STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
Horace R. Collins, Chief

Report of Investigations No. 108

AN EVALUATION OF "NEWBERRY" ANALYSIS DATA ON THE BRASSFIELD FORMATION (SILURIAN), SOUTHWESTERN OHIO

by

David A. Stith
and
Ronald D. Stieglitz

Columbus
1979

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ABSTRACT

A study of the Brassfield Formation in southwestern Ohio was begun in 1957. Intermittent work on this project produced $CaCO_3$, $MgCO_3$, and insoluble residue data for over 1,000 samples and descriptions of numerous measured sections. The analytical data are evaluated and presented here, along with weighted averages of $MgCO_3$ and insoluble material for the formation. Maps showing the distribution of iron, chert, the Belfast bed, $MgCO_3$, and insoluble material are included as well as an isopach map of the Brassfield.

INTRODUCTION

PURPOSE AND SCOPE

The Division of Geological Survey began collecting data on the Brassfield Formation (Silurian) of southwestern Ohio in 1957. The primary goal of that project was to delineate areas of economic value of the Brassfield. In addition, the stratigraphy of the Brassfield was studied to determine what geologic controls affected facies distribution and could be used as exploration tools. Numerous sections were measured and described along the outcrop of the Brassfield (fig. 1). Four cores were drilled in 1960 in Adams, Clinton, Miami, and Warren Counties to investigate the properties of the formation away from the outcrop. Many samples from the measured sections and cores were analyzed for calcium carbonate ($CaCO_3$), magnesium carbonate ($MgCO_3$), and insoluble residues. The carbonate percentages were determined by "Newberry" analysis. Problems inherent to that procedure will be discussed on page 7.

The bulk of the field work and "Newberry" analyses were performed under the direction of Robert K. Alberts; however, several members of the Survey staff have worked on the project since its inception. Personnel changes and shifting demands on the resources of the Survey have prevented publication of a final report. Because of the large number (approximately 1,000) of samples analyzed and the commercial importance of the Brassfield Formation, it was decided to evaluate, organize, and present the data in a form which might be of use in exploration or in additional studies.

STRATIGRAPHY AND LITHOLOGY

It is not the aim of this report to present a detailed discussion of the stratigraphy and lithology of the Brassfield Formation, but rather to supply chemical and purity data; however, a brief outline of relationships is included.

In 1906, Foerste named the Brassfield Limestone for the rocks exposed near the town of Brassfield in Madison County, Kentucky. Lithologically the Brassfield is heterogeneous, consisting of limestone, dolomite, and shale. Because of lithologic variability, the name Brassfield Formation instead of Brassfield Limestone has been employed by Rexroad and others (1965) in Kentucky, and by Horvath (1967) and Horvath and Sparling (1967) in Ohio. That usage is followed here.

Hoover (1963) summarized the lithology of the Brassfield outcrops in Ohio. Generally, in the northern and western areas of its outcrop (fig. 1) the formation can be informally divided into lower and upper units. The lower unit is typically composed of fine- to coarse-grained crystalline light-gray to white limestone. Green clay partings are present as well as disseminated clay. Dolomite beds are present in some sections.

The upper unit is dominantly a medium- to coarse-grained fossiliferous pink, red, or gray limestone. Green clay is common as partings throughout, more so than in the lower unit. Hematite is common in some areas (fig. 2) as replacement of fossil fragments and oolites.

In the southern part of the outcrop area, from central Clinton County to the Ohio River, the Brassfield is less bioclastic and contains much chert (fig. 3) and green shale interbeds. In most sections in the southern part of the outcrop area there is no distinct lithologic division between the upper and lower units. Total thickness of the Brassfield Formation in southwestern Ohio ranges from about 11 feet to nearly 50 feet (fig. 4).

Figure 5 shows the distribution of a basal unit, the Belfast bed, which in Kentucky is considered to be a member of the Brassfield Formation by Rexroad and others (1965). In Ohio, the Belfast bed is not present everywhere and its exact geographic extent has not been determined; however, it is more extensive in the eastern and southern parts of the study area. Lithologically this unit is very impure and is unsuitable for most purposes; therefore it is not included in the thickness or weighted-average data.

In Ohio the Brassfield Formation is placed in the

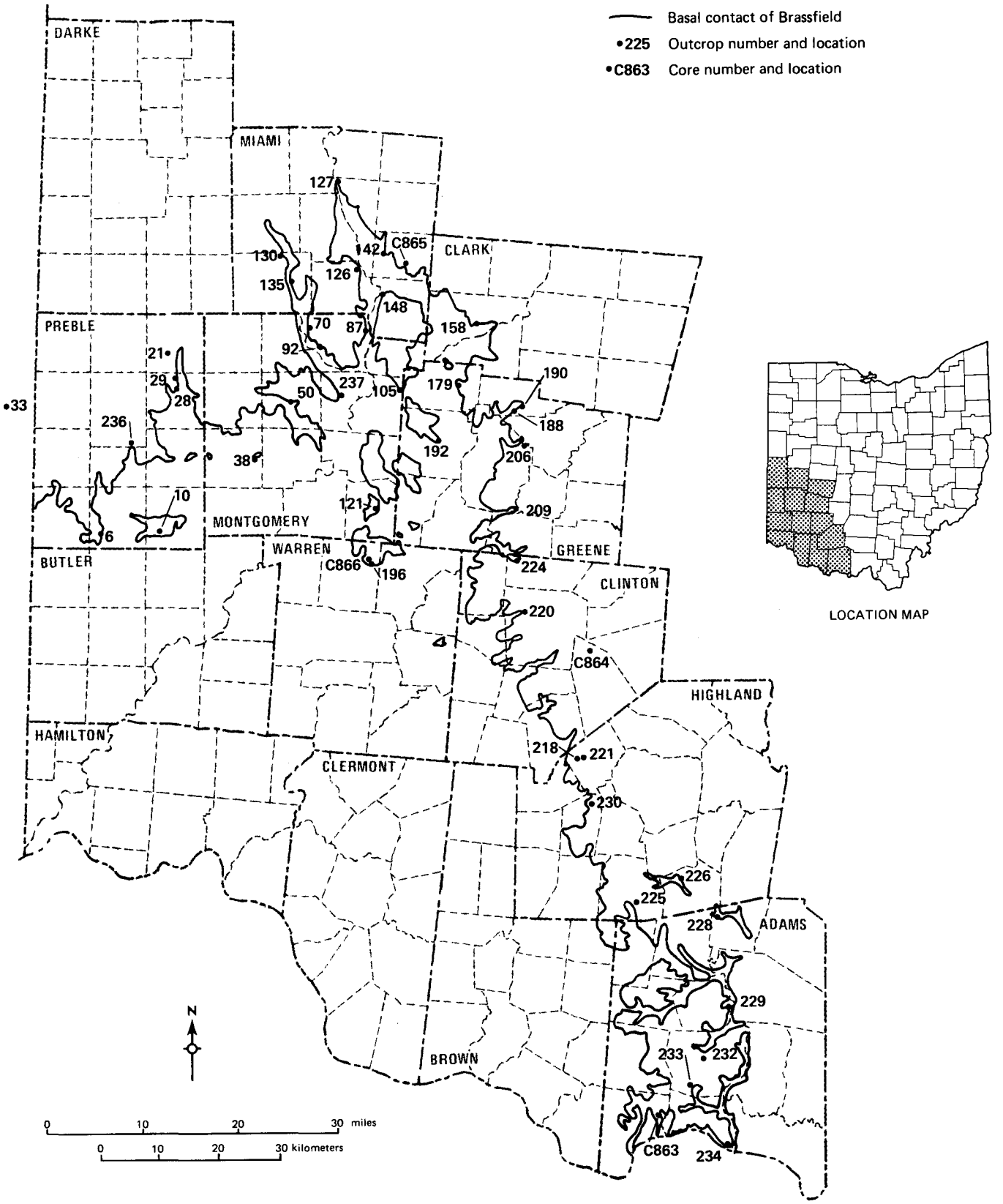

FIGURE 1.–Sample locations and basal contact of Brassfield Formation.

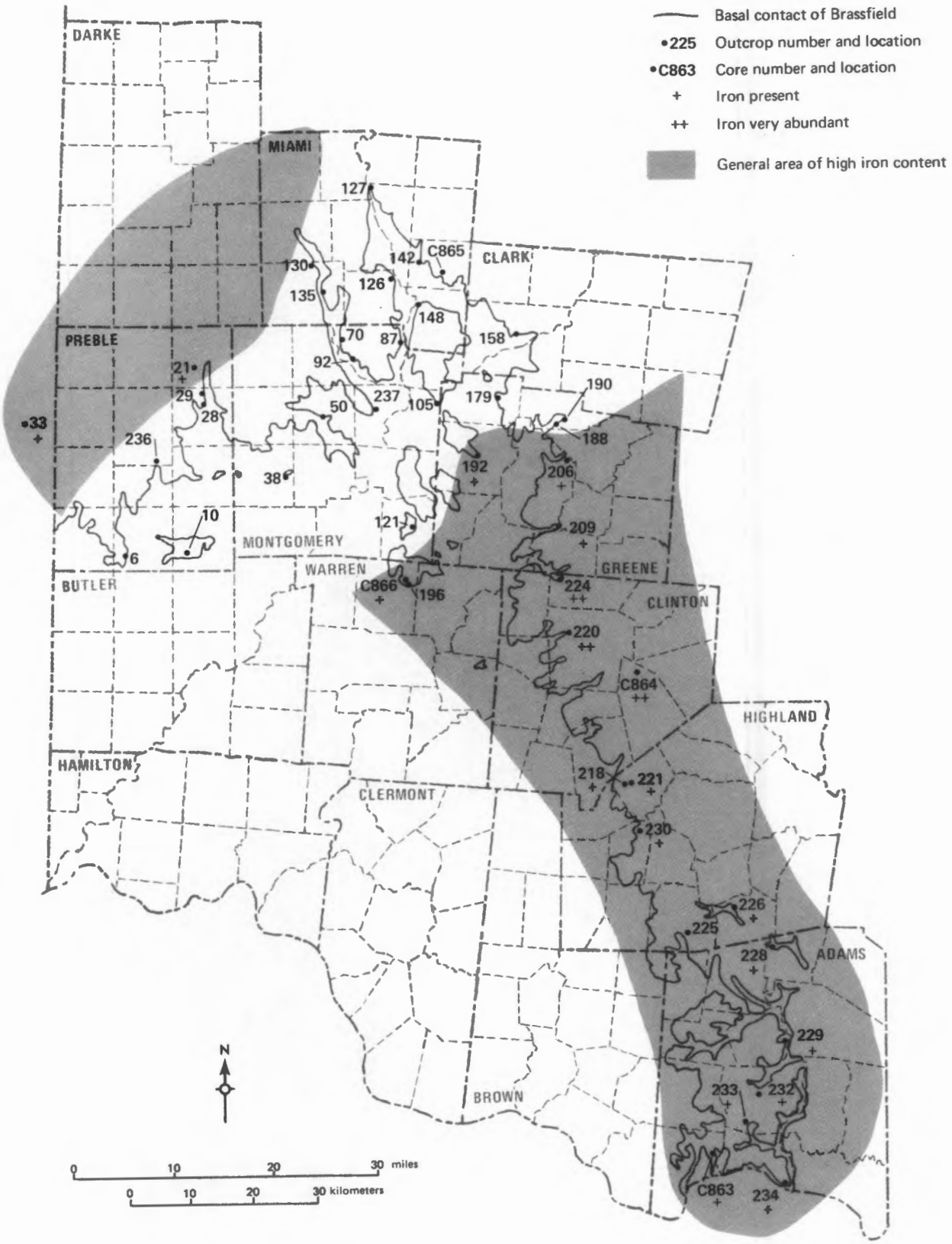

FIGURE 2.–Iron in Brassfield Formation (determined from field descriptions).

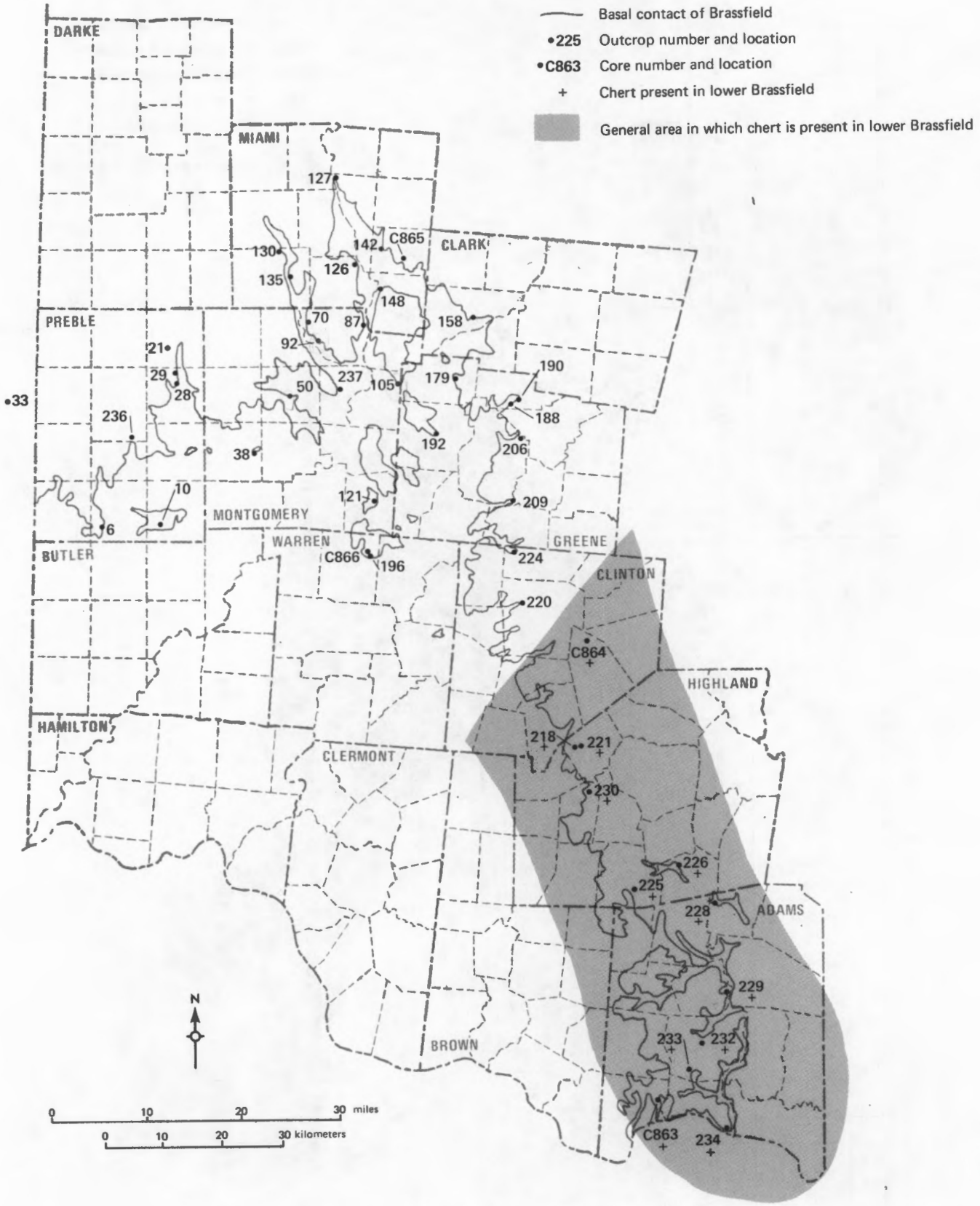

FIGURE 3.–Chert in Brassfield Formation (determined from field descriptions).

