downing	Jordan	Roadcut, on Hyw"Q"	Total thickness	10'	CCA(99.56)
Du-2	7	28	14W		C	S½	Downing	Jordan	Roadcut	Total thickness	20'	
Du-3	26	31	14W		SE	SE	Connersville	Jordan	Roadcut on Hyw. 64	Total thickness	12'	
Du-4	33	29	14W		NW	SW	Knapp	Jordan	Roadcut on Hyw"Q"	Basal 14'	14'	PCA (99.42)
Du-5a	9	27	13W		NE	SE	Menomonie	Wonewoc	Roadcut	Upper 20'	20'	
Du-5b	"	"	"		"	"	"	"	"	Lower 11'	11'	
Du-6	26	31	14W		SE	SE	Connersville	Jordan	Hillside,N of Hyw64	Total thickness	10'	
Du-7	6	29	14W		SW	SE	Downing	Jordan	Roadcut on Hyw. 64	Total thickness	21'	
Du-8	11	28	13W		SW	NE	Menomonie Jct.	Wonewoc	Roadcut	Total thickness	13'	
Du-9	16	28	11W		SE	NW	Elk Mound	Wonewoc	Roadcut on Hyw.40	Total thickness	10½'	
EAU CLAIRE(EC)												

Sample Number	Percent By Weight Retained On Sieves*																					Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
DANE(Dn)																						
Dn-14							9.0		6.4		57.6		20.8		3.8		1.2		1.2			
Dn-15a							14.1		29.4		39.8		14.0		2.4		0.4		—			
Dn-15b							15.2		32.1		36.2		13.5		2.3		0.5		0.4			
Dn-15c							13.9		26.9		40.6		15.0		2.7		0.6		0.4			
Dn-16		0.3	0.3			3.1				41.6		38.5		11.0		1.9		0.8	0.7			
DUNN(Du)																						
Du-1			0.6			60.0			35.1		3.7	0.2				0.4			—			
Du-2			0.1			15.9			47.4		30.7	2.9				2.8			0.1			
Du-3			—			2.8			5.0		20.4	11.9				58.3			1.7			
Du-4			0.4	3.5		8.5		22.3		29.9		17.3		9.5		6.4		1.8	0.5		0.9	
Du-5a			1.2	4.7		22.4		43.1		16.7		4.1		2.6		3.7		1.2	0.3			
Du-5b			1.9	9.0		22.6		24.8		16.3		5.1		5.3		7.7		5.4	1.9			
Du-6			0.2	1.7		3.7		6.4		16.4		38.7		28.1		4.3		0.3	0.2			
Du-7			—	12.4		34.8		40.0		10.9		1.4		0.3		0.1		0.1	—			
Du-8			4.6	13.3		23.2		29.1		21.5		4.8		0.9		1.2		0.4	1.0			
Du-9			10.9	18.8		18.8		25.4		17.1		4.3		1.9		1.3		0.6	0.9			
EAU CLAIRE(EC)																						

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
EC-4	28	27	8W			SE	Eau Claire	Wonewoc	Roadcut on Hyw 12	Total thickness	35'	CCA(92.54)
EC-8	25	27	10W		SE	NW	Eau Claire	Mt. Simon	Roadcut across from school	Total thickness	16'	
EC-9	28	27	8W		SE	SE	Fall Creek	Wonewoc	Roadcut on hyw 12	Total thickness	24½'	
EC-10	29	27	6W		NE	SE	Fall Creek	Mt. Simon	Hillside, E of Hyw27	Total thickness	28½'	
EC-11a	8	27	9W		SW	SW	Eau Claire	Mt. Simon	Outcrop in Mt. Simon	0' to 53' below top	53'	
EC-11b	"	"	"		"	"	"	"	"	122' to 160' below top	38'	
EC-11c	"	"	"		"	"	"	"	"	168' to 175' below top	7'	
EC-11d	"	"	"		"	"	"	"	"	178' to 196' below top	18'	
EC-12	25	27	10W		NE	NW	Eau Claire	Mt. Simon	Roadcut & bluffs	Total thickness	25'	
EC-13a	1	26	10W		NW	NW	Eau Claire	Mt. Simon	Roadcut on Hyw. 37	3' to 8' below top	5'	
EC-13b	"	"	"		"	"	"	"	"	11' to 31' below top	20'	
EC-13c	"	"	"		"	"	"	"	"	31' to 39' below top	8'	
FOND DU LAC (FL)												
FL-1	19	16	14E		NE	NE	Ripon	St. Peter	Roadcut	2' to 22' below top	20'	
FL-2	20	16	14E				Ripon	St. Peter	Quarry		25'	Sample No. 851 of Geol. Survey Bull. 69
FL-3	20	16	14E				Ripon	St. Peter	Quarry		25'	Sample No. 852 of Geol. Survey Bull. 69
GRANT (Gr)												
Gr-1	22	7	4W		NE	NW	Woodman	Jordan	Roadcut		60'	PCA

Sample Number	Percent By Weight Retained On Sieves*																					Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
EC-4			2.4			34.7			38.9		11.9	2.0				8.0			2.2			
EC-8			2.4			21.2			25.6		24.2	5.8				19.5			1.2			
EC-9			1.7	7.3		16.1		23.8		18.8		9.2		6.9		9.8		4.4	2.0			
EC-10			0.8	4.2		11.0		20.7		23.5		14.4		11.5		10.9		2.2	0.8			
EC-11a			1.0	6.2		20.0		29.7		25.5		8.0		4.0		4.0		1.2	0.4			
EC-11b			5.3	15.4		20.8		25.2		15.4		5.6		4.1		5.1		2.1	1.0			
EC-11c			7.4	10.1		12.8		15.3		16.4		17.3		12.5		6.9		1.0	0.3			
EC-11d			6.9	18.5		17.0		16.4		18.0		17.3		4.1		1.3		0.3	0.2			
EC-12			8.8	11.2		12.5		14.8		15.9		15.7		12.1		6.9		1.6	0.5			
EC-13a			4.3	4.8		6.7		10.1		13.4		15.9		15.8		21.0		6.1	1.9			
EC-13b			11.7	8.4		10.2		13.8		14.6		13.6		11.7		11.5		2.9	1.6			
EC-13c			4.2	6.2		10.8		20.2		26.1		20.3		8.0		3.2		0.6	0.4			
FOND DU LAC (FL)																						
FL-1							16.3		26.7		35.3		16.6		3.3		1.2		0.6			
FL-2		—	0.7			10.0				41.5		37.1		6.3		1.4		0.7	0.5			
FL-3		0.2	0.1			4.1				34.3		45.2		11.9		2.2		0.9	0.4			
GRANT (Gr)																						
Gr-1																						

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location: Sec.	Twn.	Range	1/4	1/4	1/4	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Gr-2	27	7	4W		NW	NE	Wauzeka	Jordan	Roadcut	Lower 5'	5'	
Gr-4	15	2	2W			C	Dickeyville	St.Peter	Roadcut on Hyw.151	Upper 12'	12'	
Gr-4a	"	"	"			"	"	"	"	Lower 26'	26'	
Gr-5	15	2	2W		SE	NE	Dickeyville	St. Peter	Roadcut on Hyw.151	Total thickness	38'	
Gr-6	11	2	2W		SE	SW	Dickeyville	St. Peter	Roadcut on Hyw.151	Lower 20' of 32' exposure	20'	CCA(97.46)
Gr-7	34	4	2W		NW	NW	Platteville	St. Peter	Roadcut on Hyw. 81	Total thickness	21'	
Gr-8	5	5	4W		SE	SW	Mt. Hope	St. Peter	Roadcut on Hyw."J"	Total thickness	50'	
Gr-9	24	7	3W		NW	NW	Boscobel	Jordan	Roadcut on Hyw. 61	Total thickness	24'	CCA(94.90)
Gr-10	24	7	3W		NW	NW	Boscobel	Jordan	Roadcut on Hyw. 61	Total thickness	22'	
Gr-11	14	8	2W		SW	SE	Blue River	Jordan	Roadcut	Total thickness	20'	
Gr-12	13	5	3W		SE	NE	Stitzer	St. Peter	Roadcut on Hyw. 61	Total thickness	32'	
Gr-13a	9	6	4W		NE	NW	Mt.Hope	St. Peter	Roadcut on Hyw.132	0' to 55' below top	55'	
Gr-13b	"	"	"		"	"	"	"	"	55' to 95' below top	40'	
Gr-13c	"	"	"		"	"	"	"	"	103' to 129' below top	26'	
Gr-13d	"	"	"		"	"	"	"	"	129' to 157' below top	28'	
Gr-14b	33	4										
Gr-15	12	2	2W		SW	NE	Dickeyville	St. Peter	Roadcut,on Hwy.151	5' to 68' below top	63'	
Gr-16	16	6	2W		NE	SE	Fennimore	St. Peter	Roadcut,on Hwy."Q"	Total thickness	28'	

