limestone
shale
limestone, shale interbeds

Stage		Formation/Cycle	Lithology	*Actinoconchus*	*Anthracospirifer*	*Brachythyris*	*Cleiothyridina*	*Composita*	*Crurithyris*	*Marginatia*	*Meristorygma*	*Neophricodothyris*	*Neospirifer*	*Parachoristites*	*Phricodothyris*	*Productids*	*Prospira*	*Rhipidomella*	*Rhynchopora*	*Spirifer*	*Syringothyris*	*Tiramnia*	*Torynifer*	*Tylothyris*
VIRGILIAN	1	Necessity (TX)						4/4	0/1							2/2								
	2	U. Winchell (TX)						4/4				6/11	3/4											
MISSOURIAN	3	Lost Branch (KS, OK)						4/4	1/21			3/6												
	4	Norfleet (KS)						1/4				1/4												
DESMOINESIAN	5	Altamont (IA, NE)						5/8	0/12			0/1												
	6	post-Mulberry (MO)							1/5															
	7	Pawnee (IA)						5/5	0/6															
	8	Fort Scott (IA)						2/2																
	9	U. Grindstone Ck. (TX)						3/4					3/3											
	10	Verdigris (OK)											2/2											
	11	L. Grindstone Ck. (TX)						4/5					5/8											
	12	Lazy Bend (TX)						3/9				1/2												
	13	Dickerson (TX)										2/2	3/4											
ATOKAN	14	Hare Fiord (Canada)									3/3			2/2								5/5		
MORROWAN	15	Sausbee (OK)						10/15												20/20				
	16	Pitkin (OK)						0/3							0/2									
CHESTERIAN	17	Kincaid (IL)			7/8		0/6	6/8																
	18	Chlore (IL)			3/3			4/5																
	19	Fraileys (IL)			0/3		0/3	0/3																
	20	Ridenhower (IL)			6/8		0/3	1/6																
	21	Pella (IA)			30/57		0/11	8/35																
MERAMECIAN	22	Ullin (IL)						0/1									9/28							
	23	Warsaw (MO)				6/9	5/8													4/8	1/3		3/15	
OSAGIAN	24	Edwardsville (IN)		3/3			0/3	5/9							2/4									2/4
	25	Burlington (IA)						0/1												0/3	2/6			
	26	Fern Glen (MO)								2/3							8/15		0/3				2/4	
KINDERHOOKIAN	27	Gilmore City (IA)						2/3									16/16							
	28	Wassonville (IA)						2/2												9/22				
	29	Starrs Cave (IA)																0/5		8/15				
	30	Glen Park (IL)																			10/19			

Data Repository Figure 1. Compilation of sampling intervals and summary of samples studied. The denominators are numbers of specimens thin-sectioned and numerators are numbers of specimens used for isotopic analysis.

TABLE DR1. PETROGRAPHIC CHARACTERISTICS AND CARBON AND OXYGEN ISOTOPE VALUES OF CARBONIFEROUS BRACHIOPOD SHELLS FROM NORTH AMERICA.

Samples*	Species	MS†	L.C.§	M#	Outer rim	Notes	M. A. **	$\delta^{13}C$ (‰)	$\delta^{18}O$ (‰)
Virgilian, Necessity Cycle, Gunsight Fm., limestone (Park Road 15 near Lake Brownwood, TX)									
TX023-1	*Composita*	p	NL/SL	L	L		NL p	4.77	-2.74
TX023-2							L m	1.50	-4.17
TX024-1	*Composita*	p	NL	L	L		NL p	5.13	-2.60
TX024-2							L m	1.56	-4.20
TX025-1	*Composita*	p, f	NL/SL	L	L		NL p	4.70	-1.57
TX025-2							L m	1.61	-3.89
TX026-1	*Composita*	p	NL/SL	L	L		NL p	5.62	-2.33
TX026-2							L m	2.44	-4.12
TX026-3							NL c	3.23	-6.77
Missourian, Upper Winchell Cycle, limestone (Lake Brownwood spillway, TX)									
+270 cm									
TX001-1	*Neophricodothyris*	p	NL	L	L		NL p	5.09	-2.24
TX001-2							L m	2.78	-6.45
TX003-1	*Neophricodothyris*	p, f	NL	L	L		NL p	4.67	-1.88
TX003-2							L m	2.49	-4.93
TX005-1	*Neophricodothyris*	p	NL/SL	L	L		NL/SL p	4.78	-2.15
TX005-2							L m	2.51	-5.38
TX008-1	*Neophricodothyris*	p	NL	L	L		NL p	5.05	-2.37
TX008-2							L m	1.71	-4.45
TX009-1	*Neophricodothyris*	p	NL/SL	L	L		NL/SL p	4.61	-2.34
TX009-2							L c	3.56	-7.34
TX009-3							L m	1.53	-3.84
TX010-1	*Neophricodothyris*	p	NL	L	L		NL p	4.85	-2.19
TX010-2							L m	1.65	-3.90
TX013-1	*Neospirifer*	p,f	NL/SL	L	L		NL p	3.53	-1.96
TX013-2							L c	3.77	-7.62
TX013-3							L m	-0.16	-3.26
-30 cm									
TX014-1	*Composita*	p,f	NL/SL	L	L		NL p	4.74	-2.61
TX014-2							L c	1.55	-8.11
TX015-1	*Productids*	f	L/SNL	L	L		L/NL f	1.24	-3.51
TX015-2							L m	2.14	-4.34
TX016-1	*Productids*	f	L/SNL	L	L		L/NL f	3.78	-4.17
TX016-2							L/NL m	-3.79	-4.85
TX017-1	*Neospirifer*	p, f	NL/SL	L	L		NL p	3.68	-2.42
TX017-2							L m	1.40	-4.24
-60 cm									
TX018	*Neospirifer*	p	NL				NL p	4.02	-3.08
TX019-1	*Composita*	p, f	NL/SL	L			NL p	4.82	-2.49
TX019-2							L m	1.84	-4.21
TX020-1	*Composita*	p, f	NL/SL	L	L		NL p	4.94	-2.33
TX020-2							L m	1.36	-5.26
-80 cm									