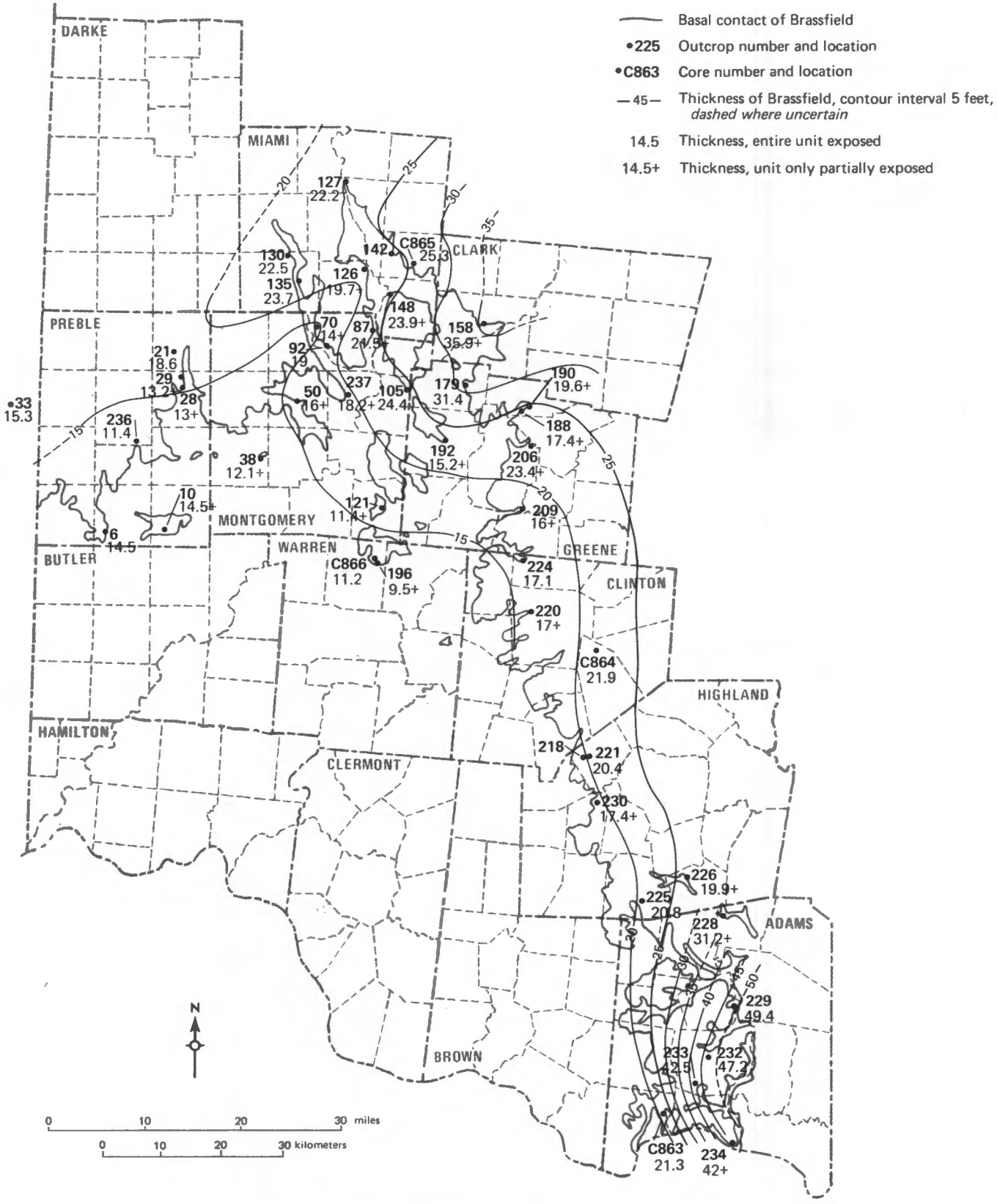

FIGURE 4.–Thickness of Brassfield Formation (less Belfast bed).

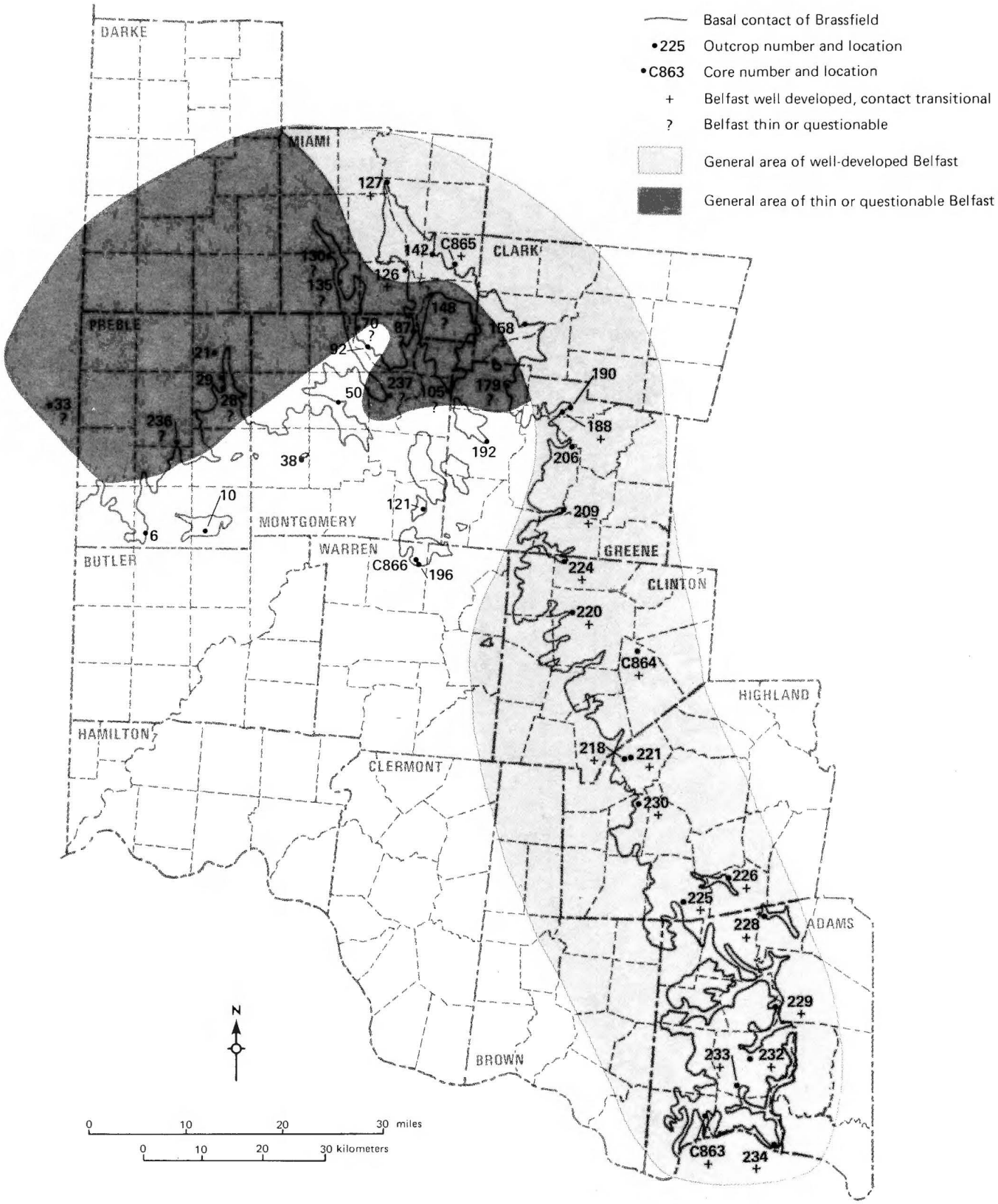

FIGURE 5.–Distribution of Belfast bed (determined from field descriptions).

Cataract Group. Eastward, away from the outcrop, in the subsurface of central and eastern Ohio, the predominantly carbonate rocks of the Brassfield are replaced by the sandstone and shale of the "Clinton." In northern Kentucky and southern Ohio, the Brassfield is disconformably overlain by undifferentiated rocks of the Noland Formation (Rexroad and others, 1965). In northern Adams County, Ohio, the lower part of the Noland Formation wedges out (Horvath, 1967), and the Brassfield is disconformably overlain by the Dayton Member of the Noland. The Dayton attains formational rank north of this area. The Brassfield is underlain by Ordovician rocks of Richmond age. The lower contact appears gradational where the Belfast bed is well developed but may be disconformable (Horvath and Sparling, 1967) or unconformable (Rexroad and others, 1965).

METHODS AND CRITIQUE

ORIGINAL METHODS

Calcium and magnesium data were obtained in 1960 by an analytical method adapted from one used by a major cement company in Ohio. This is an acid/base titration method referred to as the "Newberry" analysis (Newberry, 1903). The procedure used is:

1. Grind sample to <100 mesh.
2. Dry sample.
3. Weigh 0.8000-g sample.
4. Brush sample into 500-ml Erlenmeyer flask.
5. Add 50 ml 0.40 N $HClO_4$ (perchloric acid) from automatic pipette. Record as first acid.
6. Put flask on hot plate and boil not less than 1 minute or more than 2 minutes.
7. Cool flask to room temperature or below (water bath).
8. Add approximately 1 ml phenolphthalein indicator.
9. Titrate with 0.40 N NaOH to definite pink color; record as first alkali.
10. Place flask on hot plate and bring to boil.
11. Add approximately 0.5 ml 0.40 N NaOH and bring to boil.
12. Repeat step 11 until addition of NaOH produces no increase in color. Area around drops of NaOH should assume a definite milky white appearance at this end point. There is little latitude allowed in this end point, and it is fairly difficult to recognize at first. This step precipitates Mg as $Mg(OH)_2$; if the end point is not reached, all the Mg will not be precipitated; if the end point is exceeded too far, some Ca will be precipitated.
13. Add 1.5 ml NaOH in excess in 2 increments with boiling between. Record NaOH used in steps 11, 12, and 13 as second alkali.
14. Bring to boil, remove from hot plate, and filter through Whatman No. 4 paper. Catch filtrate in clean 500-ml Erlenmeyer flask.
15. After original red solution has filtered through, rinse first flask with distilled water and pour into funnel. Use only enough rinse water to fill to the top of the filter paper.
16. Titrate filtrate with 0.40 N $HClO_4$ until colorless. This step neutralizes the excess NaOH added in step 13 and checks the accuracy of the end point in step 12. If less than 1 ml of acid is required to neutralize the NaOH, all the Mg was not precipitated; if more than 2 ml of acid are required, some Ca was precipitated. Either condition indicates the determination is in error. Record as second acid.
17. Factor (reagents and reagent-grade $CaCO_3$ run through step 9) calculations:

50 ml acid - amount (ml) base used = x ml

$$\frac{100\%\ CaCO_3}{x\ ml} = \%\ CaCO_3/ml = CaCO_3\ factor$$

$$CaCO_3\ factor \times \frac{mol.\ wt.\ MgCO_3}{mol.\ wt.\ CaCO_3} = MgCO_3\ factor$$

Sample calculations:

(total acid - total alkali) x $CaCO_3$ factor = % $CaCO_3$ in sample
(second alkali - second acid) x $MgCO_3$ factor = % $MgCO_3$ in sample
100% - (% $CaCO_3$ + % $MgCO_3$) = remainder (% insolubles) in sample

Insoluble residue determinations were made on most of the samples by HCl digestion. This procedure is:

1. Place 50-60 g of sample in 600-ml low-form beaker.
2. Add approximately 260 ml of diluted technical HCl. Diluted technical HCl is prepared by mixing equal amounts of tap water and 20° technical HCl.
3. Allow sample to digest until effervescence ceases. Time for this varies with sample composition but digestion should be complete in 4 hours.
4. Agitate sample and allow to settle approximately 30 seconds.

Fine residue

5. Filter through Whatman No. 4 paper.
6. Rinse residue with approximately 100 ml tap water. Agitate sample and allow to settle approximately 10 seconds. Filter through paper used in step 5. Repeat this step until no particles are suspended in rinse water after 10 seconds (generally 2 or 3 rinses suffice).

Coarse residue

7. Rinse out remaining coarse residue into Whatman No. 4 filter paper.
8. Dry both coarse and fine residues and weigh each to obtain relative amounts. Subtract average weight of filter paper from each total. Save residues.

CHECKS

During a previous evaluation of the Brassfield data, it was noted that there were considerable differences between the acid digestion results and the "Newberry" remainders. In 1969, the "Newberry" analysis method was studied (Stith, open-file information, Ohio Division of Geological Survey). This study evaluated the use of both hydrochloric and perchloric acids, the type of filter paper used, and the effects of the composition (argillaceous content, magnesium percentage, and soluble iron content) of the sample.

In 1975 and 1976, insoluble residue determinations were done on 95 of the samples with the greatest variation in the original data. In general, samples chosen for checking were those whose "Newberry" remainders were 8 percent or more below or 10 percent or more above the original insoluble residue data and which had sufficient material remaining for analysis. These check determinations were made with a variation in the procedure given by Molnia (1974). The samples, approximately 0.5 g for carbonates and 0.25 g for clays and shales, were weighed and then dissolved in beakers in 25% (v/v) HCl. Preweighed membrane filters, 47-mm diameter and 0.45-micron pore size, were used in a Millipore holder with an aspirator to filter the solutions. After air-drying overnight, the filters were weighed and residue percentages calculated.

DISCUSSION

During a previous review of the "Newberry" method, several weaknesses were found when the procedure was applied to a suite of samples of wide-ranging compositions (Stith, open-file information, Ohio Division of Geological Survey). The best results were obtained on rocks containing between 2 and 20 percent $MgCO_3$, less than 15 percent insoluble material, and less than 0.3 percent soluble FeO. Apparent problems in the method as used in 1960 are: no filtration after first acid to remove insolubles; use of only

Whatman No. 4 filter paper to remove $Mg(OH)_2$; and no filtration after first base titration to remove iron hydroxides. If clays are not removed from the suspension, there is a risk of missing the first end point. The Whatman No. 4 paper does not remove all the $Mg(OH)_2$ in samples with over 10 percent $MgCO_3$, and even Whatman No. 1 paper does not filter out all the precipitate on samples that are essentially dolomite. Failure to remove all the $Mg(OH)_2$ commonly results in incorrect analyses (second acid >2 ml). The green to brown precipitate formed by samples high in soluble iron tends to require excess base to form the hydroxides, to obscure the first base end point, to block observation of the second base end point, and to adsorb the phenolphthalein indicator. These effects are noticeable with as little as 0.3 percent soluble FeO (0.5 percent $FeCO_3$) in the sample and are too strong to be remedied by filtration at 1.6 to 1.9 percent soluble FeO (2.5 to 3 percent $FeCO_3$) (Stith, open-file information, Ohio Division of Geological Survey).

After comparing all of the data, a decision was made as to the reliability of the "Newberry" analyses (Appendix A). Weighted averages were then calculated for $MgCO_3$ and insoluble material for each sampled section (Appendix B). The data deemed most reliable, either "Newberry" remainder, insoluble residue, or insoluble residue check (Appendix A), were used for the insoluble material averages. These averages were calculated for each sampled bed and unit by taking the footage interval represented by each sample and finding the corresponding percentage of bed and unit thickness (from measured section and sampling location data on open file) (Appendix C). The weighted percentage represented by each sample was calculated and totaled for each bed and unit. Final unit totals and percentage of total Brassfield thickness gave the total weighted averages for the formation. Where percentages of clay or shale were given in the field notes, the bed and unit analyses were adjusted for the clay analyses.