Sample Number	Percent By Weight Retained On Sieves*																					Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
Gr-2			—			12.6			51.9		33.9	1.1				0.4			—			
Gr-4			0.1			14.1			36.0		25.2	6.2				15.9			2.6			
Gr-4a						10.6			30.0		32.0	8.0				16.4			3.1			
Gr-5			—			8.9			27.9		38.0	7.9				14.7			2.6			
Gr-6			0.6			34.7			30.0		19.5	4.1				10.9			0.3			
Gr-7			0.4			28.6			21.0		27.4	6.3				13.1			3.1			
Gr-8			—			27.9			31.4		21.0	5.2				12.9			1.5			
Gr-9			0.2			42.7			40.3		11.0	1.3				2.8			1.7			
Gr-10							41.3		29.3		14.6		6.8		2.8		2.0		3.2			
Gr-11							13.4		29.6		29.3		13.8		5.0		3.1		5.8			
Gr-12							29.7		33.5		24.0		9.6		2.1		0.7		0.4			
Gr-13a							31.9		20.5		22.3		18.7		5.5		0.7		0.4			
Gr-13b							32.3		30.5		21.2		11.8		3.0		0.6		0.7			
Gr-13c							20.3		29.2		30.1		16.3		2.9		0.7		0.7			
Gr-13d							15.2		31.5		35.1		15.1		2.4		0.3		0.3			
Gr-14b							17.5		34.5		29.6		12.6		3.2		1.3		1.2			
Gr-15							35.5		27.3		23.8		9.8		2.4		0.7		0.5			
Gr-16							42.0		26.6		18.9		9.6		2.2		0.4		0.3			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Gr-17a	5	5	4W		SE	SW	Patch Grove	St. Peter	Roadcut, on Hyw."J"	Upper 20'	20'	
Gr-17b	5	5	4W		SE	SW	Patch Grove	St. Peter	Roadcut, on Hwy."J"	Lower 10'	10'	
Gr-18	15	4	4W		SE	SE	Beetown	St. Peter	Roadcut, on Hwy. 81	Total thickness	30'	
Gr-19	22	7	4W		SE	SW	Woodman	Jordan	Roadcut, on Hwy. 132	Total thickness	29'	
Gr-20	22	6	6W		SW	SW	Bridgeport	St. Peter	Roadcut, on Hwy."C"	5' to 56' below top	51'	
Gr-21	6	1	2W		NW	NW	Kieler	St. Peter	Streamcut	Total thickness	12'	
Gr-22	11	2	2W		SE	SW	Dickeyville	St. Peter	Roadcut, on Hwy. 151	Total thickness	21'	
Gr-23a	15	2	2W		NE	SE	Dickeyville	St. Peter	Roadcut, on Hwy. 151	13' to 38' below top	25'	
Gr-23b	"	"	"		"	"	"	"	"	38' to 55' below top	17'	
GREEN (Gn)												
Gn-1	5	1	6E		SE	SE	Browntown	St. Peter	Quarry	Total thickness	60'	
Gn-2	23	4	7E		SE	NE	New Glarus	St. Peter	Bluff	Total thickness	58'	
Gn-3	5	1	6E		SW	SE	Browntown	St. Peter	Quarry	0' to 44' above floor	44'	
Gn-4	1	1	9E		SW	NW	Juda	St. Peter	Bluff	Total thickness	35'	
GREEN LAKE (Gl)												
Gl-1	11	17	13E		NW	SW	Berlin	Jordan	Quarry	Total thickness	45'	
Gl-2	13	16	12E		NE	NE	Green Lake	Jordan	Quarry	Total thickness	30'	
Gl-3	11	17	13E		NW	SW	Berlin	Jordan	Quarry	Total thickness	24'	

Sample Number	Percent By Weight Retained On Sieves*																					Remarks
	10	12	20	30	35	40	45	50	60	70	80	100	120	140	170	200	230	270	Pan	Clay	AFS Clay	
	9	10	20	28	32	35	42	48	60	65	80	100	115	150	170	200	250	270				
Gr-17a							37.7		21.4		20.8		14.4		4.6		0.7		0.6			
Gr-17b							36.3		21.7		20.0		15.8		5.2		0.7		0.4			
Gr-18							22.1		33.5		27.5		11.4		3.1		1.1		1.3			
Gr-19							25.2		12.8		18.7		16.2		11.2		8.3		7.6			
Gr-20							30.3		29.6		22.1		11.5		4.0		1.2		1.3			
Gr-21							38.2		33.3		15.9		8.6		2.0		0.7		1.3			
Gr-22							52.1		22.0		14.4		9.0		2.2		0.2		0.1			
Gr-23a			2.9	6.5		13.1		21.2		23.8		21.5		7.1		2.2		0.9	0.8			
Gr-23b			5.2	5.2		9.4		18.5		25.4		22.3		9.1		3.1		0.9	0.9			
GREEN(Gn)																						
Gn-1			0.0			9.1			23.7		41.4	7.0				18.3			0.5			
Gn-2			0.1	1.5		5.7		13.9		30.1		32.9		13.2		1.6		0.5	0.6			
Gn-3			0.5	2.1		8.1		16.0		29.1		30.9		11.1		1.3		0.3	0.7			
Gn-4			0.6	1.3		6.8		17.6		29.3		29.7		11.7		1.6		0.6	0.9			
GREEN LAKE (GL)																						
GL-1			0.2			9.2			26.5		34.2	8.7				19.8			1.5			
GL-2							4.7		13.0		21.2		31.5		18.2		7.2		4.2			
GL-3							39.9		28.2		21.2		8.8		1.5		0.2		0.2			

*Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location						Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
	Sec.	Twn.	Range	¼	¼	¼						
Gl-4	15	17	13E		SW	NW	Berlin	Jordan		Lower 6'	6'	Sample No. 858 of Geol. Survey Bull. 69
Gl-5	"	"	"		"	"	"	"		Middle 3'	3'	Sample No. 859 of Geol. Survey Bull. 69
Gl-6	"	"	"		"	"	"	"		Upper 12'	12'	Sample No. 860 of Geol. Survey Bull. 69
Gl-7	36	15	13E				Utley Sta.	St. Peter				Sample No. 865 of Geol. Survey Bull. 69
IOWA (Iw)												
Iw-1	21	7	5E			SE	Barneveld	St. Peter	Roadcut, on Hwy "HH"	Total thickness	100'	PCA
Iw-2	24	8	2E			SW	Lone Rock	Wonewoc	Roadcut, on Hwy 130	Total thickness	15'	
Iw-3	24	8	2E			SW	Lone Rock	Wonewoc	Roadcut, on Hwy 130	Total thickness	25'	PCA
Iw-4	29	8	2E		SW	NE	Avoca	St. Peter	Roadcut, on Hwy "NN"	Total thickness	30'	
Iw-5a	13	8	2E		SW	SE	Clyde	Lone Rock	Roadcut	15' to 38' below top	18'	
Iw-5b	"	"	"		"	"	"	Wonewoc	Roadcut	38' to base of expo	19'	
Iw-6	18	8	2E		NE	SW	Avoca	Jordan	Hillside	Total thickness	11'	
Iw-7	10	6	1E		NW	NW	Highland	St. Peter	Roadcut	Total thickness	10'	
Iw-8b	15	4	2E		NW	NE	MineralPt.	St. Peter	Roadcut, on Hwy 151	13 to 40' below top	27'	
Iw-9	21	7	5E		NE	SE	Hyde	St. Peter	Bluff	Total thickness	61'	
Iw-10b	29	8	2E		SW	NE	Avoca	St. Peter	Bluff	26' to 39' below top	13'	
JACKSON (Ja)												
Ja-1	7	20	3W		SE	SW	Black River Falls	Wonewoc	Bluff	Between elev. 1040' &1140'	100'	