TX021-1	*Composita*	f	NL/SL	L	L	NL f	5.62	-2.56
TX021-2						L m	1.51	-3.21

top Desmoinesian, Lost Branch Cycle, shale (Trading Post, north of Pleasanton, KS)

X122	*Crurithyris*					cut & eliminate		
X123	*Crurithyris*	f	NL/SL	L	L	NL/SL f	2.87	-2.52
X125	*Composita*	p	NL/SL		L	NL p	4.47	-2.17
X126	*Composita*	p	NL/SL		L	NL p	4.20	-2.45
X127	*Composita*	p+f	NL/SL		L	NL p	4.55	-2.30

top Desmoinesian, Lost Branch Cycle, shale (Christianberry up 1/2', 2 miles northwest of Holdenville, OK)

X133	*Composita*	p	NL/SL		L	NL p	5.48	-2.34
X134	*Neophricodothyris*	p	NL/SL	L	L	NL p	4.22	-2.55
X135	*Neophricodothyris*	p	NL/SL		L	NL p	4.42	-2.58
X136	*Neophricodothyris*	p	NL/SL	L	L	NL p	4.28	-2.80

U. Desmoinesian, Norfleet Cycle, shale (Verdigris River bridge-1", near Coffeyville, KS)

X159	*Composita*	p	NL		L	NL p	3.93	-1.25
X161	*Neophricodothyris*	p	NL/SL		L	NL p	3.72	-0.99

U. Desmoinesian, Altamont Cycle, shale (Witzke GSI7, NW1/4, T 78N, R 30W, Guthrie County - Iow, IA)

X179	*Composita*	p	NL/SL		L	NL p	4.59	-1.76
X184	*Composita*	u	L/SNL		L	L/SNL u	4.37	-1.89
X185-1	*Composita*	p	NL/SL		L	NL/SL p	4.38	-1.61
X185-2	*Composita*					L/SNL u	3.34	-1.77

U. Desmoinesian, Altamont Cycle, shale (NAC Amerada core 373.1-373.2, northwest of Nehawka, NE)

Y20	*Composita*	p+f	NL/SL		L	NL p	4.32	-0.77
Y21-1	*Composita*	p	NL/SL		L	NL/SL p	5.47	-0.70
Y21-2	*Composita*					L c	-3.99	-3.60

U. Desmoinesian, post-Mulberry Cycle, shale (post-Mulberry pit -2', 2 miles south of Amsterdam, Bates County, MO)

X188	*Crurithyris*	f	NL	L		NL f	1.89	-2.80

U. Desmoinesian, Pawnee Cycle, shale (ILC Logan core 168.9-171.8, Logan, IA)

Y78	*Composita*	p	NL/SL	L	L	NL p	5.42	-1.94
Y79	*Composita*	p	NL/SL		L	NL p	4.47	-1.59
Y80-1	*Composita*	p+f	NL/SL	L	L	NL p	4.27	-2.39
Y80-2	*Composita*					L m	-4.16	-2.59
Y81	*Composita*	p	NL		L	NL p	3.98	-2.10
Y82	*Composita*	f	NL/SL		L	NL f	4.60	-1.61

Desmoinesian, Upper Fort Scott Cycle, shale (ILC Logan core 209.3-209.7, Logan, IA)

Y85	*Composita*	p	NL		L	NL p	4.30	-1.83
Y86-1	*Composita*	p+f	NL/SL	L	L	NL p	3.71	-1.80
Y86-2	*Composita*					L/SNL c	-5.99	-5.34

Desmoinesian, Upper Grindstone Creek Fm., shale (Rt. 4 & I-20, Weatherford, TX)