SUMMARY

Appendix A lists all data generated by the original study, the 1975-76 insoluble residue checks, and the probable reliability of the "Newberry" data. Clay and shale analyses are likely to be questionable because of the high insoluble content. In general, $MgCO_3$ figures less than 20 percent are probably the most accurate, $CaCO_3$ figures tend to be a half to 3 or 4 percent low, and remainder figures tend to be correspondingly high; $MgCO_3$ data greater than 20 percent are probably progressively inaccurate. Remainder figures for samples with very high $MgCO_3$ are generally more inaccurate than figures for samples with moderate or low $MgCO_3$.

The original insoluble residue data appear to be good except for scattered samples and sections 228, 229, and possibly 234. Suspected errors in these data are incomplete digestion, loss of residue by foaming, and incorrect sample numbers. The 1975-76 insoluble residue checks show excellent agreement with the "Newberry" remainders for the purer, less dolomitic samples, but rather ambiguous agreement with the less pure samples (table 1). The data for those samples low in $MgCO_3$ and insoluble material and whose "Newberry" remainders agree well with the acid digestion residue are probably very accurate.

The weighted averages for $MgCO_3$ and insoluble material were calculated for the Brassfield only. Calculations for the Dayton Formation were not included as it was not a complete part of the study, and the Belfast bed was eliminated because of its impurities. Footage intervals (and samples) used for the weighted-average calculations of upper and lower Brassfield units were determined by using the field descriptions. Because the descriptions were not finalized in the original study, the data were used in defining the Belfast and the Dayton in some cases where the field descriptions were questionable.

The maps (figs. 2, 3, and 5) showing the distribution of iron, chert, and the Belfast bed were based on the original field descriptions. The isopach map of the Brassfield Formation (fig. 4) is based on the complete sections, as modified by the incomplete sections and those thought, in the original study, to be nearly complete. Figures 6 and 7 are isopercentage maps based on the total weighted-average figures (Appendix B). Sections 142 and 218 were considered only partially in figures 6 and 7 because they were very short and incomplete. The uppermost 17 feet of section 233 was considered to be the Dayton Formation because of the dolomite and because of correlation problems with previous descriptions of the same outcrop.

TABLE 1.—*Agreement of 1975-76 insoluble residue data with data in original study*

Category	No. samples	1975-76 data agreement (no. samples)		
		"Newberry" remainder	Original insoluble residue	Neither
Total	95	41	42	12
"Newberry" <10% $MgCO_3$	35	27	1	7
"Newberry" >10% $MgCO_3$	60	14	41	5
"Newberry" <10% remainder	15	14	1	0
"Newberry" >10% remainder	80	27	41	12

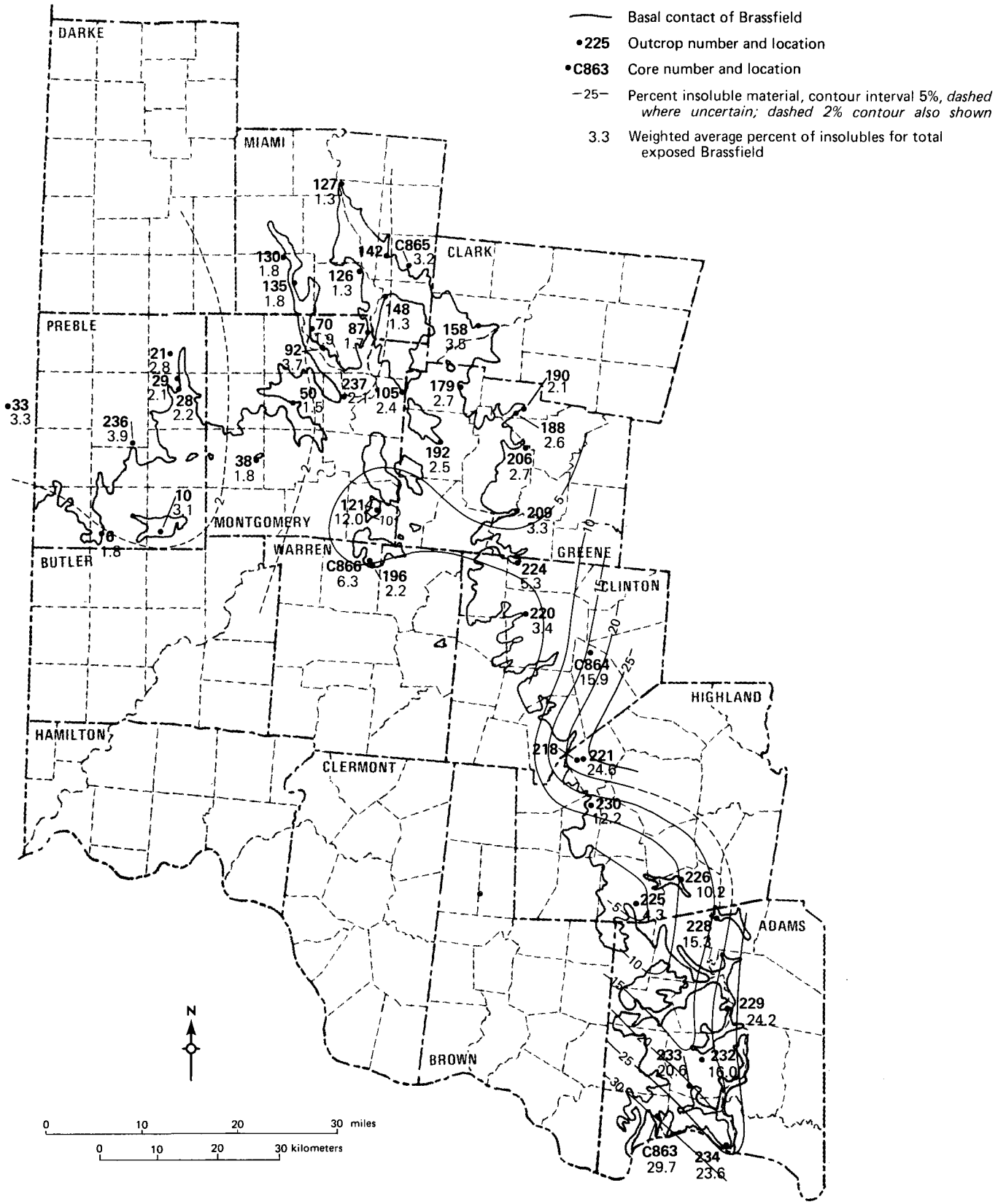

FIGURE 6.–Insoluble material in Brassfield Formation (less Belfast bed).

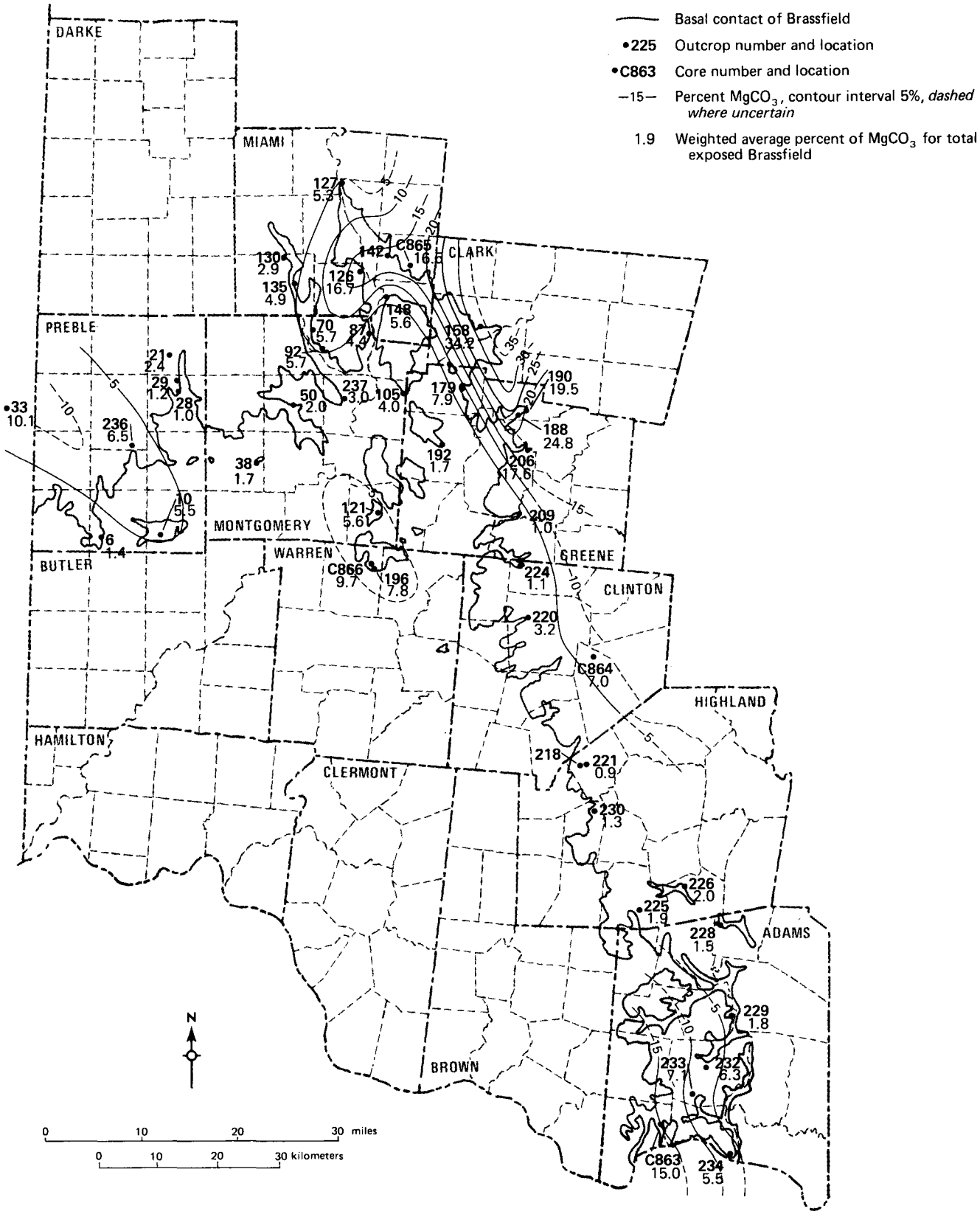

FIGURE 7.–$MgCO_3$ percentage in Brassfield Formation (less Belfast bed).

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APPENDIX A.–ANALYTICAL DATA FOR THE BRASSFIELD FORMATION

NOTE

Insoluble data (insoluble residue, "Newberry" remainder, or 1975-76 insoluble residue) marked with an asterisk are the data used in the weighted average calculations (Appendix B) as based on the authors' opinions of the reliability of the data. Probable reliability of the data is given before each outcrop or core number.

In general, adjacent limestone samples were given consecutive sample numbers; letter suffixes to sample numbers represent clay or shale composites in outcrop sections or clay or shale beds in a given foot of core. Exceptions and variations are too numerous to list. Specific details of sample identification and location within a section can be found in the stratigraphic sections on open file at the office of the Ohio Division of Geological Survey.

Outcrop or core no.	Sample no.	Unit	Original analyses				1975-1976 insoluble residue (%)
			Insoluble residue (%)	Newberry			
				$CaCO_3$ (%)	$MgCO_3$ (%)	Remainder (%)	
Reliability of core 863 is poor							
863	1	Dayton	19.5	44.64	26.56	28.80	
	2		19.0	44.88	25.86	29.26	
	3		95.5	2.04	1.62	96.34	
	4		27.8	39.72	25.76	34.52	
	5		5.0	52.08	31.31	16.61	
	6		4.0	52.92	26.16	20.92	
	7		8.6	49.08	29.09	21.83	
	8		15.4	46.20	27.17	26.63	
	9		81.0	10.80	8.08	81.12	
	10		24.4	41.52	26.66	31.82	
	11		86.6	8.04	6.36	85.60	
	12		12.6	46.68	29.49	23.83	
	13		77.0	13.18	8.79	78.03	
	14		69.6	29.88	16.26	53.86	
	15		10.2	49.32	28.79	21.89	
	16		78.6	7.08	4.85	88.07	
	17		11.0	49.20	26.46	24.34	12.8
	18		6.0	63.24	21.51	15.25	
	19	upper Brassfield	6.2*	81.12	6.26	12.62	
	20		13.4*	51.12	27.47	21.41	
	21		84.4*	3.12	3.13	93.75	
	22		85.0*	6.00	4.65	89.35	
	23		83.0*	6.84	5.05	88.11	
	23A		25.6	40.80	21.92	37.28	24.6*
	24	lower Brassfield	32.6*	36.24	21.51	42.25	
	24A		71.0*	14.64	8.89	76.47	
	25		30.0*	37.44	24.24	38.32	
	26		18.0	44.28	27.17	28.55	18.2*
	27		20.0*	43.08	27.37	29.55	
	27A		59.0*	20.88	15.96	63.16	
	28		25.6	40.44	24.14	35.42	25.7*
	28A		91.6	14.04	8.99	76.97	72.2*
	29		17.4	45.84	25.45	28.71	17.0*
	30		11.6*	50.88	28.48	20.64	
	30A		89.6*	2.88	2.93	94.19	
	31		11.6	49.08	29.80	21.12	13.1*
	31A		73.2	10.20	6.57	83.23	76.8*
	32		7.8	52.80	28.28	18.92	9.8*
	32A			7.56	6.26	86.18*	
	33		10.4	50.04	26.87	23.09	12.3*
	33A		76.7*	8.88	5.66	85.46	
	34		5.6*	56.88	26.06	17.06	
	35		3.4*	85.68	5.45	8.87	
	35A		85.0*	6.24	2.82	90.94	
	35A to 41A (composite)		64.4	18.72	7.47	73.81	
	36		10.4*	71.64	12.22	16.14	
	36A		81.3*	10.80	6.06	83.14	
	37		11.2*	73.68	11.31	15.01	
	37A		72.8	11.52	6.46	82.02	76.7*
	38		11.8*	77.64	6.26	16.10	
	38A		61.0*	26.64	4.44	68.92	
	39		5.4*	86.40	5.05	8.55	
	39A		42.0	7.92	2.02	90.06*	
	40		2.8*	93.96	1.52	4.52	
	40A			2.64	1.21	96.15*	
	41		5.2*	83.28	5.86	10.86	
	41A		75.7	4.56	2.62	92.82	87.4*
	42	Belfast	5.0	73.08	17.27	9.65	
	43		12.0	52.68	29.39	17.93	
	44		12.5	53.52	26.87	19.61	
	44A			26.16	12.32	61.52	
	45		16.5	51.36	23.33	25.31	
	46		18.5	37.72	18.58	43.70	
	47		25.5	52.56	15.96	31.48	
	47A		61.5	16.80	9.09	74.11	69.6
	48		28.5	41.76	22.02	36.22	
	49		21.5	43.92	24.85	31.23	23.2
	50		21.5	45.48	24.24	30.28	
	51	Elkhorn	66.5	20.16	9.09	70.75	
	52		71.0	12.72	8.08	79.20	
	53		69.5	10.40	6.36	83.24	77.6
Reliability of core 864 is poor for samples 1-11 and 36-43, fair for samples 12-22, good for samples 23-35							
864	1	Dayton	11.5	48.24	32.32	19.44	
	2		6.5	50.88	35.35	13.77	
	3		7.5	51.12	34.34	14.54	
	4		7.5	50.88	35.55	13.57	
	5		2.5	52.08	38.38	9.54	
	6		3.0	52.80	34.34	12.86	
	7		4.0	52.08	30.91	17.01	