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
GL-4		—	0.7			15.9				34.2		42.1		5.2		0.8		0.2	0.1			
GL-5		—	1.1			19.6				48.3		25.6		3.4		0.4		0.1	0.1			
GL-6		—	1.7			31.0				15.1		48.1		2.3		0.2		0.1	0.1			
GL-7		—	0.2			3.3				35.2		51.5		7.4		1.1		0.5	0.3			
IOWA (Iw)																						
Iw-1			—			3.7			23.2		42.8	8.7				20.0			1.5			
Iw-2			0.1			19.6			38.0		29.7	5.8				6.5			0.4			
Iw-3			0.1			18.7			31.1		36.7	7.4				7.0			0.1			
Iw-4			0.3			10.4			32.1		41.0	7.3				8.1			0.8			
Iw-5a							5.4		7.2		13.7		20.6		24.2		15.3		13.7			
Iw-5b							32.1		32.1		22.5		10.1		2.2		0.6		0.4			
Iw-6							5.2		9.8		18.6		30.8		16.7		9.0		9.9			
Iw-7							4.6		25.1		35.3		28.0		4.8		1.1		1.1			
Iw-8b							26.8		28.4		28.0		12.8		3.0		0.7		0.3			
Iw-9							18.5		34.7		32.7		11.4		2.0		0.4		0.3			
Iw-10b							26.1		28.2		31.0		10.8		2.5		0.8		0.7			
JACKSON(Ja)																						
Ja-1			0.2			17.3			26.3		30.5	7.0				18.0			0.7			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location: Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Ja-2	12	22	4W		NE	NE	Black River Falls	Wonewoc	Streamcut, on Hall's Creek	Lower 18', above shale	18'	PCA
Ja-3	28	22	6W		NW	SW	Taylor	Wonewoc	Roadcut, on Hyw "P"	44' from discontinuous 104'	104'	PCA
Ja-4	23	19	6W		SE	SW	North Bend	Wonewoc	Roadcut, on Hyw. 54	Total thickness	36'	
Ja-5	31	22	4W		C	SE	Black River Falls	Wonewoc	Roadcut, on Hyw. 27	Lower 50' of 60' exposure	50'	CCA (99.22)
Ja-6	23	19	6W		SE	SW	North Bend	Wonewoc	Roadcut, on Hyw. 54	10' to 35' below top	25'	
Ja-7a	28	22	1W		SE	SE	Pray	Wonewoc	Mound	0' to 42' below top	42'	
Ja-8	12	22	4W		NE	NE	Merrillan	Wonewoc	Streamcut on Hall's Creek	Lower 8' of 13' exposure	8'	
Ja-9a	31	22	4W		NW	SE	Black River Falls	Wonewoc	Roadcut on Hyw I-90	30' to 41' below top	11'	
Ja-9b	"	"	"		"	"	"	"	"	48' to 76' below top	28'	
Ja-9c	"	"	"		"	"	"	"	"	81' to 92' below top	11'	
Ja-9d	"	"	"		"	"	"	"	"	98' to 118' below top	20'	
Ja-9e	"	"	"		"	"	"	"	"	125' to 156' below top	31'	
Ja-10	8	22	5W		SE	SW	Hixton	Wonewoc	Bluff	Total thickness	10'	
Ja-11a	28	22	6W		NW	SW	Taylor	Wonewoc	Roadcut on Hyw "P"	5' to 37' below top	32'	
Ja-11b	"	"	"		"	"	"	"	"	37' to 69' below top	32'	
JUNEAU (Ju)												
Ju-1	24	15	3E		SE	NE	Mauston	Elk Mound	Bluff (One mile)	Lower 140' of 250' exposure	140'	PCA
Ju-2	30	16	4E		NW	NW	Mauston	Wonewoc	Bluff (Point)	Total thickness	130'	PCA

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
Ja-2			3.5			18.6			19.3		29.1	9.3				17.8			2.4			
Ja-3			2.5			38.3			35.5		16.2	2.1				3.8			1.6			
Ja-4			0.1			19.1			37.0		34.5	4.5				4.6			0.2			
Ja-5			—			7.5			34.5		46.3	6.0				5.5			0.4			
Ja-6			0.2	2.7		12.4		25.7		31.7		21.5		5.4		0.3		tr	0.1			
Ja-7a							29.6		28.4		23.6		12.0		3.4		2.7		0.4			
Ja-8			11.8	12.3		15.4		16.9		17.0		15.0		7.7		3.2		0.5	0.2			
Ja-9a			0.3	3.9		15.8		25.9		29.5		20.2		3.6		0.6		0.1	0.1			
Ja-9b			0.2	2.3		10.3		20.4		31.9		25.5		7.9		1.1		0.2	0.2			
Ja-9c							29.0		38.6		26.9		5.3		0.3		—		—			
Ja-9d			0.2	2.1		9.3		20.5		34.2		27.9		4.4		0.4		0.9	0.1			
Ja-9e			0.1	2.3		11.6		28.9		38.6		16.4		1.7		0.2		0.1	0.1			
Ja-10			0.1	0.5		3.1		10.4		35.9		43.7		5.9		0.2		0.1	0.1			
Ja-11a							50.5		21.1		15.4		9.0		3.3		-.8		—			
Ja-11b							31.7		36.5		22.5		6.8		1.8		0.6		0.2			
JUNEAU(Ju)																						
Ju-1			0.1			15.9			37.6		26.7	5.5				12.6			1.6			
Ju-2			0.4			10.3			28.0		25.4	14.1				26.3			2.6			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Ju-3	5	15	3E		NW	NW	Mauston	Wonewoc	Bluff	70' of discontinuous 140'	140'	PCA
Ju-4	29	17	2E		NE	SE	Camp Douglas	Wonewoc	Roadcut	Upper & lower 20' to 60'	40'	PCA; Middle 20' inaccessible
Ju-5	20	14	2E		NE	NE	Union Center	Wonewoc	Roadcut, on Hyw. 33	Total thickness	90'	PCA
Ju-6	22	14	2E		SW	SW	Union Center	Wonewoc	Roadcut, on Hyw. 33	Total thickness	110'	
Ju-7	35	15	4E		SE	NW	Lyndon Station	Wonewoc	Bluff	20' to 58' below top	38'	
Ju-8	26	15	4E		SE	NE	Lyndon Station	Wonewoc	Bluff	10' to 33' below top	23'	
Ju-9	29	17	2E		NE	SE	Camp Douglas	Wonewoc	Bluff	All but lower 6'	22'	
Ju-10	26	14	2E		SW	NE	Wonewoc	Wonewoc	Bluff	Lower 39' of 69' exposure	39'	
Ju-11	4	14	2E		SW	NW	Elroy	Wonewoc	Roadcut, on Hyw. 80	Total thickness	27'	
Ju-12	9	18	4E		NE	SE	Necedah	Wonewoc	Bluff (Petenwell)	Lower 32½' of 57' exposure	32½'	
Ju-13	25	16	3E		NE	NE	Mauston	Wonewoc	Bluff (Townline)	All but upper 10'	41½'	
Ju-14a	4	15	3E		NW	NW	Mauston	Wonewoc	Ridge (Duckworth)	30' to 70' below top	40'	
Ju-14b	"	"	"		"	"	"	"	"	70' to 122' below top	52'	
Ju-15a	20	14	2E		NE	NE	Union Center	Wonewoc	Bluff	10' to 24' below top	14'	
Ju-15b	"	"	"		"	"	"	"	"	30' to 66' below top	34'	
Ju-16	30	16	4E		NW	NW	Mauston	Wonewoc	Roadcut, on Hyw "Q"	Total thickness	17'	
Ju-17a	35	15	4E		SE	NW	Mauston	Wonewoc	Bluff (Sheep Pasture)	12' to 37' below top	25'	
Ju-17b	"	"	"		"	"	"	"	"	37' to 57' below top	20'	