TXD001	*Neospirifer cameratus*	f	NL/SL		L	NL f	4.24	-2.96
TXD002	*Neospirifer cameratus*	p+f	NL/SL	L	L	NL p	4.40	-2.68
TXD003-1	*Neospirifer cameratus*	p+f	NL/SL	L	L	NL p	4.20	-2.66
TXD003-2						L c	0.16	-8.74
TXD004-1	*Composita subtilita*	p+f	NL/SL	L	L	NL p	4.15	-2.31
TXD004-2						NL p	4.80	-2.34
TXD006-1	*Composita subtilita*	p	NL/SL	L	L	NL p	5.11	-2.47
TXD006-2						NL p	4.64	-2.32
TXD007	*Composita subtilita*	p	NL/SL		L	NL p	4.60	-2.47
M. Desmoinesian, Verdigris Cycle, shale (Lake Bixoma spillway, 2 miles south of Leonard, OK)								
X198	*Neospirifer*	p	NL		L	NL p	3.17	-0.05
X199	*Neospirifer*	p+f	NL/SL		L	NL p	3.42	0.09
M. Desmoinesian, Lower Grindstone Creek Fm., Brannon Bridge limestone (Weatherford quarry, TX)								
TXD009-1	*Neospirifer cameratus*	p	NL	L	L	NL p	4.82	-2.80
TXD009-2						L m	1.46	-4.50
TXD012-1	*Neospirifer cameratus*	p+f	NL/SL		L	NL p	4.51	-2.81
TXD012-2						NL p	4.28	-3.04
TXD013	*Neospirifer cameratus*	p	NL/SL		L	NL p	4.80	-2.66
TXD014	*Neospirifer cameratus*	p	NL/SL		L	NL p	4.36	-2.76
TXD015-1	*Composita subtilita*	p	NL/SL	L		NL p	5.63	-3.03
TXD015-2						L m	0.32	-4.11
TXD016-1	*Composita subtilita*	p	NL	L		NL p	5.23	-2.49
TXD016-2						L m	0.73	-5.40
TXD018-1	*Composita subtilita*	p+f	NL/SL	L		NL p	5.73	-2.80
TXD018-2						L m	2.04	-3.54
TXD019	*Neospirifer cameratus*	cf	NL/SL	L		NL cf	3.80	-2.71
TXD020-1	*Composita subtilita*	p	NL	L	L	NL p	5.56	-2.27
TXD020-2						L m	2.41	-3.86
Desmoinesian, Lazy Bend Fm., Dennis Bridge limestone (Weatherford, TX)								
TXD022-1	*Composita argentea*	cf	NL/SL	L		NL cf	5.58	-2.41
TXD022-2						L m	-0.66	-4.65
TXD024-1	*Composita argentea*	p	NL/SL	L		NL p	5.90	-2.37
TXD024-2						L m	1.15	-5.41
TXD29-1	*Composita argentea*	p	NL/SL	L		NL p	5.86	-2.62
TXD29-2						L m	-1.22	-4.55
TXD030-1	*Neophricodothyris perplexa*	p	NL/SL	L		NL p	4.99	-2.59
TXD030-2						L m	0.07	-5.93
Desmoinesian, Dickerson Fm., limestone (Martin Ranch, Weatherford, TX)								
TXD032-a-1	*Neospirifer cameratus*	p+f	NL	L	L	NL p	3.61	-1.56
TXD032-a-2						NL p	3.31	-1.18
TXD032-a-3						NL p	4.13	-1.49
TXD033-a-1	*Neospirifer cameratus*					NL p	2.74	-1.41
TXD033-a-2						NL p	3.98	-1.50
TXD034-a-1	*Neospirifer cameratus*	p	NL/SL		L	NL p	3.04	-1.45

TXD034-a-2							NL p	4.01	-1.36
TXD036-1	*Neophricodothyris perplexa*	p+f	NL/SL	L	L		NL p	5.06	-1.38
TXD036-2							L m	-2.61	-4.58
TXD037	*Neophricodothyris perplexa*						NL p	3.41	-1.86
Moscovian, Hare Fiord Fm., Tellevak Limestone Member, limestone (Ellesmere Island, Geological Survey of Canada 56430)									
GSC001-1	*Meristorygma arctica*	p	NL/SL	L	L	twinned	NL/SL p	5.69	-0.46
GSC001-2							Lm	4.82	-2.91
GSC002-1	*Meristorygma arctica*	p	NL/SL	L	L	twinned	NL/SL p	5.37	-0.54
GSC002-2							Lm	4.37	-2.21
GSC003-1	*Meristorygma arctica*	p	NL/SL	L	L	twinned	NL/SL p	5.43	-0.76
GSC003-2							L m	4.70	-0.40
GSC004-1	*Tiramnia grunti*	p	NL/SL	L	L	twinned	NL/SL p	5.77	-0.72
GSC004-2							Lm	4.52	-2.08
GSC005-1	*Tiramnia grunti*	p	NL/SL	L	L		NL/SL p	5.82	-0.54
GSC005-2							L m	4.69	-3.67
GSC006-1	*Tiramnia grunti*	p	NL/SL	L	L		NL p	5.52	-0.48
GSC006-2							L m	4.46	-6.04
GSC007-1	*Tiramnia walteri*	p	NL/SL	L	L	twinned	NL p	5.51	-0.18
GSC007-2							NL p	5.72	-0.26
GSC007-3							L m	4.77	-5.28
GSC008-1	*Tiramnia walteri*	p	NL/SL	L	L	twinned	NL/SL p	5.92	0.09
GSC008-2							Lm	4.67	-4.81
Moscovian, Hare Fiord Fm., Tellevak Limestone Member, limestone (Ellesmere Island, Geological Survey of Canada 60194)									
GSC009-1	*Parachoristites tellevakensis*	p	NL/SL	L	L		NL/SL p	6.39	0.15
GSC009-2							Lm&c	6.15	-3.64
GSC010-1	*Parachoristites tellevakensis*	p	NL/SL	L	L	twinned	NL p	6.71	-0.58
GSC010-2							L m	6.28	-3.57
Morrowan, Sausbee Fm., Braggs Member, Unit 10, limestone (Chisum Quarry, OK)									
OK001-a-1	*Spirifer gorei*	p+f	NL/SL	L	SP		NL p	3.32	-1.66
OK001-b-1							NL p	3.97	-1.26
OK002	*Spirifer gorei*	p+f	NL/SL	L	L		NL p	4.12	-2.07
OK003	*Spirifer gorei*	p+f	NL/SL	L	L		NL p	3.87	-2.02
Morrowan, Sausbee Fm., Braggs Member, Unit 9, shale (Chisum Quarry, OK)									
OK011-1	*Spirifer gorei*	p	NL		L		NL p	3.71	-1.76
OK011-2							NL p	3.61	-1.83
OK012-1	*Spirifer gorei*	p	NL/SL	L	L		NL p	4.80	-1.71
OK012-2							NL p	3.32	-1.86
OK012-3							NL p	3.88	-1.53
OK013	*Spirifer gorei*	p	NL/SL	L	L		NL p	4.32	-1.74
OK014	*Spirifer gorei*	p	NL	L	L		NL p	4.00	-1.91
Morrowan, Sausbee Fm., Braggs Member, Unit 7, shale (Chisum Quarry, OK)									
OK018	*Spirifer gorei*	p	NL/SL		L		NL p	4.96	-1.76
OK019-1	*Spirifer gorei*	p	NL/SL	L	L		NL p	3.06	-2.45
OK019-2							NL p	3.16	-2.38