Outcrop or core no.	Sample no.	Unit	Original analyses				1975-1976 insoluble residue (%)
			Insoluble residue (%)	Newberry			
				$CaCO_3$ (%)	$MgCO_3$ (%)	Remainder (%)	
	8		3.5	53.52	27.67	18.81	
	9		4.0	54.48	30.30	15.22	
	10		7.0	55.56	30.30	14.14	
	11		6.0	57.24	30.00	12.76	
	12		7.5	90.72	1.72	7.56	
	13	upper Brassfield	13.0*	81.60	4.04	14.36	
	14		76.5*	15.48	4.95	79.57	
	15		33.0*	53.64	7.68	38.68	
	16		24.0*	61.68	5.56	32.76	
	16A		72.0*	14.76	6.87	78.37	
	17		21.5*	69.36	5.25	25.39	
	18		10.5*	73.56	9.49	16.95	
	19		5.5*	73.32	14.65	12.03	
	20		3.5	56.64	27.07	16.29	3.4*
	20A		82.5*	9.84	5.86	84.30	
	21		20.0*	50.28	23.53	26.19	
	22		27.0*	67.44	4.85	27.71	
	23	lower Brassfield	5.5	87.84	5.45	6.71*	
	23A			10.92	6.57	82.51*	
	24		8.5	86.04	4.04	9.92*	
	24A		87.5	9.60	3.84	86.56*	
	25		6.0	89.40	2.73	7.87*	
	26		6.0	90.00	2.22	7.78*	
	26A		23.0	68.28	3.94	27.78*	
	27		5.5	92.52	1.82	5.66*	
	27A		65.0	34.32	2.12	63.56*	
	28		8.0	86.88	3.43	9.69*	
	28A		89.0	10.08	2.12	87.80*	
	29		9.0	86.52	3.43	10.05*	
	29A			25.92	3.74	70.34*	
	30		6.5	93.36	1.62	5.02*	
	30A			20.88	2.82	76.30*	
	31		5.5	84.84	6.36	8.80*	
	32		13.0	81.72	2.63	15.65*	
	32A			8.40	2.42	89.18*	
	33		4.0	89.64	4.64	5.72*	
	34		2.0	83.40	11.62	4.98*	
	34A		90.2	2.52	1.92	95.56*	
	35		3.0	87.72	6.97	5.31*	
	36	Belfast	18.5	62.16	16.36	21.48	
	37		16.5	47.40	26.56	26.04	17.9
	38		23.0	44.28	26.06	29.66	
	39		14.0	50.04	30.20	19.76	
	40		20.5	46.08	27.88	26.04	
	41		18.5	46.68	28.08	25.24	
	42		24.0	42.96	26.26	30.78	
	43		31.5	37.80	24.14	38.06	
Reliability of core 865 is good							
865	1	Dayton	6.5	52.32	37.77	9.91	
	2		10.5	50.28	36.46	13.26	
	2A		56.1	23.40	18.88	57.72	
	3		17.5	47.64	34.44	17.92	
	4		18.0	47.28	33.13	19.59	
	5		21.0	42.84	33.13	24.03	
	6		21.5	42.96	32.93	24.11	
	6A			30.12	24.14	45.74	
	7		24.0	43.68	32.32	24.00	
	8		21.0	44.88	32.83	22.29	
	9		18.5	45.36	32.93	21.71	
	10		20.5	44.76	32.22	23.02	

Outcrop or core no.	Sample no.	Unit	Original analyses				1975-1976 insoluble residue (%)
			Insoluble residue (%)	Newberry			
				$CaCO_3$ (%)	$MgCO_3$ (%)	Remainder (%)	
	11		19.0	45.96	32.83	21.21	
	12		17.0	47.64	33.04	19.32	
	13		10.5	51.00	35.35	13.65	
	14		4.5	55.92	33.94	10.14	
	15		14.0	55.20	33.94	10.86	
	16		9.0	56.40	33.33	10.27	
	17		9.5	58.80	29.69	11.51	
	18	upper Brassfield	1.5	94.68	3.94	1.38*	—
	19		2.0	92.52	5.76	1.72*	
	20		1.5	94.44	2.53	3.03*	
	21		4.0	90.72	4.44	4.84*	
	22		2.0	89.88	7.27	2.85*	
	23		2.0	91.80	4.34	3.86*	
	24		2.0	87.24	9.80	2.96*	
	25		4.5	82.56	13.84	3.60*	
	26		2.5	84.48	11.72	3.80*	
	27		2.0	92.76	4.75	2.49*	
	28	lower Brassfield	2.5	90.72	7.88	1.40*	
	29		2.5	89.88	8.38	1.74*	
	30		1.0	88.92	10.00	1.08*	
	31		1.5	86.64	11.72	1.64*	
	32		1.5	87.12	10.91	1.97*	
	33		2.5	91.08	7.47	1.45*	
	34		1.5	91.08	7.47	1.45*	—
	35		1.5	73.08	23.84	3.08*	
	36		2.5	86.64	11.72	1.64*	
	37		3.5	79.44	17.17	3.39*	
	38		2.0	79.44	18.48	2.08*	
	39		2.5	57.12	38.18	4.70*	
	40		2.5	55.08	39.69	5.23*	
	41		2.5	54.60	38.89	6.51*	
	42		3.5	54.72	39.79	5.49*	
	43		2.0	54.48	40.00	5.52*	
	44		3.0	54.48	38.78	6.74*	
	45	Belfast	17.5	47.88	31.61	20.51	
	46		24.0	43.68	30.50	25.82	
	47		25.0	43.80	29.39	26.81	
	48		27.5	43.56	26.97	29.47	
Reliability of core 866 is good							
866	1	Dayton	18.0	50.16	29.29	20.55	
	1A		62.0	17.40	10.61	71.99	
	2		11.5	50.64	30.50	18.86	
	3	upper Brassfield	8.0	85.80	6.36	7.84*	—
	4		7.5	84.12	3.33	12.55*	
	5		6.0	87.72	3.33	8.95*	
	5A		62.5	23.52	7.68	68.80*	
	6	lower Brassfield	1.0	94.08	3.64	2.28*	
	7		2.0	82.20	14.37	3.43*	
	8		2.0	85.20	10.40	4.40*	
	9		2.5	87.12	8.69	4.19*	
	10		1.5	78.48	15.76	5.76*	
	11		1.0	79.68	14.54	5.78*	
	12		2.5	83.76	12.02	4.22*	
	13		2.0	83.52	11.72	4.76*	—
	14	Elkhorn	36.5	33.60	20.81	45.59	
	15		25.5	51.96	19.29	28.75	
	16		37.5	49.92	12.32	37.76	
	17		37.5	41.40	19.49	39.11	
	18		42.0	34.08	20.30	45.62	
	19		32.0	46.32	16.56	37.12	

Outcrop or core no.	Sample no.	Unit	Original analyses: Insoluble residue (%)	Newberry: $CaCO_3$ (%)	Newberry: $MgCO_3$ (%)	Newberry: Remainder (%)	1975-1976 insoluble residue (%)
Reliability of section 6 is very good							
6	1	lower Brassfield		91.20	4.85	3.95*	–
	2			93.48	5.15	1.37*	
	3			97.20	1.52	1.28*	
	4			99.00	0.61	0.39*	
	5			98.98	0.61	0.41*	
	6			97.68	1.01	1.31*	
	7			97.92	0.71	1.37*	
	8			97.92	0.51	1.57*	
	9			98.40	0.51	1.09*	
	10			97.80	0.51	1.69*	
	11	upper Brassfield		95.16	1.92	2.92*	
	12			98.04	0.51	1.45*	
	13			95.76	0.81	3.43*	
	14			96.48	1.41	2.11*	
	15			97.32	0.71	1.97*	
	16			95.52	2.02	2.46*	
	17			91.32	4.24	4.44*	–
	18	Dayton		56.28	33.73	9.99	
Reliability of section 10 is good							
10	1	lower Brassfield		89.64	7.98	2.38*	
	2			90.72	6.26	3.02*	
	3			93.72	4.65	1.63*	
	4			88.92	7.98	3.10*	
	5			92.04	6.36	1.60*	
	6			97.68	0.81	1.51*	
	7			98.40	0.61	0.99*	
	8		2.4	98.52	0.71	0.77*	
	9	upper Brassfield		94.08	2.63	3.29*	
	10			92.16	3.84	4.00*	
	11			75.72	15.86	8.42*	
	12		2.6	96.00	0.81	3.19*	
	13		6.2	84.36	9.39	6.25*	
	14		2.0	93.96	1.11	4.93*	
	14A		90.0	10.08	2.22	87.70	
	15		1.4	97.44	0.61	1.99*	
	16		1.0	72.00	22.62	5.38*	
Reliability of section 21 is very good							
21	1	lower Brassfield	12.0	94.56	3.03	2.41	1.6*
	2		0.2	97.32	0.71	1.97*	
	3		<0.1	89.16	6.26	4.58*	
	4		<0.1	99.00	0.61	0.39*	
	5		<0.1	99.36	0.61	0.03*	
	6		<0.1	95.04	3.65	1.31*	
	7		3.6	80.16	11.92	7.92*	
	8		<0.1	98.40	0.61	0.99*	
	9		<0.1	98.28	0.71	1.01*	
	10		<0.1	98.40	0.81	0.79*	
	11		<0.1	98.52	0.71	0.77*	
	12		<0.1	98.40	0.40	1.20*	
	13		0.2	97.20	1.41	1.39*	
	14	upper Brassfield	0.6	98.04	0.61	1.35*	
	15		7.0	97.20	1.01	1.79	1.4*
	16		1.0	96.96	1.21	1.83*	
	17		1.6	96.84	0.91	2.25*	
	18		11.2	68.88	1.21	29.91*	
	19		3.8	94.32	1.01	4.67*	
	20		2.0	95.88	0.61	3.51*	
	21		1.0	95.52	1.11	3.37*	
	22		4.4	89.16	5.76	5.08*	
	23		21.4	54.48	19.19	26.33*	
	24	Dayton	10.2	51.60	29.29	19.11	
Reliability of section 28 is very good							
28	1	Elkhorn	9.0	86.76	1.11	12.13	
	2	Belfast?	3.8	91.92	2.02	6.06	
	3	lower Brassfield	<0.1	95.04	2.02	2.94*	
	4		2.0	96.72	0.61	2.67*	
	5		0.4	97.44	1.41	1.15*	
	6		<0.1	97.44	0.81	1.75*	
	7		4.0	92.28	3.03	4.69*	
	8		1.4	98.40	0.40	1.20*	
	9		<0.1	96.84	0.71	2.45*	
	10		0.2	99.00	0.51	0.49*	
	11		1.0	94.68	0.71	4.61*	
	12		1.0	97.92	0.61	1.47*	
	13		2.3	96.72	0.61	2.67*	
	14	upper Brassfield	1.5	96.96	0.71	2.33*	
	15		0.3	97.68	0.61	1.71*	
Reliability of section 29 is very good							
29	1	lower Brassfield	0.4	92.16	6.46	1.38*	
	2		0.4	97.56	0.61	1.83*	
	3		0.4	98.40	0.61	0.99*	
	4		0.4	98.52	0.61	0.87*	
	5		0.2	97.44	0.51	2.05*	
	6		0.2	98.16	0.71	1.13*	
	7		0.4	98.16	0.61	1.23*	
	8		0.8	98.52	0.71	0.77*	
	9	upper Brassfield	3.4	96.24	0.81	2.95*	
	10		2.4	96.72	1.01	2.27*	
	11		2.8	96.00	0.81	3.19*	
	12		0.6	94.44	2.93	2.63*	
	13		2.2	95.52	0.81	3.67*	
	14		3.8	96.84	1.01	2.15*	
	15		5.8	93.48	0.91	5.61*	
	15A		62.0	32.88	3.64	63.48	
Reliability of section 33 is fair to good							
33	1	Elkhorn	73.5	18.24	8.48	73.28	
	2	Belfast?	52.8	24.00	15.76	60.24	
	3		15.0	50.64	28.48	20.88	
	4	lower Brassfield	18.8*	45.84	29.90	24.26	
	5		1.4*	65.28	26.16	8.56	
	6		2.0*	88.08	8.18	3.74	
	7		1.4*	81.60	13.13	5.27	
	8		1.2*	92.40	5.66	1.94	
	9		1.6*	94.32	1.62	4.06	
	10		1.2*	96.84	1.41	1.75	
	11		1.6*	96.00	2.93	1.07	
	12		3.4*	82.44	13.13	4.43	
	13		1.2*	98.40	0.41	1.19	
	14		3.6*	87.24	8.18	4.58	
	15	upper Brassfield	2.2*	96.48	1.01	2.51	
	16		6.6*	53.28	34.54	12.18	
	17		3.2*	77.28	16.77	5.95	
	18		2.8*	87.12	10.20	2.68	
	19		3.2*	96.72	1.41	1.87	
	20		3.4*	97.20	1.21	1.59	
	21		6.8*	84.60	11.41	3.99	
	22	Dayton	12.8	54.36	30.91	14.73	