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10	12	20	30	35	40	45	50	60	70	80	100	120	140	170	200	230	270	Pan	Clay	AFS Clay	
	9	10	20	28	32	35	42	48	60	65	80	100	115	150	170	200	250	270				
Ju-3			0.5			22.6			32.0		28.8	6.8				8.7			0.6			
Ju-4			—			7.9			21.5		44.2	7.6				17.6			1.2			
Ju-5			0.3			11.9			30.2		37.9	6.7				12.0			1.1			
Ju-6			0.1			16.0			30.3		35.6	7.5				9.9			0.7			
Ju-7							25.6		31.3		26.2		11.8		3.4		1.3		0.4			
Ju-8							14.8		32.8		32.5		14.9		3.8		0.7		0.5			
Ju-9			1.3	3.2		11.0		22.4		34.1		20.7		5.9			0.9	0.2	0.2			
Ju-10			0.3	3.1		9.6		21.1		34.5		22.9		6.8			1.5	0.1	0.1			
Ju-11			0.7	2.6		7.1		13.9		28.3		34.8		10.4			1.9	0.2	0.1			
Ju-12			2.2	8.1		13.2		19.8		24.7		20.8		8.6			1.9	0.6	0.1			
Ju-13			1.2	3.3		7.9		15.6		29.3		30.0		10.1			2.2	0.3	0.1			
Ju-14a			0.2	2.3		8.0		15.0		24.1		30.9		15.2			3.8	0.4	0.1			
Ju-14b			0.2	3.1		11.3		21.9		27.8		26.9		7.8			0.8	0.1	0.1			
Ju-15a			0.6	4.3		11.9		15.7		24.8		30.7		10.0			1.6	0.2	0.2			
Ju-15b			1.5	5.7		9.9		17.8		28.2		24.7		9.3			2.4	0.3	0.2			
Ju-16			0.3	4.5		11.6		14.2		16.7		31.8		18.0			2.2	0.3	0.4			
Ju-17a			0.1	2.0		8.3		21.3		26.2		25.8		11.3		3.5		0.9	0.6			
Ju-17b			0.1	0.7		4.9		13.9		30.3		33.3		11.9		3.8		0.7	0.4			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location: Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments: For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Ju-17c	35	15	4E		SE	NW	Mauston	Wonewoc	Bluff (Sheep Pasture)	Lower 31'	31'	
LACROSSE (LC)												
LC-1	27	15	7W		NW	NE	La Crosse	Wonewoc	Roadcut, on Hyw.14	Total thickness	51'	CCA(98.72;96.75)
LC-2	4	17	6W		SW	SW	West Salem	Jordan	Roadcut, on Hyw 108	25' to 43' below top	18'	CCA(97.38)
LC-3	27	15	7W			N½	La Crosse	Wonewoc	Roadcut, on Hyw. 35	Total thickness	80'	PCA(98.59)
LC-4	24	16	7W			NW	La Crosse	Wonewoc	Hillside, S. of Hyw "B"	Total thickness	18½'	PCA(98.75)
LC-5a*	22	16	7W			N½	La Crosse	Jordan	Roadcut, on Hyw. "B"	Total thickness	45'	PCA(95.64)
LC-5b	15	16	7W		SW	SW	La Crosse	Wonewoc	Roadcut, on Hyw. 16	Total thickness	35'	PCA(99.36)
LC-6	29	18	7W			E½	Holmen	Wonewoc	Roadcut, MoeConlee Road	Total thickness	23'	PCA
LC-7	4	17	6W		SE	SE	West Salem	Wonewoc	Roadcut, on Hyw.108	Lower 17'	17'	
LC-8	4	15	7W				La Crosse	Elk Mound				Sample No. 889 of Geol Survey Bull. 69
LAFAYETTE (La)												
La-1a	14	3	5E		SE	NE	Argyle	St. Peter	Roadcut, on Hyw.78	9' to 47' below top	38'	
Lf-1b	"	"	"		"	"	"	"	"	47' to base at 64'	17'	
Lf-2	23	4	1E		SE	SE	Mifflin	St. Peter	Roadcut	Total thickness	15'	
MONROE (Mo)												
Mo-1	18	17	1W		SE	SE	Tomah	Wonewoc	Roadcut, on Hyw. "M"	Total thickness	15'	PCA
Mo-2	3	16	2W		NW	NE	Norwalk	Jordan	Roadcut, on Hyw "A"	Total thickness	50'	PCA

Sample Number	Percent By Weight Retained On Sieves*																					Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
Ju-17c			0.4	5.4		16.7		22.7		26.0		21.2		5.7		1.1		0.4	0.4			
LACROSSE(LC)																						
LC-1			1.4			30.8			29.7		21.4	4.2				11.8			0.7			
LC-2			0.3			38.0			36.5		17.8	2.7				3.8			1.0			
LC-3			1.0	6.0		13.9		19.2		20.3		19.7		10.4		6.5		2.6	0.5		0.6	
LC-4			2.6	17.1		27.2		27.0		14.8		5.6		2.0		1.8		0.9	1.2		1.3	
LC-5a			5.7	6.1		10.8		12.4		11.5		13.2		16.6		11.9		6.1	5.8		1.6	
LC-5b			0.8	6.6		15.2		23.4		24.3		16.7		8.5		3.9		0.5	0.1		0.3	
LC-6			1.2	7.1		14.8		23.3		24.7		14.5		8.8		4.7		0.7	0.2		0.9	
LC-7							66.1		29.5		3.7		0.3		0.1		0.1		0.2			
LC-8		—	0.7			8.2				2.7		77.2		6.7		2.3		0.8	0.2			
LAFAYETTE(Lf)																						
Lf-1a							22.7		30.2		25.9		16.4		3.1		0.9		1.0			
Lf-1b							17.1		33.1		36.2		10.5		1.4		1.1		0.7			
Lf-2							36.4		23.2		25.4		10.7		2.3		1.0		1.0			
MONROE (Mo)																						
Mo-1			—			21.8			49.5		64.5	13.9				48.1			2.2			
Mo-2			0.3			15.5			42.3		24.9	3.4				8.4			5.2			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location						Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
	Sec.	Twn.	Range	¼	¼	¼						
MO-3	16	16	2W		SW	SE	Norwalk	Jordan	Roadcut on Hyw."T"	Lower 50' of 65' exposure	50'	PCA
Mo-4	15	16	3W		NW	NE	Norwalk	Wonewoc	Railroad cut	Total thickness	50'	CCA(97.30)
Mo-5	15	16	4W		SW	NW	Sparta	Wonewoc	Roadcut	Total thickness	30'	PCA
Mo-6	9	17	4W		NE	SE	Sparta	Wonewoc	Roadcut on Hyw."B"	Lower 20' of 70' exposure	20'	
Mo-7	25	18	2W		NW	SW	Tunnel City	Wonewoc	Railroad cut	8' to 40' above base	32'	
Mo-8	11	17	1W		NE	SW	Tomah	Wonewoc	Outcrop & roadcut	0' to 50' and 70' to 110' below top	110'	CCA(96.23)
Mo-9	13	19	2W		NW	NW	Tomah	Wonewoc	Roadcut on Hyw.12	Lower 30' to 40' exposure	30'	
Mo-10	35	17	4W		SW	NW	Sparta	Wonewoc	Roadcut on Hyw. 27	Total thickness	75'	
Mo-11	25	16	2W		NE	SW	Norwalk	Jordan	Roadcut on Hyw. 71	Upper 25' of 30' exposure	25'	
Mo-12	27	16	1W		SW	SE	Wilton	Wonewoc	Roadcut on Hyw. 71	Lower 18' of 50' exposure	18'	
Mo-13	13	19	2W	NE	NW	NW	Millston	Wonewoc	Roadcut on Hyw.12	6' to 47' below top	41'	
Mo-14	14	19	2W	SW	SW	SE	Kirby	Wonewoc	Roadcut on Hyw"E"	10' to 39' below top	29'	
Mo-15	25	18	2W	NW	NW	SW	Tunnel City	Wonewoc	Railroad cut & tunnel	Basal 31'	31'	
Mo-16	35	16	4W		SW	NW	Leon	Wonewoc	Bluff	Total thickness	42'	
Mo-17	13	16	4W		SE	SE	Leon	Wonewoc	Bluff	Basal 25'	25'	
Mo-18	8	17	4W		SE	SW	Sparta	Wonewoc	Quarry	Upper 40' of 49' face	40'	
Mo-19b	34	17	4W		SE	NE	Sparta	Wonewoc	Roadcut on Hyw.27	31' to 85' below top	54'	
Mo-20	18	17	1W		SE	SE	Tomah	Wonewoc	Bluff on Hyw "M"	Total thickness	19½'	

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
Mo-3			0.3			14.6			12.0		35.7	10.9				25.5			1.1			
Mo-4			3.9			28.1			29.8		16.2	4.1				18.0			0.2			
Mo-5			0.4			19.7			32.0		18.9	4.5				21.2			3.3			
Mo-6			1.5			40.3			37.0		11.1	1.8				5.9			2.5			
Mo-7			0.9			23.2			33.0		22.0	5.0				14.6			1.4			
Mo-8			0.4			22.3			24.6		22.8	6.1				21.9			1.9			
Mo-9			0.2			18.1			27.8		35.4	7.9				10.3			0.4			
Mo-10			0.2			16.5			25.2		27.4	6.4				23.0			1.3			
Mo-11			0.1			15.1			31.1		35.6	6.3				11.0			0.8			
Mo-12			0.9			28.0			25.3		31.2	6.1				8.0			0.7			
Mo-13							27.5		31.5		30.2		4.9		3.7		1.6		0.6			
Mo-14							60.7		20.5		8.5		6.8		1.8		1.5		0.2			
Mo-15							34.6		25.3		16.3		11.6		8.8		2.7		0.7			
Mo-16							37.8		19.3		16.2		16.3		7.7		2.1		0.6			
Mo-17							60.3		23.0		10.1		3.9		1.2		0.7		0.8			
Mo-18							37.1		34.0		23.4		4.1		1.3		0.1		—			
Mo-19b							21.3		30.0		33.3		11.1		3.0		0.8		0.5			
Mo-20			0.7	1.2		5.4		16.4		27.1		29.9		14.8		3.7		0.5	0.3			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Mo-21	3	16	2W		NW	NE	Norwalk	Jordan	Roadcut on Hyw"4"	Lower 25' of 33' exposure	25'	
Mo-22	16	16	2W		SE	SW	Norwalk	Jordan	Roadcut on Hyw"T"	Total thickness	17'	
Mo-23	11	17	1W		NE	SW	Tomah	Wonewoc	Quarry	Lower 23' of 40' exposure	33½'	
Mo-24	24	17	1E		NE	NW	Camp Douglas	Wonewoc	Bluff	Upper 88' of 107' exposure	88'	
OUTAGAMIE(Ou)												
Ou-1	15	21	16E		SW	NE	Greenville	St. Peter	Pit run			
PEPIN (Pp)												
Pp-1a	34	25	13W			NE	Durand	Jordan	Roadcut on Hyw"F"	Upper 30'	30'	PCA(97.18)
Pp-1b	"	"	"			"	"	"	"	Lower 23'	23'	PCA(97.44)
Pp-2	5	23	14W			SW	Pepin	Jordan	Roadcut on Hyw"N"	Total thickness	50'	PCA(98.87)
PIERCE(Pi)												
Pi-1	15	24	16W		NW	SE	Maiden Rock	Jordan	Underground mine	Crusher run	20'	
Pi-4	3	24	17W		NE	SW	Bay City	Jordan	Underground mine	Crusher run	20'	
Pi-6	13	25	19W		SE	NW	Diamond Bluff	Jordan	Storage tunnel	Total thickness	6'	
Pi-7	6	26	17W		SE	SW	Ellsworth	St. Peter	Roadcut on Hyw.35	Total thickness	30'	
Pi-8	17	27	18W		SE	NW	Ellsworth	St. Peter	Roadcut on Hyw.35	Lower 25' of 45' exposure	25'	CCA(98.48)
Pi-9	15	24	16W			SE	Maiden Rock	Jordan	Underground mine	Total thickness	21'	PCA(98.91)
Pi-10a	22	25	15W			NE	Plum City	Jordan	Roadcut on Hyw. 10	30' to 55' above base	25'	PCA(99.3)