OK019-3							NL p	4.02	-1.46
OK023-1	*Spirifer gorei*	p	NL	L	L		NL p	4.09	-2.22
OK023-2							NL p	3.94	-2.26
OK024-1	*Composita ozarkana*	p	NL	L	L		NL p	4.96	-1.14
OK024-2							L m	3.04	-3.68
OK026-1	*Composita ozarkana*	p	NL/SL	L	L		NL p	5.36	-1.34
OK026-2							NL/SL c	1.33	-3.73
OK026-3							L/SNL c	1.37	-4.04
OK028-1	*Composita ozarkana*	p	NL/SL	L	SP		NL p	5.17	-0.75
OK028-2							NL/SL m	2.40	-5.22
OK029-1	*Composita ozarkana*	p+f	NL/SL	L	DL		NL p	5.18	-1.06
OK029-2							L m	2.89	-4.44
Morrowan, Sausbee Fm., Braggs Member, Unit 6, shale (Chisum Quarry, OK)									
OK030-1	*Spirifer gorei*	p	NL/SL		L		NL p	3.95	-1.67
OK030-2							NL p	3.54	-1.26
OK030-3							NL p	3.95	-1.20
OK030-4							NL p	3.72	-1.30
OK031	*Spirifer gorei*	p	NL		L		NL p	4.17	-1.46
OK032	*Spirifer gorei*	p	NL/SL		L		NL p	4.25	-1.46
OK036-1	*Spirifer gorei*	p	NL	L	L		NL p	3.91	-1.61
OK037	*Spirifer gorei*	p	NL	L	L		NL p	4.68	-1.83
OK038-1	*Composita ozarkana*	p	NL	L	L		NL p	5.38	-0.65
OK038-2							NL p	5.28	-0.75
OK039	*Composita ozarkana*	p+f	NL/SL	L	L		NL p	5.03	-0.50
OK040	*Composita ozarkana*	p	NL/SL	L	L		NL p	5.05	-0.81
Morrowan, Sausbee Fm., Braggs Member, Unit 6, shale (Webbers Fall section, OK)									
OK046-1	*Spirifer gorei*	p	NL/SL	L	L		NL p	4.11	-1.77
OK046-2							NL p	4.20	-1.81
OK047-1	*Spirifer gorei*	p	NL		L		NL p	3.92	-2.29
OK047-2							NL p	3.51	-2.34
OK047-3							NL p	3.63	-2.49
OK047-4							NL p	3.51	-2.69
OK048	*Spirifer gorei*	p	NL	L	L		NL p	4.15	-1.52
OK051-1	*Composita ozarkana*	p	NL/SL		L		NL p	5.11	-1.54
OK051-2							NL p	4.99	-1.49
OK052	*Composita ozarkana*	p	NL	L	DL		NL p	5.06	-1.45
Morrowan, Sausbee Fm., Braggs Member, shale (Singin T Acres section, OK)									
OK054	*Spirifer gorei*	p+f	NL/SL		L		NL p	3.26	-2.49
OK055	*Spirifer gorei*	p	NL/SL	L	L		NL p	3.82	-3.09
OK058	*Composita ozarkana*	p	NL	L	L		NL p	5.00	-2.13
Chesterian, Kincaid Fm., Cave Hill Member, shale (Millstone Bluff Quarry, IL)									
ILL001-1	*Anthracospirifer increbescens*	p	NL	L	L	twinned	NL p	2.19	-1.85
ILL001-2							L m	1.21	-4.23
ILL002-2	*Anthracospirifer increbescens*	gf+p	NL/SL	L	L		NL p	1.64	-1.51
ILL005	*Anthracospirifer increbescens*	p+f	NL	L	L		NL p	3.27	-2.67
ILL005A	*Anthracospirifer increbescens*	p+f	NL	L	L		NL p	2.01	-2.04