Outcrop or core no.	Sample no.	Unit	Original analyses: Insoluble residue (%)	Newberry: $CaCO_3$ (%)	Newberry: $MgCO_3$ (%)	Newberry: Remainder (%)	1975-1976 insoluble residue (%)
Reliability of section 38 is very good							
38	1	Elkhorn	56.5	27.24	14.14	58.62	
	2	lower Brassfield	4.6	90.60	0.51	8.89*	
	3		1.0	95.64	2.73	1.63*	
	4		1.2	94.32	3.43	2.25*	
	5		1.4	90.60	7.47	1.93*	
	6		1.2	96.72	2.22	1.06*	
	7		1.2	97.68	1.01	1.31*	
	8		0.8	98.76	0.61	0.63*	
	9		0.8	98.88	0.40	0.72*	
	10		1.0	98.40	0.51	1.09*	
	11		5.6	97.20	0.81	1.99*	
	12		0.8	98.40	0.61	0.99*	
	13	upper Brassfield	1.2	98.28	0.61	1.11*	
	14		1.4	97.80	0.30	1.90*	
	15		2.8	96.36	0.51	3.13*	
Reliability of section 50 is very good							
50	1	lower Brassfield	0.8	97.92	0.81	1.27*	
	2		0.8	97.32	2.11	0.57*	
	3		0.6	97.56	1.01	1.43*	
	4		1.0	83.04	14.14	2.82*	
	5		1.8	94.44	3.74	1.82*	
	6		1.0	98.04	0.71	1.25*	
	7		0.8	97.68	1.21	1.11*	
	8		1.0	94.68	2.53	2.79*	
	9		0.6	97.92	1.01	1.07*	
	10		0.8	97.20	1.82	0.98*	
	11		0.8	98.64	0.40	0.96*	
	12		0.6	98.40	0.61	0.99*	
	13		0.8	98.40	0.61	0.99*	
	14		1.0	98.04	0.81	1.15*	
	15	upper Brassfield	0.4	98.88	0.51	0.61*	
	16		2.2	97.20	0.61	2.19*	
	17		2.4	95.76	0.61	3.63*	
Reliability of section 70 is good							
70	1	Elkhorn	28.6	41.64	24.34	34.02	
	2	Belfast?	23.6	55.08	27.57	17.35	
	3	lower Brassfield	1.4	97.20	1.82	0.98*	
	4		1.6	92.76	5.76	1.48*	
	5		1.2	85.32	10.71	3.97*	
	6		1.6	90.72	7.47	1.81*	
	7		0.6	94.20	4.24	1.56*	
	8		0.6	95.76	2.53	1.71*	
	9		0.6	89.28	9.60	1.12*	
	10		0.6	81.48	15.96	2.56*	
	11		0.6	94.80	4.04	1.16*	
	12		0.6	88.56	10.50	0.94*	
	13		1.0	97.92	1.21	0.87*	
	14	upper Brassfield	1.6	97.56	1.11	1.33*	
	15		4.4	92.16	4.44	3.40*	
	16		3.0	94.32	3.03	2.65*	
	17		1.2	97.85	0.61	1.54*	
	18		1.2	97.56	0.91	1.53*	
	19		2.0	96.96	0.61	2.43*	
	20	Dayton (float)	4.2	82.56	13.33	4.11	
Reliability of section 87 is very good for samples 9-32, good for samples 1-8							
87	1	Belfast?	29.4	34.44	25.05	40.51	36.9
	2		35.2	39.84	27.98	32.18	
	3		25.6	41.52	29.29	29.19	
	4		23.8	42.12	29.69	28.19	
	5		20.0	44.88	31.21	23.91	
	6		15.0	49.80	31.01	19.19	
	7		20.0	49.92	28.08	22.00	
	8		15.8	53.04	28.48	18.48	
	9	lower Brassfield	0.2	87.60	10.20	2.20*	
	10		0.2	89.28	9.09	1.63*	
	11		0.2	96.60	2.73	0.67*	
	12		0.6	93.36	5.86	0.78*	
	13		0.2	92.64	6.46	0.90*	
	14		0.2	98.40	1.01	0.59*	
	15		3.8	82.80	10.91	6.29*	
	16		1.2	96.74	2.73	0.53*	
	17		0.4	91.68	6.46	1.86*	
	18		0.6	98.40	1.01	0.59*	
	19		0.6	81.12	16.46	2.42*	
	20		1.0	90.12	7.98	1.90*	
	21		0.4	98.88	0.61	0.51*	
	22		0.2	99.12	0.71	0.17*	
	23	upper Brassfield	1.8	93.96	2.73	3.31*	
	24		1.2	98.04	0.71	1.25*	
	25		1.6	94.44	4.55	1.01*	
	26		1.4	95.28	3.03	1.69*	
	27		1.4	94.56	3.84	1.60*	
	28		1.8	96.48	1.01	2.51*	
	29		2.2	96.96	0.61	2.43*	
	30		2.0	96.36	0.71	2.93*	
	31		2.0	97.32	0.61	2.07*	
	32		2.4	92.16	3.84	4.00*	
Reliability of section 92 is good							
92	1	lower Brassfield		92.64	4.44	2.92*	
	2		1.2	92.04	6.36	1.60*	
	3		1.2	93.48	5.15	1.37*	
	4		1.0	97.20	1.52	1.28*	
	5		0.6	86.28	11.51	2.21*	
	6		0.6	83.16	14.04	2.80*	
	7		0.8	98.88	0.61	0.51*	
	8		1.0	97.68	1.62	0.70*	
	9		1.0	80.64	15.96	3.40*	
	10		0.8	89.40	9.19	1.41*	
	11		1.0	96.48	2.32	1.20*	
	12		0.8	79.44	17.68	2.88*	
	13		0.8	98.76	0.71	0.53*	
	14		2.8	82.80	8.89	8.31*	
	15	upper Brassfield	2.8	96.72	0.81	2.47*	
	16		2.0	96.96	0.91	2.13*	
	17		3.2	96.60	0.51	2.89*	
	18		4.2	95.40	1.41	3.19*	
	19		3.2	90.48	5.66	3.86*	
	20		4.2	94.32	2.12	3.56*	
	21		5.0	93.72	1.52	4.76*	
	22		35.0	63.36	4.85	31.79*	
	23	Dayton	7.4	52.92	30.50	16.58	
Reliability of section 105 is good for samples 3-28, fair for samples 1, 2, 28B, 29, 30							
105	1	Belfast?	18.2	46.80	23.84	29.36	24.9
	2		6.0	52.56	31.41	16.03	11.6
	2A		0.8	86.40	11.21	2.39	
	3	lower Brassfield	0.4	93.00	6.16	0.84*	
	4		0.4	96.36	1.62	2.02*	

Outcrop or core no.	Sample no.	Unit	Original analyses: Insoluble residue (%)	Newberry: $CaCO_3$ (%)	Newberry: $MgCO_3$ (%)	Newberry: Remainder (%)	1975-1976 insoluble residue (%)
	5		0.4	88.68	8.89	2.43*	
	6		1.0	80.64	15.96	3.40*	
	7		0.6	84.00	12.73	3.27*	
	8		0.6	95.28	3.43	1.29*	
	9		2.2	80.16	15.96	3.88*	
	10		0.6	90.48	8.08	1.44*	
	11		1.2	97.56	1.52	0.92*	
	12	upper Brassfield	2.8	96.48	1.11	2.41*	
	13		1.8	92.52	3.43	4.05*	
	14		1.4	96.36	1.31	2.33*	
	15		2.0	97.20	1.01	1.79*	
	16		1.6	97.80	0.51	1.69*	
	17		1.4	96.72	1.72	1.56*	
	18		1.2	97.20	0.61	2.19*	
	19		1.8	97.44	1.01	1.55*	
	20		2.0	96.24	1.62	2.14*	
	21		1.0	95.52	0.81	3.67*	
	22		1.6	96.72	2.02	1.26*	
	23		3.0	90.96	6.26	2.78*	
	24		1.8	97.92	0.81	1.27*	
	25		3.2	93.00	2.53	4.47*	
	26		2.4	96.48	1.21	2.31*	
	27		3.2	95.28	1.01	3.71*	
	28		3.2	95.76	1.01	3.23*	
	28B		96.8	16.44	2.73	80.83	
	29	Dayton	7.0	54.84	31.82	13.34	
	30		8.0	54.84	33.23	11.93	
Reliability of section 121 is fair to good							
121	1	lower Brassfield	1.2*	90.24	7.47	2.29	
	2		0.8*	80.64	13.94	5.42	
	3		0.8*	97.44	0.81	1.75	
	4		1.6*	90.96	6.87	2.17	
	5		6.2*	82.92	12.42	4.66	
	6		2.2*	85.92	9.90	4.18	
	7		1.6*	96.12	1.82	2.06	
	7A		39.5*	34.56	20.81	44.63	
	8	upper Brassfield	2.2*	97.44	1.01	1.55	
	9		4.0*	94.80	1.62	3.58	
	10		5.4*	94.08	1.01	4.91	
	11		96.5*	1.78	0.02	98.20	
	12		6.8*	92.40	1.01	6.59	
	13		99.0*	1.58	0.02	98.40	
	14	Dayton	6.4	91.32	1.31	7.37	
	15		2.8	86.40	8.28	5.32	
Reliability of section 126 is fair to good							
126	1	Elkhorn	21.6	45.36	27.27	27.37	
	2	Belfast	9.2	54.48	32.12	13.40	
	3		14.8	51.60	31.71	16.69	
	4		13.2	48.24	29.49	22.27	
	5	lower Brassfield	6.0*	78.36	18.28	3.36	
	6		0.8*	91.44	7.27	1.29	
	7		0.6*	78.84	17.78	3.38	
	8		0.6*	63.12	30.30	6.58	
	9		2.6*	61.80	31.71	6.49	
	10		1.0*	90.96	8.28	0.76	
	11		0.6*	68.04	27.37	4.59	
	12		1.0*	90.84	6.57	2.59	
	13		1.2*	95.76	3.23	1.01	
	14		0.8*	54.48	38.99	6.53	
	15		1.0*	53.40	39.09	7.51	
	16		0.8*	97.92	1.41	0.67	
	17		1.4*	90.96	7.68	1.36	
	18		0.8*	83.28	15.35	1.37	
	19	upper Brassfield	1.8*	91.92	5.86	2.22	
Reliability of section 127 is good							
127	1	Belfast?	25.2	42.84	26.77	30.39	
	3	lower Brassfield	0.6	91.92	6.87	1.21*	
	4		0.6*	83.52	14.54	1.94	
	5		0.6	69.24	26.97	3.79*	
	6		0.6	90.48	8.38	1.14*	
	7		0.6	92.52	6.26	1.22*	
	8		0.4	95.52	3.23	1.25*	
	9		0.4	97.92	1.82	0.26*	
	10		0.4	98.64	1.21	0.15*	
	11		2.2	93.60	4.04	2.36*	
	12		0.4	96.96	2.02	1.02*	
	13		0.4	95.76	3.03	1.21*	
	14		0.4	95.04	4.44	0.52*	
	15		0.4	99.12	0.61	0.27*	
	16		2.0	81.48	15.86	2.66*	
	17		0.6	98.40	0.81	0.79*	
	18		0.4	97.80	1.52	0.68*	
	19		0.4	98.88	0.61	0.51*	
	20		0.6	98.28	1.01	0.71*	
	21		0.8	98.64	1.31	0.05*	
	22		0.6	98.52	0.81	0.67*	
	23		0.6	98.40	0.71	0.89*	
	24		0.8	99.00	0.51	0.49*	
	25	upper Brassfield	3.2	91.92	5.05	3.03*	
	26		4.8	66.12	22.32	11.56*	
	27		6.6	94.68	3.54	1.78*	
	28	Dayton	9.0	60.24	22.62	17.14	
	29		6.4	60.72	28.08	11.20	
Reliability of section 130 is good for samples 5-28, fair for samples 1-4, 29, 30							
130	1	Elkhorn?	35.4	36.96	21.21	41.83	
	2	Belfast?	43.0	33.36	19.80	46.84	
	3		30.6	40.20	26.16	33.64	
	4		21.0	45.36	27.17	27.47	
	5	lower Brassfield	8.6*	62.40	24.24	13.36	
	6		1.0	88.92	8.99	2.09*	
	7		0.6	96.24	2.63	1.13*	
	8		0.4	98.04	1.31	0.65*	
	9			98.52	1.21	0.27*	
	10		0.8	94.08	4.85	1.07*	
	11		0.8	97.44	2.12	0.44*	
	12		0.4	96.84	2.53	0.63*	
	13		0.4	98.88	0.91	0.21*	
	14		0.4	99.00	0.51	0.49*	
	15		0.4	98.64	0.81	0.55*	
	17		0.4	98.64	0.40	0.96*	
	18		0.6	98.04	1.62	0.34*	
	19		3.8	97.08	2.02	0.90*	
	20		4.2	97.68	1.41	0.91*	
	21		11.2	98.16	0.61	1.23*	0.7
	22	upper Brassfield	25.0	96.72	1.41	1.87*	1.6
	23		5.4	93.84	1.82	4.34*	
	24		2.0	96.12	0.91	2.97*	
	25		1.6	91.80	3.13	5.07*	
	26		1.2	93.87	2.74	3.39*	

Outcrop or core no.	Sample no.	Unit	Original analyses: Insoluble residue (%)	Newberry: $CaCO_3$ (%)	Newberry: $MgCO_3$ (%)	Newberry: Remainder (%)	1975-1976 insoluble residue (%)
	27		1.6	83.64	11.01	5.35*	
	28		0.6	94.68	1.51	3.81*	
	29	Dayton	2.2	57.60	33.94	8.46	
	30		1.6	59.28	28.68	12.04	8.5
Reliability of section 135 is good							
135	1	Belfast?	1.0	33.24	20.20	46.56	40.8
	2	lower Brassfield	21.0	65.40	20.91	13.69*	10.1
	3		6.0	90.00	7.27	2.73*	
	4		2.2	96.48	3.03	0.49*	
	5		4.8	94.08	4.85	1.07*	
	6		4.4	88.32	9.49	2.19*	
	7		4.4	93.96	4.55	1.49*	
	8		2.0	73.38	22.03	4.59*	
	9		1.0	96.00	3.64	0.36*	
	10		1.0	97.20	1.82	0.98*	
	11		1.4	90.84	6.36	2.80*	
	12		1.4	98.04	1.01	0.95*	
	13		1.2	90.48	7.88	1.64*	
	14		1.0	94.92	4.14	0.94*	
	15		0.6	87.72	10.61	1.67*	
	16		0.8	99.00	0.61	0.39*	
	17		1.0	98.40	1.01	0.59*	
	18		1.8	91.34	6.09	2.57*	
	19	upper Brassfield	3.6	97.97	0.71	1.32*	
	20		1.0	98.33	1.02	0.65*	
	21		2.2	96.52	0.71	2.77*	
	22		2.0	97.61	0.81	1.58*	
	23		2.8	98.09	0.81	1.10*	
	24		2.2	97.12	1.42	1.46*	
	25		2.4	97.97	0.51	1.52*	
	26		3.2	89.53	9.24	1.23*	
	27	Dayton	8.4	59.89	31.47	8.64	
	28		11.2	53.98	32.89	13.13	
Reliability of section 142 is very good							
142	1	lower Brassfield	0.8*	98.38	1.62	0.00	
	2		1.2	98.33	1.42	0.25*	
	3		1.0	96.00	2.83	1.17*	
	4		1.4	94.44	4.55	1.01*	
	5	upper Brassfield	1.8	98.21	0.91	0.88*	
	6		1.0	98.09	1.22	0.69*	
	7		1.6	98.09	0.61	1.30*	
	8		3.8	93.27	1.02	5.71*	
	9		1.8	97.00	1.12	1.88*	
Reliability of section 148 is very good							
148	1	Belfast?	2.8	94.80	0.81	4.39	
	2	lower Brassfield	1.8	77.52	18.18	4.30*	
	3		0.6	79.56	17.88	2.56*	
	4		0.8	89.28	9.70	1.02*	
	5		1.2	81.24	16.26	2.50*	
	6		0.8	89.40	9.49	1.11*	
	7		1.0	94.80	4.55	0.65*	
	8		1.0	94.08	5.05	0.87*	
	9		0.8*	97.17	2.83	0.00	
	10		1.0	94.20	5.66	0.14*	
	11		1.4*	98.52	1.31	0.17	
	12		1.2*	92.88	6.67	0.45	
	13		1.2	92.88	6.26	0.86*	
	14		1.0	90.60	9.19	0.21*	
	15		1.2	79.56	18.99	1.45*	
	16		1.2*	98.99	1.01	0.00	
	17		1.0	98.64	0.81	0.55*	
	18	upper Brassfield	2.2	96.96	0.61	2.43*	
	19		3.6	97.20	0.61	2.19*	
	20		1.6	95.32	1.62	3.06*	
	21		2.0	94.71	3.05	2.24*	
	22		1.8	97.61	1.42	0.97*	
	23		1.8	98.69	0.71	0.60*	
	24		1.6	98.45	0.61	0.94*	
	25		1.6	99.17	0.61	0.22*	
	26			97.85	0.61	1.54*	
Reliability of section 158 is poor for samples 1-19, fair for samples 20-44							
158	1	Belfast	14.0	40.97	30.04	28.99	
	2		19.2	40.73	30.45	28.82	
	3		21.0	41.93	33.50	24.57	
	4		15.8	47.04	36.36	16.60	
	5		10.0	53.86	38.67	7.47	
	6		5.0	53.52	41.81	4.67	
	7	lower Brassfield	4.8*	50.88	38.78	10.34	
	8		2.2*	52.44	40.50	7.06	
	9		2.6*	52.08	40.60	7.32	
	10		3.4*	55.20	38.89	5.91	
	11		2.4*	52.56	41.01	6.43	
	12		1.8*	53.76	36.97	9.27	0.4
	13		2.0*	52.08	36.66	11.26	2.6
	14		4.0*	52.56	37.27	10.17	
	15		1.6*	55.56	37.47	6.97	
	16		12.8*	55.20	28.28	16.52	
	17		13.4*	55.92	37.77	6.31	
	18		2.6*	57.36	36.87	5.77	
	18A		47.0*	31.92	22.42	45.66	
	19		25.4*	47.40	32.83	19.77	
	20		2.6*	55.80	39.49	4.71	
	21		2.2*	54.96	40.10	4.94	
	22		2.8*	56.52	38.38	5.10	
	23		2.6*	56.04	40.30	3.66	
	24		1.6*	55.80	41.71	2.49	
	25		1.2*	54.12	42.42	3.46	
	26		1.4*	53.52	42.42	4.06	
	27		2.2*	52.08	40.70	7.22	
	28		1.4*	52.80	41.81	5.39	
	29		1.4*	55.08	41.71	3.21	
	30		1.6*	53.40	40.91	5.69	
	31		1.8*	53.28	40.80	5.92	
	32		1.8*	55.92	40.40	3.68	
	33		4.6*	57.00	39.19	3.81	
	34		4.6*	57.36	34.74	7.90	
	35		2.2*	57.00	37.88	5.12	
	36		2.2*	55.68	38.99	5.33	
	37		5.0*	74.28	21.82	3.90	
	38	upper Brassfield	3.2*	93.84	3.84	2.32	
	39		3.4*	84.84	10.71	4.45	
	40		2.8*	93.00	4.55	2.45	
	41		4.6*	68.40	25.96	5.64	
	42		2.2*	90.36	7.98	1.66	
	43		1.4*	64.20	33.33	2.47	
	44		1.4*	96.00	2.42	1.58	