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
Mo-21							25.0		33.2		24.9		7.9		3.3		2.5		3.7			
Mo-22							11.7		25.8		50.3		10.9		1.0		0.3		—			
Mo-23							23.0		23.1		30.1		15.7		5.6		1.8		0.7			
Mo-24							27.8		28.2		30.2		10.9		2.3		0.4		0.2			
OUTAGAMIE(Ou)																						
Ou-1			0.2			10.7			20.9		42.5	8.2				16.9			0.6			
PEPIN(Pp)																						
Pp-1a			3.1	15.8		31.1		29.8		13.7		3.3		1.2		0.8		0.5	0.7		0.3	
Pp-1b			1.3	2.8		4.1		5.7		10.0		16.1		26.5		22.8		6.0	4.9		1.2	
Pp-2			2.8	13.3		26.3		33.8		19.3		4.9		0.6		0.3		0.2	0.2		0.3	
PIERCE(Pi)																						
Pi-1			7.2			70.4			19.5		2.1	0.1				0.4			0.3			
Pi-4			4.6			72.0			20.0		1.9	0.2				0.7			0.7			
Pi-6			1.4			29.9			48.7		17.3	2.3				3.3			0.1			
Pi-7			—			13.1			32.9		28.9	5.7				24.0			1.7			
Pi-8			—			3.3			27.5		28.3	6.6				32.6			1.6			
Pi-9			5.6	22.6		34.2		23.7		8.8		3.3		1.0		0.4		0.2	0.2		0.3	
Pi-10a			1.2	12.2		35.4		39.6		10.3		0.9		0.2		0.1		0.1	tr		0.1	

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location: Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Pi-10b	22	25	15W			NE	Plum City	Jordan	Roadcut on Hyw.10	10' to 30' above base	20'	PCA
Pi-10c	"	"	"			"	"	"	"	Lower 10'	10'	PCA(96.3)
Pi-11	3	24	17W			W½	Bay City	Jordan	Underground mine	0' to 20' above mine floor	20'	PCA(99.20)
Pi-12	6	26	17W			S½	Ellsworth	St. Peter	Roadcut on Hyw.35	Total thickness	26'	PCA(99.05)
Pi-13a	5	27	15W		NW	NW	Spring Valley	Jordan	Dam Excavation	0' to 23' below top	20'	PCA(98.24)
Pi-13b	"	"	"		"	"	"	"	"	23' to 33' below top	10'	PCA(97.50)
Pi-13c	"	"	"		"	"	"	"	"	33' to 63' below top	30'	PCA(92.70)
Pi-13d	"	"	"		"	"	"	"	"	83' to 103' below top	20'	PCA(93.61)
Pi-14	5	25	18W			SW	Diamond Bluff	Jordan	Roadcut on Hyw. 0	Total thickness	25'	PCA(97.05)
Pi-15	35	27	20W			SE	Prescott	St. Peter	Bluff, S. end Dill Mound	Total thickness	8'	PCA(99.26)
Pi-16	27	27	18W		SW	SW	River Falls	St. Peter	Roadcut on Hyw.35	Total thickness	31'	
Pi-17	13	25	19W		SE	NW	Hager City	Wonewoc	Bluff (Diamond)	Lower 23'	23'	
RICHLAND(Ri)												
Ri-1	7	9	2E		SE	SE	Sextonville	Wonewoc	Roadcut on Hyw.14	Total thickness	30'	CCA(96.11)
Ri-2	11	9	2E		NW	NW	Bear Valley	Wonewoc	Bluff near Hyw.130	Lower 17'	17'	
Ri-3	18	9	2E		NE	SE	Gotham	Wonewoc	Roadcut on Hyw. 14	Lower 16' of 38' exposure	16'	
ROCK(Ro)												
Ro-1	23	2	11E		NW	NE	Hanover	St. Peter	Quarry	Total thickness	80'	

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
Pi-10b			3.9	15.0		26.6		30.3		18.8		2.9		0.8		0.6		0.4	0.7		0.3	
Pi-10c			3.1	6.8		9.8		15.9		24.2		14.5		8.0		9.1		4.8	3.7		0.7	
Pi-11			3.4	21.9		47.4		23.0		3.2		0.6		0.3		0.2		0.1	tr		—	
Pi-12			0.1	0.3		7.0		23.7		26.2		20.4		13.0		7.9		1.1	0.4		0.9	
Pi-13a			3.0	1.7		2.9		7.4		12.7		13.3		14.1		22.0		12.5	10.3		2.6	
Pi-13b			2.6	3.4		6.2		15.1		16.8		13.8		13.5		14.1		7.5	7.2		0.9	
Pi-13c			4.4	5.0		6/2		7.5		10.9		16.4		18.2		15.7		6.6	9.1		2.6	
Pi-13d			4.2	4.7		12.1		17.3		16.5		13.6		13.5		11.1		3.1	4.0		1.3	
Pi-14			4.8	22.4		35.0		25.1		7.6		2.4		1.0		0.7		0.4	0.6		0.4	
Pi-15			—	0.1		5.7		23.6		22.0		20.7		14.9		10.9		1.7	0.5		1.0	
Pi-16			3.7	4.4		13.7		19.0		22.0		18.2		11.1		6.5		0.7	0.7			
Pi-17			56.1	6.6		4.2		3.4		3.1		3.4		3.9		5.1		4.4	9.8			
RICHLAND(Ri)																						
Ri-1			1.2			31.8			29.5		15.5	5.4				15.5			1.2			
Ri-2							43.7		20.6		18.6		12.3		3.4		1.1		0.5			
Ri-3							32.9		26.0		18.4		17.8		4.2		0.5		0.2			
ROCK (Ro)																						
Ro-1			—			9.0			21.6		39.4	7.4				20.5			2.2			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Ro-3	23	2	11E		NW	NE	Hanover	St. Peter	Quarry	Crusher run	___	
Ro-4	22	2	10E		NW	NE	Orfordville	St. Peter	Roadcut	Total thickness	15'	
Ro-5	14	2	11E		SE	SW	Hanover	St. Peter	Quarry	All but upper 15' & lower 10'	75'	
Ro-6	27	2	12E		SE	SW	Afton	St. Peter	Bluff	Total thickness	16'	
Ro-7	15	4	12E		SW	NW	Fulton Center	St. Peter	Streamcut Rock River	Total thickness	17'	
ST.CROIX(SC)												
SC-1	23	28	19W			NW	River Falls	St. Peter	Roadcut on Hyw.35	Total thickness	35'	PCA(98.96)
SC-2	34	29	19W			NE	Hudson	St. Peter	Roadcut on Hyw"N"	Total thickness	13'	PCA(99.00)
SC-3a	34	30	15W		NE	SE	Glenwood City	Jordan	Roadcut on Hyw.128	3' to 31' below top	28'	
SC-3b	"	"	"		"	"	"	"	"	31' to 42' below top	11'	
SAUK(Sk)												
Sk-5	16	11	5E		NE	SE	North Freedom	Wonewoc	Quarry	Total thickness	40'	
Sk-6	15	11	5E		NW	SW	North Freedom	Wonewoc	Roadcut on Hyw"PF"	Total thickness	50'	
Sk-7	21	12	5E		NW	NE	Rock Springs	Wonewoc	Roadcut	Total thickness	15'	
Sk-8	25	13	4E		NE	SW	Reedsburg	Wonewoc	Roadcut on Hyw"HH"	Lower 8' of 10' exposure	8'	
Sk-9	23	13	5E		NW	SE	Wis. Dells	Wonewoc	Roadcut	14' from 17' exposure	14'	
Sk-10	7	12	5E		NW	SE	Reedsburg	Wonewoc	Sand pit	Total thickness	10'	
Sk-11	6	12	4E		NW	SE	Reedsburg	Wonewoc	Bluff	Lower 45' of exposure	45'	