ILL006-1	*Composita subquadrata*	gf+f	NL/SL	L	DL		NL/SL gf	2.73	-2.66
ILL008-1	*Composita subquadrata*	gf+f	NL/SL	L	L		NL/SL gf	2.31	-1.92
ILL008-b-1							L m	1.47	-3.80
ILL008-b-2							L c	1.76	-3.86
ILL008-b-3		f	NL/SL	L	L		NL/SL f	2.82	-2.52
ILL009-1	*Composita subquadrata*	f	NL/SL	L			NL f	1.98	-2.60
ILL009-2							L m	1.96	-4.03
ILL010-1	*Composita subquadrata*	f	NL/SL	L	L		NL/SL f	2.63	-1.63
ILL010-2							L c	-0.16	-6.28
ILL011-1	*Composita subquadrata*	f	NL	L	L		NL/SL f	2.72	-3.67
ILL011-2							L m	1.12	-6.05
ILL013-1	*Composita subquadrata*	f	NL/SL	L			NL/SL f	1.65	-2.55
ILL013-2							L m	0.00	-4.46
Chesterian, Kincaid Fm., Niggli Creek Member, limestone (Millstone Bluff Quary, IL)									
ILL019-a-1	*Anthracospirifer increbescens*	p	NL/SL	L	L		NL p	2.06	-2.59
ILL019-a-2							NL p	2.62	-3.36
ILL020	*Anthracospirifer increbescens*	p	NL	L	L		NL p	1.98	-2.81
ILL021-1	*Anthracospirifer increbescens*	p	NL	L	L		NL p	2.02	-2.92
ILL021-2							NL p	1.88	-3.14
Chesterian, Chlore Fm., Ford Station Member, limestone (Robbis Station RR cut, IL)									
ILL034-1	*Anthracospirifer increbescens*	p	NL/SL	L	SP		NL p	3.49	-3.09
ILL034-2							NL p	3.41	-3.25
ILL035-1	*Anthracospirifer increbescens*	p+f	NL/SL		L		NL p	2.47	-2.88
ILL035-2							NL p	2.60	-3.23
ILL036-1	*Anthracospirifer increbescens*	p	NL/SL		L		NL p	3.03	-2.77
ILL036-2							NL p	3.23	-2.66
ILL041-1	*Composita subquadrata*	f	NL/SL	L	L	Silicn.	NL f	1.99	-2.81
ILL041-2							L m	0.68	-3.15
ILL042-a-1	*Composita subquadrata*	f	NL/SL	L	L		NL f	2.91	-2.84
ILL042-a-2							NL f	3.03	-2.85
ILL042-a-3							L m	0.88	-3.05
ILL043-1	*Composita subquadrata*	gf	NL/SL	L	SP		NL/SL gf	1.57	-2.75
ILL043-2							L m&c	1.10	-2.72
ILL045-1	*Composita subquadrata*	f	NL/SL	L	L		NL/SL f	3.25	-2.92
ILL045-2							L m	0.64	-3.18
Chesterian, Ridenhower Fm., limestone (Vogel School, IL)									
ILL063-1	*Anthracospirifer increbescens*	gf	NL/SL	L	L		NL cf	3.20	-3.94
ILL063-2							L m	1.05	-3.67
ILL064-1	*Anthracospirifer increbescens*	p	NL/SL	L	L		NL p	2.53	-3.67
ILL064-2							L m	0.35	-4.04
ILL065	*Anthracospirifer increbescens*	p+f	NL/SL	L	L		NL p	3.30	-1.93
ILL066	*Anthracospirifer increbescens*	p	NL		L		NL p	2.58	-2.80

ILL067	*Anthracospirifer increbescens*	p	NL/SL		L		NL p	2.71	-3.13
ILL068	*Anthracospirifer increbescens*	p	NL/SL		L		NL p	2.66	-2.57
ILL074-1	*Composita subquadrata*	f	NL	L	L		NL f	1.96	-4.00
ILL074-2							L c	0.32	-3.94
Chesterian, Pella Fm., NW corner Pond #3, shale (Oskaloosa Quary, IA)									
IA002-1	*Anthracospirifer pellaensis*	p+f	NL/SL	L	L	Silicn.	NL cf?	2.15	-0.47
IA002-2							L m	-1.14	-3.68
IA003-1	*Anthracospirifer pellaensis*	p+f	NL/SL	L	L	Silicn.	NL p	2.78	-1.75
IA003-2							L m	-0.73	-3.46
IA004-1	*Anthracospirifer pellaensis*	p	NL/SL	L	L	Silicn.	NL p	1.58	0.01
IA004-2							L m	-1.21	-3.61
IA007-1	*Anthracospirifer pellaensis*	p+f	NL/SL	L	L		NL p	1.81	-1.12
IA007-2							L m	-1.13	-3.09
IA008-1	*Composita trinuclea*	f	NL/SL	L	L	Silicn.	NL/SL f	0.97	-1.51
IA008-2							L m	-2.63	-4.36
Chesterian, Pella Fm., roaddcut W of Pond #4, shale (Oskaloosa Quary, IA)									
IA012-1	*Anthracospirifer pellaensis*	p	L/SNL	L	L	Silicn.	NL/SL p	2.45	-2.45
IA012-2							L m	-0.40	-2.68
IA013-1	*Anthracospirifer pellaensis*	f	NL/SL	L	L	Silicn.	NL?f	1.75	-1.94
IA013-2							L m	-3.10	-4.57
IA016-1	*Anthracospirifer pellaensis*	p	NL/SL	L	L	Silicn.	NL p	2.61	-0.79
IA016-1	*Anthracospirifer pellaensis*						NL p	2.60	-0.81
IA016-2							L m	-2.94	-3.93
IA017-1	*Anthracospirifer pellaensis*	p+f	NL/SL	L	L	Silicn.	NL/SL p	2.22	-2.16
IA017-2							L m	-2.23	-3.74
IA018	*Anthracospirifer pellaensis*	p	NL/SL		L		NL p	2.44	-2.21
IA020	*Anthracospirifer pellaensis*	p	NL/SL		L		NL p	2.49	-2.17
IA021-1	*Anthracospirifer pellaensis*	p	NL/SL		L	Silicn.	NL p	3.10	-1.92
IA021-2							L dmc?	-1.92	-3.79
IA022	*Anthracospirifer pellaensis*	p	NL/SL		L	Silicn.	NL p	2.63	-1.49
IA023	*Anthracospirifer pellaensis*	p+f	NL/SL		L	Silicn.	NL p	1.74	-1.87
IA024-1	*Anthracospirifer pellaensis*	p	NL/SL	L	L		NL p	2.87	-0.79
IA024-2							L m	-5.40	-5.98
IA027-a-1+2	*Composita trinuclea*	f	NL/SL	L	L	Silicn.	NL f	2.09	-0.38
IA027-a-3							L m	-0.88	-3.33
IA032-1	*Composita trinuclea*	f	NL/SL	L	L	Silicn.	NL f	2.50	-0.82
IA032-2							L m	-0.94	-3.30
IA033-1	*Composita trinuclea*	f	NL/SL	L	L	Silicn.	NL/SL f	2.98	-1.02
IA033-2							L c	-1.87	-3.83