Outcrop or core no.	Sample no.	Unit	Original analyses				1975-1976 insoluble residue (%)
			Insoluble residue (%)	Newberry			
				$CaCO_3$ (%)	$MgCO_3$ (%)	Remainder (%)	
Reliability of section 179 is fair for samples 1-8, good for samples 9-44							
179	1	Elkhorn?	31.6	38.88	29.90	31.22	
	2	Belfast	28.1	36.72	28.08	35.20	
	3		27.6	38.88	28.48	32.64	
	4		28.0	41.28	30.30	28.42	
	5		19.4	45.72	32.12	22.16	
	6		8.2	51.24	38.58	10.18	
	7		6.0	54.00	34.74	11.26	
	8	lower Brassfield	1.6*	63.72	28.79	7.49	
	9		1.4	84.00	13.53	2.47*	
	10		1.4	68.64	25.65	5.71*	
	11		1.2	89.64	8.79	1.57*	
	12		1.8	90.24	8.28	1.48*	
	13		1.4	92.88	6.06	1.06*	
	14		1.2	96.12	2.93	0.95*	
	15		1.0	98.52	0.91	0.57*	
	16		1.4	90.48	7.37	2.15*	
	17		1.6	95.88	3.23	0.89*	
	18	upper Brassfield	1.8	96.84	1.31	1.85*	
	19		29.0	47.76	9.09	43.15*	41.1
	20		4.4	86.64	1.21	12.15	8.4*
	21		26.5	51.14	10.81	38.05*	36.8
	22		7.0	80.28	9.60	10.12*	
	23		2.2	96.96	1.01	2.03*	
	24		5.0	78.12	16.26	5.62*	
	25		4.0	85.92	9.09	4.99*	
	26		46.0	42.60	4.75	52.65*	
	27		4.6	95.04	0.81	4.15*	
	28		4.2	95.16	0.91	3.93*	
	29		2.8	97.80	0.71	1.49*	
	30		6.0	97.20	1.41	1.39*	0.6
	31		3.6	98.88	0.51	0.61*	
	32		1.8	98.28	0.81	0.91*	
	33		1.6	94.32	4.65	1.03*	
	34		2.0	97.08	1.31	1.61*	
	35		2.6	97.92	1.11	0.97*	
	36		2.6	81.60	14.75	3.65*	
	37		1.2	96.36	2.73	0.91*	
	38		1.8	96.00	2.83	1.17*	
	39		1.4	96.00	2.63	1.37*	
	40		2.4	81.36	15.35	3.29*	
	41		2.0	85.08	13.43	1.49*	
	42		1.8	90.00	8.28	1.72*	
	43		2.8	67.68	27.88	4.44*	
	44	Dayton	3.0	60.72	33.84	5.44	
Reliability of section 188 is fair for samples 1-14, good for samples 15-27							
188	1	Belfast	22.4	42.00	32.32	25.68	
	2		18.6	44.88	34.34	20.78	
	3		13.2	46.56	36.36	17.08	
	4		14.0	47.52	35.55	16.93	
	5		8.8	51.00	36.87	12.13	
	6		7.6	52.44	40.20	7.36	
	7	lower Brassfield	2.6*	51.36	39.39	9.25	
	8		1.6*	59.04	37.07	3.89	
	9		2.6*	52.20	40.80	7.00	
	10		2.2*	53.52	39.19	7.29	
	11		1.8*	64.08	28.68	7.24	
	12		1.2*	57.00	35.05	7.95	
	13		7.6*	59.28	34.14	6.58	
	14		0.6*	55.80	37.88	6.32	
	15		1.0*	68.04	27.17	4.79	
	16		2.0*	75.12	22.62	2.26	
	17		1.0*	81.96	15.55	2.49	
	18		3.8*	56.64	36.56	6.80	
	19		1.0*	93.96	3.74	2.30	
	20		1.6*	97.44	1.41	1.15	
	21	upper Brassfield	3.0*	83.28	12.52	4.20	
	22		2.8*	84.36	12.93	2.71	
	23		3.2*	87.60	8.69	3.71	
	24		3.8*	91.80	4.95	3.25	
	25		2.2*	97.44	1.52	1.04	
	27		7.8*	62.76	27.17	10.07	
Reliability of section 190 is fair for samples 1-4, 8, good for samples 5-7, 9-28							
190	1	lower Brassfield	1.0*	53.28	40.60	6.12	
	2		1.2*	53.52	36.76	9.72	
	3		1.2*	51.60	34.95	13.45	0.8
	4		0.8*	57.48	36.36	6.16	
	5		1.0*	94.44	4.75	0.81	–
	6		1.4*	74.76	22.02	3.22	
	7		0.6*	91.20	7.27	1.53	
	8		2.8*	59.52	28.89	11.60	
	9	upper Brassfield	4.2*	75.60	16.36	8.04	
	10		4.0*	73.80	21.32	4.88	
	11		1.8*	81.24	14.85	3.91	
	12		1.0*	82.92	14.14	2.92	
	13		2.0*	88.44	9.49	2.07	
	14		2.0*	82.68	14.44	2.88	
	15		1.6*	78.36	18.18	3.46	
	16		2.4*	95.16	2.02	2.82	
	17		2.6*	75.72	22.11	2.17	
	18		1.6*	85.20	13.13	1.67	
	19		1.4*	95.16	3.84	1.00	
	20		3.2*	55.08	36.66	8.26	
	21		3.0*	56.04	36.06	7.90	
	22		4.0*	61.56	32.22	6.22	
	23		4.4*	70.08	23.03	6.89	–
	24		51.5*	39.24	12.02	48.74	
	25		2.4*	92.16	5.56	2.28	
	26	Dayton	10.2	84.96	9.70	5.34	
	27		7.0	55.80	36.06	8.14	
	28		5.4	51.12	39.19	9.69	
Reliability of section 192 is very good							
192	1	lower Brassfield	2.0	96.48	1.21	2.31*	
	2		1.6	95.76	2.02	2.22*	
	3		0.8	92.76	5.35	1.89*	
	4		0.8	99.00	0.71	0.29*	
	5		1.4	93.84	3.94	2.22*	
	6		2.2	99.24	0.40	0.36*	
	7		2.6	98.16	0.81	1.03*	
	8		3.6	84.72	5.56	9.72*	
	9		0.6	99.12	0.61	0.27*	
	10	upper Brassfield	1.0	98.40	0.61	0.99*	

Outcrop or core no.	Sample no.	Unit	Original analyses: Insoluble residue (%)	Newberry: $CaCO_3$ (%)	Newberry: $MgCO_3$ (%)	Newberry: Remainder (%)	1975-1976 insoluble residue (%)
	11		0.8	96.48	1.62	1.90*	
	12		1.2	98.28	0.51	1.21*	
	13		0.6	96.96	0.71	2.33*	
	14		6.6	91.80	0.71	7.49*	
	15		5.2	93.36	1.21	5.43*	
Reliability of section 196 is good to very good							
196	1	Elkhorn?	11.0	76.56	13.94	9.50	
	2	lower Brassfield	3.0	67.32	26.36	6.32*	
	3(1)		0.8	83.28	13.33	3.39*	
	3(2)		0.6	91.92	6.26	1.82*	
	4		1.0	79.68	16.36	3.96*	
	5		0.6	86.76	10.71	2.53*	
	6		0.8	92.16	6.36	1.48*	
	7		0.8	93.84	5.25	0.91*	
	8		0.4	97.80	1.41	0.79*	
	9		0.6	98.88	0.91	0.21*	
	10	upper Brassfield	2.2	96.96	0.71	2.33*	
Reliability of section 206 is fair for samples 1-4, 22, good for samples 5-21							
206	1	lower Brassfield	0.6*	57.00	36.36	6.64	
	2		0.4*	59.28	34.74	5.98	
	3		0.6*	66.00	26.06	7.94	
	4		1.2*	55.68	36.16	8.16	
	5		0.8	78.48	18.28	3.24*	
	6		1.0	98.76	0.91	0.33*	
	7		1.4	77.88	19.49	2.63*	
	8		0.8	91.32	6.97	1.71*	
	9		1.6	93.12	5.45	1.43*	
	10	upper Brassfield	3.6*	56.16	35.96	7.88	
	11		1.0	65.52	29.49	4.99*	
	12		0.6	95.16	3.23	1.61*	
	13		0.4	97.32	1.72	0.96*	
	14		1.0	88.68	9.60	1.72*	
	15		3.6	94.68	2.93	2.39*	
	16		2.8	89.64	7.88	2.48*	
	17		2.0	80.52	15.05	4.43*	
	18		1.6	88.08	9.29	2.63*	
	19		2.0	89.40	7.98	2.62*	
	20		6.4	91.68	5.35	2.97*	
	21		3.0	95.88	1.21	2.91*	
	22	Dayton	17.4	47.16	29.49	23.35	
Reliability of section 209 is good to very good							
209	1	Belfast	8.6	55.80	31.01	13.19	
	2		15.4	51.60	30.91	17.49	
	3		12.4	48.72	30.70	20.58	
	4		12.2	49.78	29.90	20.32	
	5	lower Brassfield	0.6	98.40	0.61	0.99*	
	6		1.2	93.81	3.03	3.16*	
	7		0.4	98.28	0.81	0.91*	
	8		0.6	98.04	0.81	1.15*	
	9		0.6	97.82	0.81	1.37*	
	10		0.4	98.52	0.51	0.97*	
	11		0.8	98.16	0.81	1.03*	
	12		0.6	98.11	0.77	1.12*	
	13		0.6	97.78	0.73	1.49*	
	14		1.0	96.96	1.17	1.87*	
	15	upper Brassfield	1.4	97.44	0.71	1.85*	
	16		2.8	95.76	1.82	2.42*	
	17		1.0	96.72	1.01	2.27*	
	18		2.6	95.88	1.01	3.11*	
	19		2.2	96.96	1.11	1.93*	
	20		1.8	95.88	0.91	3.21*	
	21		8.2	76.80	0.81	22.39*	20.2
	22		5.2	92.76	1.01	6.23*	
Reliability of section 218 is good							
218	1	Elkhorn	76.5	15.24	8.79	75.97	
	2	Belfast	45.0	31.68	18.99	49.33	
	3		4.8	90.60	4.54	4.86	
	4		7.8	74.88	17.17	7.95	
	5		15.6	64.44	15.05	20.51	
	6		9.8	92.04	1.11	6.85	
	7	lower Brassfield	3.4	97.80	0.61	1.59*	
	9		1.2	96.36	0.81	2.83*	
Reliability of section 220 is fair for samples 1-9, 27, very good for samples 11-26							
220	1	Elkhorn	51.5	27.60	16.87	55.53	
	3	Belfast	23.4	43.56	29.09	27.35	
	4		17.4	45.96	30.70	23.34	
	5		8.8	54.24	34.74	11.02	
	7		9.0	56.28	30.40	13.32	
	8		10.8	51.36	32.52	16.12	
	9		10.4	58.20	28.38	13.42	
	11	lower Brassfield	3.0	90.72	6.87	2.41*	
	12		0.6	98.04	1.72	0.24*	
	13		0.4	98.40	1.21	0.39*	
	14		0.6	98.04	1.72	0.24*	
	15		1.0	99.00	0.91	0.09*	
	16		0.8	96.24	2.93	0.83*	
	17		2.6	85.20	10.71	4.09*	
	18		0.8	96.72	0.81	2.47*	
	19	upper Brassfield	0.4	96.96	1.62	1.42*	
	20		0.6	92.52	4.55	2.93*	
	21		1.8	91.20	4.85	3.95*	
	22		1.2	98.52	0.51	0.97*	
	23		2.2	95.76	1.62	2.62*	
	24		3.2	92.64	3.43	3.93*	
	25		7.0	91.20	1.21	7.59*	
	26		4.8	93.36	0.81	5.83*	
	27		20.0	71.64	0.71	27.65*	
Reliability of section 221 is very good							
221	1	Belfast	8.0	81.60	8.28	10.12	
	2	lower Brassfield	5.8	98.88	0.61	0.51*	
	3		1.2	98.16	1.01	0.83*	
	5		1.2	96.24	1.82	1.94*	
	6		1.6	96.96	1.01	2.03*	
	7		3.4	98.16	0.61	1.23*	
	8		29.2	65.64	0.61	33.75*	
	9		1.0	97.44	0.61	1.95*	
	10		83.5	3.12	0.81	96.07*	
	11		36.4	59.28	0.61	40.11*	
	12		0.8	98.28	0.81	0.91*	
	13		0.6	98.16	0.51	1.33*	
	15		1.4	95.76	1.01	3.23*	
	16		6.4	91.92	1.21	6.87*	
	17		2.6	95.04	1.01	3.95*	
	18		5.0	95.40	0.81	3.79*	
	19		3.2	94.92	1.21	3.87*	
	20		2.0	94.08	2.42	3.50*	
	21		1.8	95.28	1.21	3.51*	
	22	upper Brassfield?	96.5	0.36	0.30	99.34*	