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10	12	20	30	35	40	45	50	60	70	80	100	120	140	170	200	230	270	Pan	Clay	AFS Clay	
	9	10	20	28	32	35	42	48	60	65	80	100	115	150	170	200	250	270				
Ro-3			—			9.2			21.6		39.5	7.4				20.4			2.0			
Ro-4			0.2	2.0		7.8		15.0		26.6		32.1		13.8		1.7		0.4	0.5			
Ro-5			0.1	1.0		5.3		11.9		23.1		39.3		14.3		2.8		0.8	1.4			
Ro-6							19.2		26.4		36.2		14.4		2.8		0.4		0.6			
Ro-7			0.8	2.3		8.7		17.0		26.1		28.1		12.0		3.3	0.9		1.0			
ST CROIX (SC)																						
SC-1			0.5	0.4		1.4		10.7		30.2		34.6		17.0		3.1		0.7	1.4		1.1	
SC-2			tr	0.1		1.5		19.5		26.9		24.2		18.0		8.5		0.7	0.7		1.8	
SC-3a			0.1	5.6		24.6		42.1		24.5		2.6		0.2		0.1		0.1	0.1			
SC-3b			0.6	7.6		17.4		22.6		23.1		18.0		8.4		1.9		0.2	0.2			
SAUK (Sk)																						
Sk-5			—			3.6			22.0		43.7	7.4				30.3			3.1			
Sk-6			0.3			3.2			17.9		41.8	7.4				25.8			3.7			
Sk-7			—			7.9			36.6		40.4	6.1				8.7			0.3			
Sk-8			—			15.7			22.3		39.7	8.3				13.6			0.4			
Sk-9			0.4			24.5			31.3		28.8	5.9				8.9			0.4			
Sk-10			0.2			14.2			32.7		27.6	5.0				18.8			1.4			
Sk-11			0.5			20.5			36.0		31.5	4.0				7.1			0.4			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location						Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
	Sec.	Twn.	Range	¼	¼	¼						
Sk-12	25	13	3E		NE	NW	La Valle	Wonewoc	Roadcut on Hyw"V"	Lower 10' of 40' exposure	10'	PCA
Sk-13	5	13	3E		NW	NW	Wonewoc	Wonewoc	Bluff	Lower 46' of 110' exposure	46'	CCA(98.92)
Sk-14	7	13	6E		SE	NW	Wis. Dells	Wonewoc	Roadcut	10' to 23' below top	13'	
Sk-15	11	12	4E		SW	NE	Reedsburg	Wonewoc	Roadcut on Hyw"H"	Total thickness	38'	
Sk-16	14	13	5E		SW	NE	Lake Delton	Jordan	Bluff along quarry road	5' to 18' below top	9'	
Sk-17	23	12	4E		SW	NE	Reedsburg	Mazomanie	Roadcut	5' to 43' below top	32'	
Sk-18	7	12	5E		NW	SE	Reedsburg	Wonewoc	Quarry	Total thickness	7½'	
Sk-19	25	13	4E		NE	SW	Reedsburg	Wonewoc	Roadcut on Hyw"H"	Total thickness	20'	
Sk-20	23	13	5E		SW	NE	Lake Delton	Wonewoc	Roadcut on Hyw"P"	Total thickness	15'	
Sk-21	30	12	5E		NE	NW	Rock Springs	Wonewoc	Railroad cut	Lower 11'	11'	
Sk-22	16	11	5E		NE	SE	LaRue	Wonewoc	Quarry	Lower 35'	35'	
Sk-23	25	13	3E		NE	NW	LaValle	Wonewoc	Roadcut on Hyw"V"	Lower 17' of 32' exposure	17'	
Sk-24	6	12	4E		SW	NE	Reedsburg	Wonewoc	Bluff	Total thickness	46'	
Sk-25	21	13	3E		NW	NW	LaValle	Wonewoc	Roadcuts	5' to 95' below top of 107'	90'	
Sk-26	14	13	5E		SW	NE	Lake Delton	Jordan	Bluff along quarry road	Total thickness	26'	
Sk-27	15	11	5E				North Freedom	Wonewoc				Sample No. 874 of Geol. Survey Bull. 69
TREMPEALEAU(Tr)												
Tr-1	33	19	8W		NW	NW	Galesville	Wonewoc	Streamcut	Lower 20' of 100' exposure	20'	

Sample Number	Percent By Weight Retained On Sieves*																					Remarks
	10	12	20	30	35	40	45	50	60	70	80	100	120	140	170	200	230	270	Pan	Clay	AFS Clay	
	9	10	20	28	32	35	42	48	60	65	80	100	115	150	170	200	250	270				
Sk-12			—			9.6			33.2		32.8	6.3				17.6			0.5			
Sk-13			0.1			11.6			32.5		36.4	6.9				11.6			0.8			
Sk-14							17.5		27.1		34.9		15.2		3.4		1.3		0.6			
Sk-15							24.1		39.9		24.7		7.7		2.9		0.6		0.2			
Sk-16							29.0		26.3		25.0		15.8		3.1		0.5		0.3			
Sk-17							5.6		10.4		31.4		40.8		6.4		2.3		3.1			
Sk-18							33.7		32.3		20.2		9.5		3.4		0.7		0.2			
Sk-19							30.1		34.4		26.3		7.5		1.4		0.2		0.1			
Sk-20							19.4		31.0		33.8		12.4		2.7		0.5		0.2			
Sk-21							26.7		38.6		26.0		7.7		1.0		tr		tr			
Sk-22							18.3		35.2		32.7		10.8		2.2		0.5		0.3			
Sk-23			0.9	4.6		13.0		24.0		29.1		18.2		8.2		2.0		0.1	0.1			
Sk-24			1.5	6.4		13.2		22.0		31.1		18.0		6.0		1.5		0.1	0.1			
Sk-25							37.2		29.3		23.5		8.2		1.0		0.2		0.6			
Sk-26							39.6		20.5		22.3		11.6		3.1		1.1		1.8			
Sk-27		0.3	1.9			4.7				0.6		80.4		8.6		1.4		0.6	0.2			
TREMPEALEAU (Tr)																						
Tr-1			0.1			26.9			43.4		22.7	3.0				3.6			0.4			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location: Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Tr-3	21	20	9W		SW	NE	Arcadia	Jordan	Roadcut, on Hyw.93	Lower 20' of 55' exposure	20'	
Tr-4	2	24	8W		NW	SW	Osseo	Wonewoc	Roadcut	Total thickness	12'	
Tr-6	22	23	7W		NW	SW	Pigeon Falls	Wonewoc	Roadcut on Hyw.53	Lower 50' of 70' exposure	50'	PCA
Tr-7	28	20	8W			N½	Ettrick	Wonewoc	Roadcut	Total thickness	26'	PCA
Tr-8a	11	19	10W			E½	Dodge	Wonewoc	Roadcut, Dodge-Pine	Upper 10'	10'	PCA(98.91)
Tr-8b	"	"	"			"	"	"	"	Lower 14'	14'	PCA(99.33)
Tr-9a	21	20	9W			NE	Arcadia	Jordan	Roadcut on Hyw.93	Upper 20'	20'	PCA
Tr-9b	"	"	"			"	"	"	"	15' to 40' above base	25'	PCA
Tr-9c	"	"	"			"	"	"	"	0' to 15' above base	15'	PCA
Tr-10a	17	22	9W			S½	Independence	Wonewoc	Roadcut	13' to 28' above base	15'	PCA (99.24)
Tr-10b	"	"	"			"	"	"	"	0' to 12' above base	13'	PCA (99.04)
Tr-11a	33	19	8W		NW	NW	Galesville	Wonewoc	Streamcut	6' to 82' below top	76'	
Tr-11b	"	"	"		"	"	"	"	"	98' to 120' below top	22'	
Tr-12a	22	23	7W		NW	SW	Pigeon Falls	Wonewoc	Roadcut on Hyw.53	0' to 7' below top	7'	
Tr-12b	"	"	"		"	"	"	"	"	16' to 54' below top	38'	
Tr-13a	3	13	7W		NW	NE	Pigeon Falls	Wonewoc	Roadcut on Hyw. 53	10' to 20' below top	10'	
Tr-13b	"	"	"		"	"	"	"	"	31' to 64' below top	33'	
Tr-14	33	24	8W		SW	SW	Strum	Wonewoc	Roadcut on Hyw"D"	Total thickness	22'	