IA034	*Composita trinuclea*	f	NL/SL	L	L	Silicn.	NL f	1.83	-1.58
Chesterian, Pella Fm., upper level [+5 ft], shale (Taylor Quarry, IA)									
IA040-1	*Anthracospirifer pellaensis*	p+f	NL/SL	L	L		NL/SL p	2.89	-1.34
IA040-2							L m	-1.42	-3.78
IA041-1	*Anthracospirifer pellaensis*	p+f	NL/SL	L	L	Silicn.	NL/SL p	1.99	-2.08
IA041-2	*Anthracospirifer pellaensis*						L m	-1.97	-3.88
IA044-1	*Anthracospirifer pellaensis*	p	NL/SL	L	L	Silicn.	NL/SL p	2.62	-1.18
IA044-2							L dmc	-1.71	-4.03
Chesterian, Pella Fm., mid level [10-15 ft], shale (Taylor Quarry, IA)									
IA056-1	*Anthracospirifer pellaensis*	p+f	NL/SL	L	L	Silicn.	NL/SL p	2.46	-1.80
IA056-2							L m	-1.80	-4.49
IA057-a-1	*Anthracospirifer pellaensis*	p	NL/SL	L	L	Silicn.	NL/SL p	1.91	-2.00
IA057-a-2							L m	-2.43	-4.13
IA058	*Anthracospirifer pellaensis*	p	NL/SL	L	L	Silicn.	NL p	2.07	-2.29
Chesterian, Pella Fm., lower level [+20 ft], shale (Taylor Quarry, IA)									
IA073-1	*Anthracospirifer pellaensis*	cf	L/SNL	L	L	Silicn.	NL/SL p	1.22	-2.05
IA073-2							L m	-1.89	-4.64
IA077-1	*Anthracospirifer pellaensis*	p+f	NL/SL	L	L	Silicn.	NL/SL p	2.60	-1.23
IA077-1	*Anthracospirifer pellaensis*						NL/SL p	2.60	-1.30
IA077-2							L m	-2.22	-4.07
IA078-1	*Anthracospirifer pellaensis*	p+f	NL/SL	L	L		NL/SL p	2.84	-1.70
IA078-2							L m	-2.63	-4.45
IA080-1	*Anthracospirifer pellaensis*	p+f	NL/SL	L	L	Silicn.	NL p	2.07	-1.79
IA080-2							L dmc	-1.75	-3.40
IA082	*Anthracospirifer pellaensis*	p	NL/SL	L	L	Silicn.	NL/SL p	2.26	-2.51
IA083	*Anthracospirifer pellaensis*	p	NL	L	L		NL p	3.66	-1.19
IA086	*Anthracospirifer pellaensis*	p+f	NL/SL		L	Silicn.	NL p	1.86	-1.83
IA086A	*Anthracospirifer pellaensis*	p	NL/SL		L	Silicn.	NL p	2.11	-2.14
IA086B	*Anthracospirifer pellaensis*	p	NL		L	Silicn.	NL p	2.15	-2.18
IA089-1	*Composita trinuclea*	f	NL/SL	L	L		NL/SL f	2.10	-0.49
IA089-2	*Composita trinuclea*						L m	-2.45	-4.49
IA090	*Composita trinuclea*	f	NL/SL	L	L	Silicn.	NL f	2.69	-2.58
IA094	*Composita trinuclea*	f	NL/SL	L	L	Silicn.	NL/SL f	2.55	-1.84
Meramecian, Ullin Fm., road cut cliff [+20 ft], limestone (Columbia roadcut, IL)									
ILL082-1	*Prospira washingtonensis*	p	L/SNL	L	L	Silicn.	NL p	3.61	-2.32
ILL082-2							L m	3.54	-1.46
Meramecian, Ullin Fm., onramp cliff-SE [+10 ft], limestone (Columbia roadcut, IL)									
ILL085-1	*Prospira washingtonensis*	p	L/SNL	L	DL	Silicn.	NL p	3.37	-1.95