Outcrop or core no.	Sample no.	Unit	Original analyses: Insoluble residue (%)	Newberry: $CaCO_3$ (%)	Newberry: $MgCO_3$ (%)	Newberry: Remainder (%)	1975-1976 insoluble residue (%)
	23		11.0	87.60	0.81	11.59*	
	24		11.6	91.44	0.61	7.95*	
	E	Dayton	9.4	87.84	1.41	10.75	
Reliability of section 224 is poor for samples A-J, Z, A-1, very good for samples K-Y, B-1, C-1							
224	A	Elkhorn	33.8	33.12	21.21	45.67	
	B	Belfast	24.2	39.36	26.06	34.58	28.0
	C		38.6	36.00	24.04	39.96	
	D		36.4	37.96	25.96	36.08	
	E		23.0	49.80	27.47	22.73	
	F		18.6	38.64	25.65	35.71	25.5
	G		13.8	53.28	29.90	16.82	
	H		18.0	49.44	27.67	22.89	
	I		14.2	49.92	16.97	33.11	27.2
	J		10.6	48.72	12.83	38.45	33.0
	K	–	3.6	94.92	1.11	3.97	
	L	lower Brassfield	1.2	97.44	1.62	0.94*	
	M		0.8	96.72	1.62	1.66*	
	N		1.0	97.92	1.62	0.46*	
	O		0.6	98.76	0.81	0.43*	
	P		0.4	98.64	0.61	0.75*	
	Q		0.6	98.00	0.81	1.19*	
	R		0.8	98.16	1.01	0.83*	
	S		0.4	98.76	0.71	0.53*	
	T		0.6	98.28	0.61	1.11*	
	U		0.8	97.44	0.91	1.65*	
	V	upper Brassfield	1.8	95.04	1.01	3.95*	
	W		12.2	84.72	0.71	14.57*	
	X		5.0	93.96	1.72	4.32*	
	Y	–	6.4	90.72	0.61	8.67*	
	Z		9.0	81.48	1.82	16.70*	
	A-1		21.6	68.28	1.11	30.61*	
	B-1		6.4	91.44	1.01	7.55*	
	C-1	Dayton?	3.0	96.48	0.81	2.71	
Reliability of section 225 is good							
225	1	Elkhorn	36.5	57.96	4.04	38.00	
	2	Belfast?	17.0	81.72	1.72	16.56	
	3		12.2	73.44	9.49	17.07	
	4		4.0	92.88	3.03	4.09	
	5		5.4	80.28	10.61	9.11	
	6		6.2	92.04	3.33	4.63	
	7		4.0	92.16	2.83	5.01	
	8	lower Brassfield	0.8	97.80	0.51	1.69*	
	9		1.2	98.40	0.61	0.99*	
	10		0.6	97.80	0.61	1.59*	
	11		0.8	96.84	0.61	2.55*	
	12		2.0	96.48	0.61	2.91*	
	13		3.0	95.76	1.01	3.23*	
	14		1.8	96.84	0.91	2.25*	
	15A		1.4	96.24	0.81	2.95*	
	15B		1.0	96.72	0.61	2.67*	
	17		3.2	83.64	8.18	8.18*	
	18		2.2	95.88	0.71	3.41*	
	19		2.4	91.68	3.43	4.89*	
	20		1.8	94.92	1.62	3.46*	
	21		3.2	85.20	7.07	7.73*	
	22		5.0	88.68	3.43	7.89*	
	23		3.0	95.28	1.21	3.51*	
	24		2.4	94.32	0.81	4.87*	
	25		1.8	93.60	1.42	4.98*	
	26	upper Brassfield?	8.0	90.96	2.02	7.02*	
	27		16.8	83.52	1.62	14.86*	
	28		2.0	96.24	0.81	2.95*	
	29	Dayton	8.4	91.20	2.02	6.78	
Reliability of section 226 is fair to good							
226	1	Elkhorn	41.0	32.64	14.95	52.41	
	2	Belfast	27.5	44.16	21.41	34.43	27.5
	3		20.0	50.52	14.44	35.04	28.8
	4		16.0	81.36	0.71	17.93	
	5		3.6	95.52	1.82	2.66	
	6		13.2	83.04	4.55	12.41	
	7		9.6	76.32	4.65	19.03	15.3
	7A		54.0	36.84	1.82	61.34	
	8	lower Brassfield	7.0	96.72	1.21	2.07*	
	9		10.2	84.48	2.23	13.29*	
	10		5.6	81.24	7.37	11.39*	
	11		4.8	94.44	1.11	4.45*	
	12		87.5	36.84	0.30	62.86*	61.3
	13		1.6	97.80	0.51	1.69*	
	14		3.2	95.88	0.81	3.31*	
	14A		30.5	23.76	1.21	75.03*	
	15		4.4	91.44	2.83	5.73*	
	16		7.4	83.04	4.04	12.92*	
	17		3.6	95.88	0.61	3.51*	
	18	upper Brassfield	3.0	95.76	0.81	3.43*	
	19		85.5	5.40	1.11	93.49*	
	20		1.8	95.28	1.31	3.41*	
	21		2.4	96.00	1.01	2.99*	
	22		5.0	87.84	1.11	11.05*	
	23		2.0	96.36	1.11	2.53*	
	24		1.2	96.48	0.81	2.71*	
	25		1.4	92.88	2.63	4.49*	
	26		2.2	92.28	2.53	5.19*	
	27		1.6	93.00	3.13	3.87*	
	28		4.0	91.56	2.22	6.22*	
	29		79.0	6.24	0.71	93.05*	
Reliability of section 228 is fair for samples 1-8, good for samples 9-41							
228	1	Elkhorn	81.0	23.28	12.12	64.60	
	2	Belfast	38.4	29.76	15.35	54.89	49.0
	3		40.6	34.44	18.48	47.08	
	4		37.4	37.44	20.60	41.96	
	5		24.6	37.44	20.00	42.56	36.8
	6		34.8	38.40	22.22	39.38	
	7		32.4	43.56	23.33	33.11	
	8		64.0	55.56	16.87	27.57	22.2
	9	lower Brassfield	14.0	93.96	1.72	4.32*	3.7
	10		52.0	22.56	2.02	75.42*	73.0
	11		39.6	94.92	1.31	3.77*	3.0
	12		28.0	89.16	1.11	9.73*	9.0
	13		29.4	94.44	1.21	4.35*	3.2
	14		27.0	88.20	3.33	8.47*	7.0
	15		6.8	89.04	0.81	10.15*	
	16		43.4	91.92	1.41	6.67*	5.2
	17		5.6	94.56	1.01	4.43*	
	17A		33.0	1.68	0.81	97.51*	
	17B		49.5	23.28	2.22	74.50*	
	18		10.0	83.40	0.71	15.89*	

Outcrop or core no.	Sample no.	Unit	Original analyses: Insoluble residue (%)	Newberry: $CaCO_3$ (%)	Newberry: $MgCO_3$ (%)	Newberry: Remainder (%)	1975-1976 insoluble residue (%)
	19		8.5	0.72	0.81	98.47*	97.9
	20		11.4	91.92	2.12	5.96*	
	21		4.4	87.96	0.51	11.53*	
	22		5.6	88.32	1.01	10.67*	
	23		11.2	85.92	0.81	13.27*	
	24		6.2	83.52	0.91	15.57*	
	25		1.8	97.80	0.51	1.69*	
	25A		74.0	36.96	0.81	62.23*	
	26	–	1.4	94.36	1.42	4.02*	
	27		3.8	94.80	1.21	3.99*	
	28		1.8	95.76	0.81	3.43*	
	29		3.6	95.76	0.81	3.43*	
	30		2.8	94.80	1.01	4.19*	
	31		2.4	94.92	1.01	4.07*	
	32	upper Brassfield?	2.0	92.16	2.42	5.42*	
	33		6.8	91.32	3.13	5.55*	
	34		4.2	86.52	3.74	9.74*	
	35		8.6	84.92	1.01	14.07	
	36		23.0	51.48	2.32	46.20*	41.3
	37		5.2	84.48	2.82	12.70*	
	38		3.4	91.68	1.82	6.50*	
	39		3.4	93.60	0.81	5.59*	
	40		2.4	94.80	0.61	4.59*	
	41	–	3.6	93.12	2.02	4.86*	
Reliability of section 229 is poor for samples 1-10A, fair for samples 11-58							
229	1	Elkhorn	58.4	21.00	5.15	73.85	
	2		61.8	43.56	6.67	49.77	
	3		19.8	50.76	23.13	26.11	
	4 (shale)		65.0	29.76	13.53	56.71	
	4 (limestone)		27.2	49.56	15.66	34.78	
	5	Belfast	25.2	58.68	18.18	23.14	
	6		44.2	35.88	18.89	45.23	
	7		45.2	40.68	17.07	42.25	
	8		19.8	50.52	13.84	35.64	30.7
	9		7.6	91.80	2.12	6.08	
	10		19.2	60.60	15.86	23.54	
	10A		40.6	31.20	7.88	60.92	
	11	lower Brassfield	5.8	89.76	1.31	8.93*	
	12		43.6	29.52	3.18	67.30*	63.6
	13		2.2	94.56	1.21	4.23*	
	14		15.6	89.40	2.73	7.87*	6.6
	15		5.2	94.20	1.31	4.49*	
	16		6.6	90.36	2.73	6.91*	
	17		61.2	50.40	2.32	47.28*	44.8
	17A		60.2	22.68	4.55	72.77*	
	18		3.4	93.72	2.22	4.06*	
	19		4.6	93.60	1.21	5.19*	
	20		3.4	93.48	1.92	4.60*	
	21		2.6	95.04	1.62	3.34*	
	22		3.4	95.16	1.72	3.12*	
	23		1.8	97.20	0.61	2.19*	
	24		1.4	92.16	0.61	7.23*	
	25		1.2	96.60	1.01	2.39*	
	26	upper Brassfield	3.6	94.44	0.71	4.85*	
	27		5.0	89.88	1.11	9.01*	
	27A		77.5	3.60	0.61	95.79*	
	28		14.8	84.48	1.11	14.41*	
	29		10.4	81.36	1.72	16.92*	
	30		6.2	94.08	1.01	4.91*	
	31		13.2	83.76	1.92	14.32*	

Outcrop or core no.	Sample no.	Unit	Original analyses: Insoluble residue (%)	Newberry: $CaCO_3$ (%)	Newberry: $MgCO_3$ (%)	Newberry: Remainder (%)	1975-1976 insoluble residue (%)
	32		12.0	83.04	3.74	13.22*	
	33		13.0	88.44	1.31	10.25*	
	34		3.0	94.80	1.01	4.19*	
	35		1.6	96.12	0.81	3.07*	
	35A		12.4	79.68	1.01	19.31*	
	36		7.4	91.44	1.21	7.35*	
	37		3.6	96.12	1.72	2.16*	
	38		7.6	75.72	5.35	18.93*	14.3
	39		8.2	74.88	10.00	15.12*	
	40		6.0	89.16	2.93	7.91*	
	40A		2.6	93.72	1.62	4.66*	
	41		5.4	91.92	1.82	6.26*	
	42		3.4	92.16	2.02	5.82*	
	43		3.2	90.84	1.31	7.85*	
	44		22.6	78.14	1.01	20.85*	
	45		5.0	92.76	0.91	6.33*	
	46		13.0	88.80	1.01	10.19*	
	47		2.4	94.56	1.21	4.23*	
	48		13.0	83.40	1.31	15.29*	
	49		1.6	97.20	0.61	2.19*	
	50		1.0	96.84	0.71	2.45*	
	51		1.0	96.36	1.01	2.63*	
	52		3.0	90.60	2.93	6.47*	
	53		4.2	91.68	2.22	6.10*	
	54		2.6	94.68	1.31	4.01*	
	55		12.0	84.60	0.61	14.79*	
	55A		88.0	1.32	1.31	97.37*	
	56		7.0	87.72	1.82	10.46*	
	57	Dayton?	6.2	93.72	1.11	5.17	
	58		6.2	91.44	0.61	7.95	
Reliability of section 230 is good							
230	1	Belfast	16.2	70.68	11.62	17.70	
	2		11.6	76.80	8.08	15.12	
	3	–	6.2	90.96	2.63	6.41	
	3B		1.6	97.68	0.61	1.71	
	4	lower Brassfield	4.2	96.00	1.92	2.08*	
	5		0.8	97.32	0.81	1.87*	
	6		1.8	96.48	0.81	2.71*	
	7		1.0	94.32	1.62	4.06*	
	7A	✓	94.4	2.16	0.40	97.44*	
	8		1.8	92.28	1.52	6.20*	
	9		4.4	92.28	1.31	6.41*	
	10		0.8	98.16	0.81	1.03*	
	11		0.8	97.80	0.71	1.49*	
	12		0.4	97.20	1.01	1.79*	
	13		2.2	94.44	0.91	4.65*	
	14		7.6	95.76	1.41	2.83*	
	15		0.6	96.12	1.01	2.87*	
	16		0.4	96.60	0.81	2.59*	
	16A	✓	85.0	3.48	2.63	93.89*	
	17	upper Brassfield	1.8	94.92	1.21	3.87*	
	17A	✓	84.5	6.12	2.32	91.56*	
	18		3.4	95.16	1.11	3.73*	
	19		3.4	94.14	1.21	4.65*	
	20	–	2.2	94.32	1.41	4.27*	
	21		6.8	81.00	3.64	15.36*	
	22		15.6	87.60	1.21	11.19*	
	23	(float)	2.6	89.04	2.12	8.84	
	24		1.6	93.84	1.41	4.75	

Outcrop or core no.	Sample no.	Unit	Original analyses				1975-1976 insoluble residue (%)
			Insoluble residue (%)	Newberry			
				$CaCO_3$ (%)	$MgCO_3$ (%)	Remainder (%)	
Reliability of section 232 is poor to fair							
232	1	Elkhorn	58.5	34.32	6.06	59.62	
	2		29.2	39.72	21.82	38.46	
	3		43.0	36.00	19.80	44.20	
	4	Belfast	18.2	48.00	22.83	29.17	21.0
	5		29.4	41.16	19.09	39.75	31.6
	6	lower Brassfield	11.4*	78.96	6.87	14.17	
	7		20.6*	68.76	10.40	20.84	
	8		13.0*	86.16	4.65	9.19	
	9		4.6*	91.80	1.72	6.48	
	10		10.2*	80.88	6.46	12.66	
	11		10.2*	79.92	7.68	12.40	
	12		4.2*	90.96	3.13	5.86	
	12A		53.5*	29.52	6.46	64.02	
	13		8.0*	89.76	5.05	5.19	
	14		2.8*	93.24	2.53	4.23	
	15		2.2*	94.68	1.92	3.40	
	16		5.8*	92.76	3.23	4.01	
	17		2.8*	94.20	2.12	3.68	
	18		8.2*	84.24	1.31	14.45	
	19		4.4*	94.20	1.31	4.49	
	20		1.6*	96.24	1.11	2.65	
	21		2.6*	93.72	1.21	5.07	
	22		3.8*	93.00	1.72	5.28	
	23		2.0*	95.04	1.21	3.75	
	24		29.2*	70.38	1.92	27.70	
	25		2.4*	93.12	2.63	4.25	
	26		12.0*	63.96	15.86	20.18	
	27		8.2*	93.48	2.12	4.40	
	28		2.6*	90.00	4.65	5.35	
	28B		83.5*	6.24	1.01	92.75	
	29	upper Brassfield	3.2*	93.12	2.83	4.05	
	30		26.5*	52.56	18.18	29.26	
	30A		77.0*	10.20	5.76	84.04	
	31		7.4	57.12	24.24	18.64	8.1*
	32		8.6	51.36	25.86	22.78	9.3*
	33		12.8*	85.32	2.93	11.75	
	34		4.8*	95.16	1.52	3.32	
	35		82.5	3.72	1.92	94.36	93.2*
	36		5.6*	91.32	1.72	6.96	
	37		2.6*	79.08	12.63	8.29	
	38		2.6*	90.84	4.75	4.41	
	39		5.6*	87.00	6.26	6.74	
	40		2.8*	90.48	4.65	4.87	
	41		6.4*	85.92	4.65	9.43	
	42		5.2*	80.64	8.08	11.28	
	42B			7.92	2.22	89.86*	
	43		10.6*	90.36	1.31	8.33	
	44		11.4*	85.20	3.84	10.96	
	45		6.8*	66.84	19.49	13.67	
	46		3.4*	80.40	11.92	7.68	
	47		3.0*	69.24	20.71	10.05	
	48	Dayton	2.6	58.68	22.93	18.39	
	49		2.4	59.04	23.13	17.83	
Reliability of section 233 is poor							
233	1	Elkhorn	37.0	40.08	21.41	38.51	
	2	Belfast	41.0	32.04	17.27	50.69	
	3		13.0	50.04	28.38	21.58	
	4		23.0	45.36	25.25	29.39	
	5	lower Brassfield	65.4	51.60	17.57	30.83	25.1*