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10 9	12 10	20 20	30 28	35 32	40 35	45 42	50 48	60 60	70 65	80 80	100 100	120 115	140 150	170 170	200 200	230 250	270 270	Pan	Clay	AFS Clay	
Tr-3			0.2			17.5			42.3		32.5	3.9				3.3			0.3			
Tr-4			0.8			36.6			31.2		14.1	2.8				12.1			2.4			
Tr-6			2.0			42.2			28.1		18.1	3.1				6.0			0.6			
Tr-7			1.5	1.7		2.7		4.0		5.6		7.7		10.8		36.1		25.0	4.9		1.8	
Tr-8a			4.9	9.2		29.6		24.6		11.7		4.4		1.9		1.9		0.8	1.0		1.8	
Tr-8b			0.3	3.7		12.9		26.1		31.2		17.2		6.1		2.1		0.3	tr		0.2	
Tr-9a			1.4	13.0		33.3		34.4		11.7		4.6		1.0		0.4		0.2	0.3		0.2	
Tr-9b			2.0	8.0		15.1		24.3		27.4		13.2		4.2		3.4		1.0	1.3		0.8	
Tr-9c			0.8	3.8		6.0		12.3		32.9		32.7		9.3		1.6		0.3	0.4		0.2	
Tr-10a			0.4	1.0		4.7		16.2		31.0		27.5		12.7		5.4		0.6	0.6		2.3	
Tr-10b			0.3	0.7		2.7		7.9		19.3		35.1		23.6		9.2		0.7	0.4		0.7	
Tr-11a							53.0		20.2		12.5		8.1		4.3		1.5		0.4			
Tr-11b							32.9		28.4		25.5		8.6		3.2		1.2		0.3			
Tr-12a							61.5		19.0		9.6		5.3		2.2		1.2		0.9			
Tr-12b							51.0		21.3		16.0		8.2		2.8		0.7		0.2			
Tr-13a			2.2	5.0		8.6		31.7		38.7		9.5		2.0		1.0		0.4	0.9			
Tr-13b			1.2	9.6		18.0		20.9		15.1		10.8		8.8		8.5		4.4	2.7			
Tr-14			11.7	17.3		24.8		21.8		15.5		2.7		2.3		2.0		0.7	1.2			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location Sec.	Twn.	Range	¼	¼	¼	Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica
Tr-15	5	24	8W		NW	SW	Strum	Wonewoc	Roadcut on Hyw"D"	Total thickness	23½'	
Tr-16	3	24	8W		NE	SE	Strum	Wonewoc	Roadcut	1' to 12' below top	11'	
Tr-17	3	23	7W		NW	SE	Pigeon Falls	Wonewoc	Roadcut on Hyw.53	Total thickness	18'	
VERNON (Ve)												
Ve-3	9	12	4W		SW	SW	Viroqua	St. Peter	Roadcut on Hyw.14	Lower 32' of 35' exposure	32'	CCA(93.11)
Ve-5	17	14	6W			C	Chaseburg	Jordan	Roadcut on Hyw.K	50' to 80' above base	30'	CCA(99.26)
Ve-6	22	13	7W			SW	Genoa	Jordan	Roadcut on Hyw.K	Total thickness	39'	PCA(92.35)
Ve-7	27	14	7W			SE	Stoddard	Jordan	Roadcut on Hyw.162	Total thickness	61'	PCA(95.14)
Ve-8	21	14	6W		SE	NW	Chaseburg	Wonewoc	Roadcut on Hyw. K	Total thickness	33'	PCA(98.71)
Ve-9	17	14	6W		SE	NW	Chaseburg	Jordan	Roadcuts on Hyw.K	8' to 76' below top	68'	
Ve-10	13	14	2W		NE	SW	Ontario	Wonewoc	Bluff	Total thickness	20½'	
Ve-11	16	12	4W		NW	NW	Viroqua	St. Peter	Roadcut on Hyw.14	Lower 42' of 43' exposure	42'	
WAUSHARA (Ws)	16	19	11E			NE	Mt. Morris	Wonewoc	Quarry	Total thickness	50'	
Ws-1	16	19	11E			NE	Mt. Morris	Wonewoc	Quarry	Total thickness	50'	
Ws-2	16	19	11E		NW	NW	Mt. Morris	Wonewoc	Quarry	Total thickness	37'	
WINNEBAGO (Wi)												
Wi-1	13	20	15E			SW	Winchester	Jordan	Sand pit	Total thickness	40'	CCA(97.32)
Wi-2	3	17	14E		NW	SE	Waukan	St. Peter	Quarry	Total thickness	27'	

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10	12	20	30	35	40	45	50	60	70	80	100	120	140	170	200	230	270	Pan	Clay	AFS Clay	
	9	10	20	28	32	35	42	48	60	65	80	100	115	150	170	200	250	270				
Tr-15			12.1	16.9		18.2		24.7		18.0		6.8		2.0		0.8		0.2	0.3			
Tr-16			2.0	7.7		19.1		33.2		24.9		8.3		2.8		1.4		0.3	0.3			
Tr-17			0.5	0.5		3.5		11.9		28.4		40.5		11.9		2.5		0.2	0.1			
VERNON(Ve)																						
Ve-3			—			7.2			33.8		30.7	7.8				19.1			1.3			
Ve-5			0.3			41.9			49.2		7.6	0.3				0.5			0.2			
Ve-6			4.8	5.7		9.0		12.1		12.4		9.4		12.3		15.9		6.9	11.5		1.8	
Ve-7			2.8	7.3		13.5		18.6		19.6		18.3		8.6		4.5		2.7	4.3		2.0	
Ve-8			5.2	14.0		18.4		19.3		22.9		13.0		3.6		1.5		0.8	1.4		3.2	
Ve-9							45.8		19.5		14.4		10.7		4.1		2.7		2.8			
Ve-10			1.3	6.0		17.8		22.8		20.6		16.9		10.5		3.5		0.4	0.2			
Ve-11							30.0		27.5		24.4		13.4		3.3		0.7		0.7			
WAUSHARA(Ws)																						
Ws-1			1.0			23.1			24.9		24.8	6.7				18.0			1.5			
Ws-2							20.8		34.9		30.1		9.3		3.5		1.2		0.2			
WINNEBAGO(Wi)																						
Wi-1			—			3.5			23.8		52.2	7.6				12.3			0.5			
Wi-2							13.9		23.2		40.0		19.3		2.7		0.5		0.4			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

Counties and Sample Numbers	Location						Nearest Town	Geologic Formation	Type of Exposure	Portion of Exposure Sampled	Thickness In Feet	Comments **For complete results of chemical analyses see Table II. CCA=complete chemical analysis; PCA=partial chemical analysis; () indicates percent silica**
	Sec.	Twn.	Range	¼	¼	¼						
Wi-3	13	20	15E		SE	SW	Winchester	Jordan	Quarry	Total thickness	20'	

Sample Number	Percent By Weight Retained On Sieves*																				Remarks
	10	12	20	30	35	40	45	50	60	70	80	100	120	140	170	200	230	270	Pan	Clay	AFS Clay	
	9	10	20	28	32	35	42	48	60	65	80	100	115	150	170	200	250	270				
Wi-3							22.8		23.3		36.2		14.6		2.3		0.4		0.4			

Upper figures-U.S. numbers; Lower figures-Tyler numbers

TABLE IV. Chemical analyses of Wisconsin silica sandstones

Counties and Sample Numbers	%Loss on Ignition at 1000°C	SiO_2	Fe_2O_3	Al_2O_3	TiO_2	CaO	MgO	Analyst
ASHLAND								
Basswood Island (6)		87.02	3.91	7.17		0.11	0.06	E.T. Sweet
Lehighs (6)		69.78	7.93	15.43		0.49	1.17	E.T. Sweet
Lehighs (6)		49.94-75.24						E.T. Sweet
BAYFIELD								
Ba-8		98.36	0.208	------0.88----		0.88	0.01	Sharp-Schurtz
Ba-8			0.080					Hygiene Lab.
BUFFALO								
Bf-1a	5.87							A. Aktay
Bf-1b	4.27	94.66	0.301	0.758	0.011			A. Aktay
Bf-1c	9.25	89.87	0.259	0.609	0.012			A. Aktay
Bf-2a	2.53	96.25	0.612	0.563	0.031			A. Aktay
Bf-2b	0.57							"
Bf-2c	0.29							"
Bf-3	0.37	98.41	0.913	0.267	0.037			"
CHIPPEWA								
Ch-1		92.74	0.21	2.81	0.008	0.23	0.08	Spectro-Chemical
Ch-1		96.84						" "
Ch-1			0.04					Hygiene Lab.
CLARK								
Ck-1			0.42					Soils Lab.
Ck-1			0.416					" "
*Dorchester		94.00		------0.60----			3.22	Pittsburg Testing
Columbia								
Co-2		96.00	0.10	2.60	0.01	0.27	0.09	Spectro-Chemical
*Portage		99.58	0.021-0.026	0.20	0.011	0.01	Tr	Sharp-Schurtz
DANE								
Rockdale (4)		99.78	0.006	0.144		0.042	0.023	Sharp-Schurtz
DUNN								
Du-1		99.56	0.060	------0.12----		0.02	0.03	Sharp-Schurtz
Du-4	0.15	99.42	0.215	0.196	0.018			A. Aktay