ILL085-2							L c&m	2.57	-6.97
ILL086-1	*Prospira washingtonensis*	p	NL	L		Silicn.	NL p	3.38	-2.25
ILL086-2							L m	2.75	-5.41
ILL087-1	*Prospira washingtonensis*	p	NL/SL	L	L	Silicn.	NL p	2.95	-2.21
ILL087-2							L c&m	2.60	-5.11
Meramecian, Ullin Fm., onramp cliff-NW [+7 ft], limestone (Columbia roadcut, IL)									
ILL091	*Prospira washingtonensis*	p	NL/SL	L	DL	Silicn.	NL p	4.43	-2.32
ILL092-1	*Prospira washingtonensis*	p	NL/SL	L	L	Silicn.	NL p	4.29	-2.03
ILL092-2							NL p	3.53	-1.88
Meramecian, Ullin Fm., onramp ditch [+5 ft], limestone (Columbia roadcut, IL)									
ILL097-1	*Prospira washingtonensis*	p	NL/SL	L	L	Silicn.	NL p	3.07	-2.22
ILL097-2							L c	2.84	-6.94
ILL100	*Prospira washingtonensis*	p	NL	L	L	Silicn.	NL p	3.79	-2.53
Meramecian, Ullin Fm., basal bed [0 ft], limestone (Columbia roadcut, IL)									
ILL105-1	*Prospira washingtonensis*	p	NL/SL	L	L	Silicn.	NL/SL p	3.36	-2.70
ILL105-2							L m	2.86	-2.41
L. Meramecian, Warsaw Fm., limestone (Meramec River Bridge, MO)									
MO001-1	*Cleiothyridina obmaxima*	p+f	NL/SL		L	Silicn.	NL p	3.28	-1.05
MO001-2	*Cleiothyridina obmaxima*						NL p	4.05	-1.12
MO005	*Torynifer pseudolineatus*	f	NL		L		NL f	3.32	-1.52
L. Meramecian, Warsaw Fm., limestone (S. Fenton, MO)									
MO012	*Spirifer tenuicostatus*	p	NL		L	Silicn.	NL p	3.45	-1.36
MO014-1	*Brachythyris suborbiculatus*	p	NL		L	Silicn.	NL p	3.92	-1.59
MO014-2							L/SNL c	1.69	-7.16
MO015	*Brachythyris suborbiculatus*	p	NL		L	Silicn.	NL p	3.97	-1.44
MO016	*Brachythyris suborbiculatus*	p	NL		L	Silicn.	NL p	4.05	-1.66
MO019-1	*Syringothyris subcuspidatus*	f	NL/SL	L		Silicn.	NL f	3.91	-1.35
MO019-2							L c&m	2.09	-8.05
MO026-1	*Torynifer pseudolineatus*	u to f	NL/SL	L		Silicn.	NL/SL f	4.13	-1.61
MO026-2							L/SNL m	2.08	-4.06
L. Meramecian, Warsaw Fm., limestone (Pink Elephant site, MO)									
MO034	*Spirifer tenuicostatus*	p	NL	L		Silicn.	NL p	4.02	-1.70
MO035	*Spirifer tenuicostatus*	p	NL/SL	L		Silicn.	NL p	2.86	-1.65
MO036-1	*Spirifer tenuicostatus*	cf	NL	L		Silicn.	NL p	3.68	-1.60
MO036-2							NL p	3.33	-1.55
MO039	*Brachythyris suborbiculatus*	p	NL	L		Silicn.	NL p	4.08	-1.30
MO040-1	*Brachythyris suborbiculatus*	p	NL/SL	L		Silicn.	NL p	3.03	-1.45
MO040-2	*Brachythyris suborbiculatus*					Silicn.	L m	1.94	-4.62
MO042	*Brachythyris suborbiculatus*	f	NL	L		Silicn.	NL p	3.98	-1.34
MO044-1	*Cleiothyridina obmaxima*	p	NL	L	L	Silicn.	NL p	4.71	-1.43