Outcrop or core no.	Sample no.	Unit	Original analyses				1975-1976 insoluble residue (%)
			Insoluble residue (%)	Newberry			
				$CaCO_3$ (%)	$MgCO_3$ (%)	Remainder (%)	
	6		8.0*	86.16	5.45	8.39	
	7		7.0*	92.52	3.13	4.35	
	8		2.8*	92.88	2.82	4.30	
	9		5.0*	81.60	9.49	8.91	
	10		1.6*	97.08	1.01	1.91	
	11		0.6*	97.20	1.01	1.79	
	12		0.8*	97.44	0.81	1.75	
	13		1.6*	95.28	1.21	3.51	
	14		2.4*	88.92	4.75	6.33	
	14A		63.0	4.80	2.02	93.18*	
	15		1.2*	96.84	0.91	2.25	
	16		0.8*	93.12	2.42	4.46	
	17		4.8*	84.96	7.17	7.87	
	18		2.0*	91.92	3.43	4.65	
	19		4.2*	84.00	7.07	8.93	
	20		1.8	73.80	13.53	12.67	5.2*
	21		4.0*	76.20	14.65	9.15	
	22		5.8	54.00	29.49	16.51	6.0*
	23		5.8*	59.52	26.66	13.82	
	24		1.6*	96.52	1.21	2.27	
	25		1.4*	96.96	0.51	2.53	
	26		2.4*	94.56	1.82	3.62	
	26A		92.5*	0.48	0.81	98.71	
	27		3.0*	90.24	4.65	5.11	
	28		4.0*	77.40	13.33	9.27	
	29		5.2*	85.92	6.06	8.02	
	30		3.0*	90.12	3.94	5.94	
	31		2.2*	94.08	1.62	4.30	
	32		2.8*	92.40	2.73	4.87	
	33	upper Brassfield	5.6*	89.28	4.04	6.68	
	34		6.8*	81.84	7.68	10.48	
	35		18.0	46.32	24.85	28.83	15.0*
	36		22.6	33.24	30.00	36.76	22.6*
	37		5.2	50.76	23.53	25.71	8.5*
	37A		85.0	5.88	3.54	90.58*	
	38		11.6	64.32	7.98	27.70	18.3*
	39		8.2*	81.00	5.96	13.04	
	40		5.6*	86.28	3.74	9.98	
	41		3.8*	89.16	3.64	7.20	
	42		7.0*	81.00	4.04	14.96	
	43		7.0*	87.60	2.02	10.38	
	43A		87.5*	3.72	2.53	93.75	
	43B		11.0*	71.04	8.48	20.48	
	44	Dayton?	7.8	55.20	27.98	16.82	
	45		3.4	54.72	24.24	21.04	3.2
	46		5.2	52.68	24.24	23.08	6.5
	47		2.8	53.64	28.28	18.08	3.4
	48		1.6	52.56	28.48	18.96	1.3
	49		1.4	55.92	29.29	14.79	4.3
	50		1.8	48.84	28.68	22.48	1.3
	51		1.2	53.64	27.57	18.79	2.8
	52		6.0	42.48	29.69	27.83	5.3
	53		4.4	53.76	26.06	20.18	4.6
	54		3.0	53.04	28.28	18.68	2.4
	55		4.8	52.56	25.86	21.58	5.8
	56		5.6	51.12	24.54	24.34	11.8
	57		3.8	55.56	27.47	16.97	3.1
	58		5.4	50.76	28.38	20.86	6.6
	59		6.8	52.08	24.24	23.68	5.5
	61		3.6	51.60	29.09	19.31	6.0
	62		4.6	54.12	31.61	14.27	

Outcrop or core no.	Sample no.	Unit	Original analyses: Insoluble residue (%)	Newberry: $CaCO_3$ (%)	Newberry: $MgCO_3$ (%)	Newberry: Remainder (%)	1975-1976 insoluble residue (%)
Reliability of section 234 is fair							
234	1	Elkhorn	66.0	16.92	7.17	75.91	
	1A		10.0	86.28	2.32	11.40	
	2	Belfast	8.4	83.76	4.04	12.20	
	3		11.2	39.12	22.12	38.76	32.3
	4		53.4	30.36	17.37	52.27	
	4A		14.0	91.20	4.24	4.56	3.3
	5		9.2	34.80	12.52	52.68	45.0
	6	lower Brassfield	34.8	92.76	2.73	4.51*	3.2
	7		3.8	81.00	6.57	12.43*	
	8		22.8	84.96	3.03	12.01*	9.4
	8B		68.0	27.48	6.87	65.65*	
	9		36.4	45.00	8.69	46.31*	41.7
	10		27.4	65.64	12.93	21.43*	
	11		2.8	90.00	5.56	4.44*	
	11A		19.5	39.24	10.91	49.85*	
	12		2.0	94.56	1.41	4.03*	
	13		5.0	67.92	19.80	12.28*	
	14		2.0	83.88	10.30	5.82*	
	15		96.0	1.56	0.10	98.34*	
	16	upper Brassfield	2.6	78.24	14.24	7.52*	
	17		5.6	90.36	2.02	7.62*	
	18		1.8	94.80	1.01	4.19*	
	19		2.2	94.80	1.41	3.79*	
	20		3.8	90.36	3.33	6.31*	
	21		1.8	95.16	1.41	3.43*	
	21A		40.0	3.00	1.31	95.69*	
	22		8.2	90.00	1.01	8.99*	
	23 (bottom)		5.8	87.00	1.62	11.38*	
	23 (top)		4.4	86.76	2.02	11.22*	
	24		13.0	77.28	4.65	18.07*	
	25		9.0	90.72	2.42	6.86*	
	26		3.8	93.72	2.53	3.75*	
	27		5.8	73.68	15.55	10.77*	
	28		3.4	89.28	5.96	4.76*	
	29		2.8	81.60	9.70	8.70*	
	29A		81.5	7.56	2.53	89.91*	
Reliability of section 236 is fair for samples 1-8, 18A, very good for samples 9-20							
236	1	Elkhorn	29.5	67.80	7.07	25.13	
	2	Belfast?	24.8	78.96	3.03	18.01	
	3		15.4	79.68	2.22	18.10	
	4		17.8	68.52	12.52	18.96	
	5	lower Brassfield	6.0*	95.88	2.32	1.80	
	6		0.8*	91.92	5.45	2.63	
	7		0.8*	58.08	33.33	8.59	
	8		0.6	63.12	22.02	14.86	0.8*
	9	"	0.8	97.32	1.52	1.16*	
	10		0.4	98.64	1.21	0.15*	
	11		1.0	97.32	1.62	1.06*	
	12	upper Brassfield	0.6	98.52	0.71	0.77*	
	13		2.6	96.72	0.81	2.47*	
	14		2.8	95.28	1.41	3.31*	
	15		2.0	96.36	1.21	2.43*	
	16		3.4	92.04	2.93	5.03*	
	17		3.6	98.76	0.51	0.73*	
	18	"	4.4	94.08	1.01	4.91*	
	18A		59.5	22.32	3.94	73.74*	
	19	Dayton	13.2	53.16	32.83	14.01	
	20		10.0	56.40	31.21	12.39	

Outcrop or core no.	Sample no.	Unit	Original analyses: Insoluble residue (%)	Newberry: $CaCO_3$ (%)	Newberry: $MgCO_3$ (%)	Newberry: Remainder (%)	1975-1976 insoluble residue (%)
Reliability of section 237 is poor for samples 1, 2, 23A, very good for samples 3-23							
237	1	Elkhorn (limestone lens)	14.0	89.04	4.24	6.72	
	2		26.4	54.24	10.71	35.05	
	3	Belfast	6.0	83.04	7.27	9.69	
	4	lower Brassfield	3.0	85.92	9.60	4.48*	
	5		0.6	86.76	11.21	2.03*	
	6		1.0	84.24	13.13	2.63*	
	7	"	0.6	91.44	6.46	2.10*	
	8		0.4	98.16	1.52	0.32*	
	9		0.8	98.16	1.21	0.63*	
	10		0.4	96.76	0.71	2.53*	
	11		1.0	99.24	0.71	0.05*	
	12		0.4	99.12	0.81	0.07*	
	13		0.8	98.76	0.61	0.63*	
	14		0.8*	99.12	0.91	0.00	
	15		1.0	95.64	3.64	0.72*	
	16		0.6	97.56	1.72	0.72*	
	17		0.6	99.36	0.61	0.03*	
	18		0.4	98.88	0.71	0.41*	
	19	upper Brassfield	0.8	98.16	0.61	1.23*	
	20		2.0	96.96	1.21	1.83*	
	21		1.6	96.00	0.81	3.19*	
	22		1.2	93.60	4.65	1.75*	
	23	"	3.6	96.96	0.61	2.43*	
	23A		58.5*	66.96	4.65	28.39	

APPENDIX B.–WEIGHTED AVERAGES FOR UPPER AND LOWER UNITS AND TOTAL BRASSFIELD

Outcrop or core no.	Upper unit of Brassfield			Lower unit of Brassfield			Total Brassfield	
	Sample nos.	$MgCO_3$ (%)	Insoluble (%)	Sample nos.	$MgCO_3$ (%)	Insoluble (%)	$MgCO_3$ (%)	Insoluble (%)
C-863	19-23A	7.5	57.1	24-41A	16.8	23.3	15.0	29.7
C-864	13-22	11.1	20.9	23-35	4.3	12.7	7.0	15.9
C-865	18-27	7.0	3.1	28-44	22.0	3.3	16.5	3.2
C-866	3-5A	4.2	12.4	6-13	11.4	4.4	9.7	6.3
6	11-17	1.3	2.5	1-10	1.4	1.4	1.4	1.8
10	9-16	5.8	4.7	1-8	5.2	1.6	5.5	3.1
21	14-23	2.3	4.4	1-13	2.4	1.9	2.4	2.8
28	14-15	0.7	2.0	3-13	1.0	2.3	1.0	2.2
29	9-15	1.3	3.1	1-8	1.1	1.3	1.2	2.1
33	15-21	10.8	4.0	4-14	9.6	2.9	10.1	3.3
38	13-15	0.4	2.2	2-12	1.9	1.8	1.7	1.8
50	15-17	0.6	2.1	1-14	2.2	1.4	2.0	1.5
70	14-19	2.1	2.2	3-13	7.2	1.7	5.7	1.9
87	23-32	2.0	1.9	9-22	5.9	1.6	4.4	1.7
92	15-22	2.2	4.9	1-14	7.3	3.1	5.7	3.7
105	12-28	1.6	2.5	3-11	8.6	2.3	4.0	2.4
121	8-13	0.9	30.0	1-7A	8.2	1.6	5.6	12.0
126	19	5.9	1.8	5-18	17.9	1.3	16.7	1.3
127	25-27	11.5	6.1	3-24	5.0	1.1	5.3	1.3
130	22-28	3.2	3.8	5-21	2.8	1.1	2.9	1.8
135	19-26	1.4	1.5	2-18	6.4	2.0	4.9	1.8
142	5-9	0.9	2.0	1-4	2.5	0.8	1.5	1.5
148	18-26	1.2	1.6	2-17	7.9	1.2	5.6	1.3
158	38-44	13.5	2.8	7-37	38.8	3.7	34.2	3.5
179	18-43	6.2	3.2	8-17	11.5	1.8	7.9	2.7
188	21-27	10.7	3.9	7-20	30.5	2.1	24.8	2.6
190	9-25	16.1	2.5	1-8	26.3	1.1	19.5	2.1
192	10-15	0.9	3.4	1-9	2.1	2.0	1.7	2.5
196	10	0.7	2.3	2-9	8.7	2.1	7.8	2.2
206	10-21	11.7	2.8	1-9	24.1	2.5	17.6	2.7
209	15-22	1.1	5.7	5-14	1.0	1.4	1.0	3.3
218				7-9	0.7	2.7	0.7	2.7
220	19-27	2.2	5.4	11-18	3.9	1.9	3.2	3.4
221	22-24	0.4	85.7	2-21	1.0	11.8	0.9	24.6
224	V-(B-1)	1.2	12.2	L-U	1.1	1.0	1.1	5.3
225	26-28	1.4	5.4	8-25	2.0	4.1	1.9	4.3
226	18-29	1.9	8.1	8-17	2.1	12.8	2.0	10.2
228	32-41	2.8	15.0	9-31	1.2	15.3	1.5	15.3
229	26-56	1.6	26.4	11-25	2.1	18.9	1.8	24.2
230	17-22	1.7	13.0	4-16A	1.1	11.9	1.3	12.2
232	29-47	9.4	22.5	6-28B	4.1	11.3	6.3	16.0
233	33-43B	6.9	42.1	5-32	7.1	10.5	7.1	20.6
234	16-29A	4.2	19.5	6-15	7.0	28.4	5.5	23.6
236	12-18A	1.5	6.6	5-11	11.3	1.2	6.5	3.9
237	19-23A	1.8	5.0	4-18	3.4	1.1	3.0	2.1

APPENDIX C.–OUTCROP AND FILE STRATIGRAPHIC SECTION NUMBERS[1]

Outcrop no.	Core or stratigraphic section no.	County	Township
	C-863	Adams	Sprigg
	C-864	Clinton	Green
	C-865	Miami	Elizabeth
	C-866	Warren	Clear Creek
6	15758	Preble	Somers
10	15750	Preble	Gratis
21	15756	Preble	Harrison
28	15772	Preble	Twin
29	15773	Preble	Twin
33	15780	Union County, Indiana	
38	15683	Montgomery	Jackson
50	15696	Montgomery	Madison
70	15672	Montgomery	Butler
87	13614	Montgomery	Butler
92	13616	Montgomery	Butler
105	15712	Montgomery	Mad River
121	12778	Montgomery	Washington
126	15652	Miami	Monroe
127	15654	Miami	Staunton
130	12772	Miami	Union
135	12771	Miami	Union
142	15647	Miami	Elizabeth
148	14491	Miami	Bethel
158	14494, 15579	Clark	Bethel
179	12729	Greene	Bath
188	12731	Greene	Miami
190	15624	Greene	Miami
192	15616	Greene	Beaver Creek
196	14484	Warren	Clear Creek
206	15632	Greene	Xenia
209	15626	Greene	New Jasper
218	15637	Highland	Union
220	15602	Clinton	Union
221	9733	Highland	Union
224	15161	Clinton	Liberty
225	9732	Highland	Concord
226	13609	Highland	Jackson
228	14350	Adams	Bratton
229	12670	Adams	Oliver
230	13610	Highland	Hamer
232	12668	Adams	Tiffin
233	12667	Adams	Tiffin
234	12691	Adams	Monroe
236	14489	Preble	Washington
237	15682	Montgomery	Harrison

[1] Each outcrop section and core description contains the sampling data for that particular section. This information is on open file at the office of the Ohio Division of Geological Survey. To obtain the description for a given outcrop or core the following information is needed: stratigraphic section number or core number, county, township, and the name of the person who measured the section (R. K. Alberts for all sections in this study).