Counties and Sample Numbers	%Loss on Ignition at 1000°C	SiO_2	Fe_2O_3	Al_2O_3	TiO_2	CaO	MgO	Analyst
EAU CLAIRE								
EC-4		92.54	0.099	-----3.98----		0.04	0.02	Sharp-Schurtz
GRANT								
Gr-1			0.26					Soils Lab.
Gr-2			0.26					" "
Gr-6		97.46	0.13	1.88	0.01	0.28	0.10	Spectro-Chemical
Gr-9		94.90	0.167	-----0.39----		1.23	0.90	Sharp-Schurtz
Beetown (3)		99.17	0.22	0.25				
Boscobel (3)		99.47	0.07					
GREEN								
Juda (4)		98.66	0.16	0.39		0.45	0.18	
IOWA								
Iw-1			0.71					Soils Lab.
Iw-3			0.023					" "
Mineral Point (6)		96.74	1.45	0.71		0.63	0.88	E. T. Sweet
JACKSON								
Ja-2			0.048					Soils Lab.
Ja-3			0.572					" "
Ja-5		99.22	0.047	-----0.22----		0.05	Tr	Sharp-Schurtz
JUNEAU								
Ju-1			0.089					Soils Lab.
Ju-2			0.20					" "
Ju-3			0.087					Soils Lab.
Ju-4			0.025					" "
Ju-5			0.089					" "
LA CROSSE								
LC-1		98.72	0.059	-----0.55----		0.04	Tr	Sharp-Schurtz
LC-1		96.75	0.10	1.77	0.01	0.23	0.10	Spectro-Chemical
LC-1			0.037					Hygiene Lab.
LC-2		97.38	0.27	3.29	0.006	0.28	0.30	Spectro-Chemical
LC-3	0.22	98.59	0.087	0.300	0.013			A. Aktay
LC-4	0.60	98.75	0.260	0.368	0.016			"
LC-5a	3.43	95.64	0.192	0.691	0.038			"
LC-5b	0.17	99.36	0.196	0.240	0.030			"
LC-6	0.29							"

Counties and Sample Numbers	%Loss on Ignition at 1000°C	SiO_2	Fe_2O_3	Al_2O_3	TiO_2	CaO	MgO	Analyst
MARATHON								
*Knowlton		96.68		-----0.30----			1.76	Pittsburg Testing
MONROE								
Mo-1			0.115					Soils Lab.
Mo-2			0.130					" "
Mo-3			0.179					" "
Mo-3			0.34					" "
Mo-4			0.021					" "
Mo-4		97.30	0.14	3.03	0.01	0.08	0.10	Spectro-Chemical
Mo-4			0.098					Soils Lab.
Mo-5			0.22					" "
Mo-8		96.23	0.16	2.79	0.026	0.29	0.18	Spectro-Chemical
Mo-8			0.033					Hygiene Lab.
PEPIN								
Pp-1a	1.90	97.18	0.702	0.188	0.021			A. Aktay
Pp-1b	1.71	97.44	0.616	0.214	0.019			"
Pp-2	0.46	98.87	0.241	0.413	0.009			"
PIERCE								
Pi-8		98.48	0.076	-----0.68----		0.04	0.01	Sharp-Schurtz
Pi-8			0.089					Hygiene Lab
Pi-9	0.48	98.91	0.352	0.245	0.009			A. Aktay
Pi-10a	0.19	99.30	0.296	0.201	0.013			"
Pi-10b	2.06							"
Pi-10c	3.11	96.30	0.248	0.315	0.019			"
Pi-11	0.16	99.20	0.313	0.312	0.011			"
Pi-12	0.27	99.05	0.247	0.415	0.011			"
Pi-13a	1.03	98.24	0.401	0.301	0.021			"
Pi-13b	1.86	97.50	0.396	0.218	0.018			"
Pi-13c	6.64	92.70	0.218	0.412	0.029			"
Pi-13d	5.75	93.61	0.315	0.302	0.022			"
Pi-14	2.38	97.05	0.303	0.245	0.017			"
Pi-15	0.29	99.26	0.215	0.218	0.015			"
*Bay City		98.88	-----0.48----			0.22 & alkali		Owner reports Twin City Testin
POLK								
H. Holbert		89.05	-----6.41----			1.72	2.27	F. Julian

Counties and Sample Numbers	%Loss on Ignition at 1000°C	SiO_2	Fe_2O_3	Al_2O_3	TiO_2	CaO	MgO	Analyst
PORTAGE								
*Ellis		97.90		-----0.56----			1.30	Pittsburg Testing
RICHLAND								
Ri-1		96.11	0.11	2.23	0.01	0.28	0.31	Spectro-Chemical
ROCK								
*Hanover		99.46	0.053	0.22	0.019	0.01	0.14	Sharp-Schurtz
*Hanover		99.30	0.066	0.32	0.022	0.02	0.18	"
ST. CROIX								
SC-1	0.39	98.96	0.652	0.349	0.013			A. Aktay
SC-2	0.27	99.00	0.456	0.256	0.014			"
SAUK								
Sk-12			0.0399					Hygiene Lab.
Sk-13		98.92	0.044	-----0.48----		0.02	0.02	Sharp-Schurtz
Ablemans (1)		99.42		-----0.31----				E.A. Schneider
Ablemans (2)		98.64		1.10				W.W. Daniels
*LaRue		97.32	0.43	1.00		0.17	0.37	Wis. Elec. Power
TREMPEALEAU								
Tr-6			0.0602					Hygiene Lab.
Tr-7	0.49							A. Aktay
Tr-8a	0.39	98.91	0.239	0.450	0.009			"
Tr-8b	0.21	99.33	0.202	0.240	0.015			"
Tr-9a	0.75							"
Tr-9b	1.40							"
Tr-9c	0.28							"
Tr-10a	0.40	99.24	0.305	0.375	0.032			"
Tr-10b	0.20	99.04	0.372	0.361	0.019			"
VERNON								
Ve-3		93.11	0.16	3.21	0.028	0.15	0.26	Spectro-Chemical
Ve-3		96.34						" "
Ve-5		99.26	0.087	-----0.15----		0.10	0.09	Sharp-Schurtz
Ve-6	6.21	92.35	0.424	0.983	0.030			A. Aktay
Ve-7	4.12	95.14	0.304	0.420	0.007			"
Ve-8	0.65	98.71	0.217	0.413	0.008			"

Counties and Sample Numbers	%Loss on Ignition at 1000°C	SiO_2	Fe_2O_3	Al_2O_3	TiO_2	CaO	MgO	Analyst
WINNEBAGO								
Wi-1		97.32	0.16	3.38	0.009	0.25	0.07	Spectro-Chemical
WOOD								
*Rudolph		97.20		------0.20----			1.50	Pittsburg Testin

Analyses

* Furnished by owner
Sharp-Schurtz = The Sharp-Schurtz Co., Lancaster, Ohio
Spectro-Chem. = Spectro-Chemical Research Laboratories, Inc., Chicago, Ill.
Wis. Elec. = Wisconsin Electric Power Co. Laboratory, Milwaukee, WI
Twin City Test = Twin City Testing & Engineering Laboratory, Inc., St. Paul, Minn.
Pittsburgh Test. = Pittsburgh Testing Laboratory, Milwaukee, WI
Hygiene Lab. = Wisconsin State Laboratory of Hygiene, Madison, WI
Soils Lab. = University of Wisconsin, Soils Department Laboratory, Madison, WI
by S. C. Chang & J. Steuerwald
A. Aktay = University of Wisconsin, Department of Minerals & Metals.
F. Julian

Locations

LaRue = Afram Brothers undeveloped deposit one mile south of La Rue.
Portage = Martin-Marietta pit at Portage.
Ellis = Ellis Stone and Construction Co. quarry near Ellis.
Rudolph = Ellis Stone and Construction Co. quarry near Rudolph.
Knowlton = Ellis Stone and Construction Co. quarry near Knowlton.
Dorchester = Ellis Stone and Construction Co. quarry near Dorchester.

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