MO044-2							L c	2.78	-1.86
MO046	*Cleiothyridina obmaxima*	p	NL	L	L	Silicn.	NL p	4.23	-0.96
MO047	*Cleiothyridina obmaxima*	p	NL	L	L	Silicn.	NL p	4.88	-1.53
MO048-1	*Cleiothyridina obmaxima*	p	NL	L	L	Silicn.	NL p	4.25	-1.31
MO048-2							NL p	4.67	-0.96
MO054-1	*Torynifer pseudolineatus*	f	NL/SL	L		Silicn.	NL f	3.54	-1.86
MO054-2							L c	1.93	-7.71
Osagian, Edwardsville Fm., shale (Etter Farms, Martinsville, IN)									
IND001-a-1	*Composita globosa*	f	NL/SL	L	L		NL f	3.62	-0.52
IND001-a-2							L m	-3.09	-4.29
IND002-1	*Composita globosa*	f	NL/SL	L	L	Silicn.	NL? f	4.12	-0.67
IND002-2							L m	-6.52	-4.93
IND003-b-1	*Composita globosa*	f	NL/SL	L	L	Silicn.	NL f	3.52	-0.62
IND003-b-2							L m	-7.53	-4.52
IND003-c-1							NL f	3.93	-0.89
IND004-a-1	*Composita globosa*	f	NL/SL	L	L		NL/SL f	3.79	-0.65
IND004-a-2							L m	-7.04	-6.50
IND006-1	*Composita globosa*	f	NL/SL	L	L		NL/SL f	3.38	-0.61
IND016-1	*Actinoconchus lamellosa*	p+f	NL	L	L		NL p	2.93	-0.40
IND016-2							NL p	2.85	-0.27
IND016-3							L m	-3.03	-6.96
IND017-1	*Actinoconchus lamellosa*	p+f	NL		L		NL p	4.34	-0.25
IND018-1	*Actinoconchus lamellosa*	p+f	NL	L	L		NL p	2.36	-0.47
IND018-2							L m&c	-3.08	-6.34
IND023-a-1	*Phricodothyris*	f	NL/SL	L	L		NL f	3.21	-0.65
IND023-a-2							L/SNL m	-2.41	-3.64
IND024-a-1	*Phricodothyris*	f	NL/SL				NL f	3.35	-0.25
IND026-1	*Tylothyris sp.*	p	NL	L			NL/SL p	3.36	-0.58
IND026-2							L/SNL m	-5.62	-5.12
IND027-a-1	*Tylothyris sp.*	p	NL	L	L		NL p	3.23	-0.14
IND027-a-2							NL p	3.76	-0.20
IND027-b-1							NL p	3.27	-0.29
IND027-b-2							NL p	4.52	0.08
Osagian, Burlington Fm., Cedar Fork Member, limestone (Keota Quarry, IA)									
IA104-1	*Syringothyris typa*	f	NL/SL	L	L	Silicn.	NL/SL cf	4.63	-2.18
IA104-2							L c	0.31	-4.86
IA105-1	*Syringothyris typa*	gf	NL/SL	L		Silicn.	NL/SL gf	4.75	-1.77
Osagian, Fern Glen Fm., limestone (Rock Creek Valley roadcut, MO)									
MO062-1	*Marginatia fernglenensis*	u to f	NL/SL	L	L		NL/SL f	2.99	-1.34
MO062-2							L m	2.71	-2.91
MO063-1	*Marginatia fernglenensis*	u to f	L/SNL	L			NL/SL f	2.83	-1.54
MO063-2							L m	2.77	-2.36
MO065-1	*Prospira vernonensis*	p	NL	L	L	Silicn.	NL p	2.93	-1.78
MO065-2							NL p	3.38	-1.76
MO065-3							L m	1.99	-1.80

MO067-1	*Prospira vernonensis*	p	NL/SL	L	L	Silicn.	NL/SL p	3.90	-1.85
MO067-2							L m	2.78	-2.51
MO068-1	*Prospira vernonensis*	p	NL	L	L	Silicn.	NL p	3.56	-1.56
MO068-2							L m	3.03	-1.54
MO070	*Prospira vernonensis*	p	NL	L		Silicn.	NL p	3.45	-1.73
MO074	*Prospira vernonensis*	p	NL	L		Silicn.	NL p	3.26	-1.50
MO076	*Prospira vernonensis*	p	NL/SL	L		Silicn.	NL p	2.87	-1.56
MO077	*Prospira vernonensis*	p	NL/SL	L		Silicn.	NL p	3.68	-1.27
MO078	*Prospira vernonensis*	p	NL/SL	L	L	Silicn.	NL p	3.51	-1.83
MO081-1	*Torynifer glenparkensis*	f	NL/SL	L	L		NL/SL f	3.14	-1.17
MO081-2							L m	2.70	-2.30
MO083-1	*Torynifer glenparkensis*	u	NL/SL	L	L	Silicn.	NL/SL f	3.28	-0.87
MO083-2							L m	2.95	-1.58
Kinderhookian, Gilmore City Fm., Rhodocrinus zone, loading ramp, limestone (Hallett Quary, IA)									
IA110-1	*Prospira cf. greenockensis*	p+f	L/SNL	L	L		NL p	5.83	-0.33
IA110-2							L m	4.31	-2.13
IA111	*Prospira cf. greenockensis*	f	NL	L	L		NL f	4.39	-0.95
IA112-1	*Prospira cf. greenockensis*	p+f	NL/SL	L	L		NL p	5.42	-1.79
IA112-2							NL p	4.96	-1.80
IA112-3							L c&m	2.16	-4.12
IA113-1	*Prospira cf. greenockensis*	f	NL	L	L		NL f	5.00	-1.32
IA113-2							L m	3.43	-3.26
IA114	*Prospira cf. greenockensis*	p	NL/SL	L	SP		NL p	4.64	-0.13
IA115-1	*Prospira cf. greenockensis*	p+f	NL/SL	L	L		NL p	5.57	-1.76
IA115-1-2							L m	1.19	-4.07
IA116-1	*Prospira cf. greenockensis*	p	NL/SL	L	L		NL p	5.00	-1.76
IA116-2							NL p	6.11	-1.61
IA116-3							L c&m	0.08	-4.76
IA117-1+2	*Prospira cf. greenockensis*	p	NL/SL	L	L		NL p	5.55	-0.77
IA140-1	*Composita humilis*	f	L/SNL	L	L		NL f	5.89	-1.31
IA140-2							L m	2.93	-2.99
IA142-1	*Composita humilis*	f	NL	L	L		NL f	5.56	-1.22
IA142-2							L m	0.43	-5.11
Kinderhookian, Gilmore City Fm., Rhodocrinus zone, pit location, limestone (Hallett Quarry, IA)									
IA143	*Prospira cf. greenockensis*	f	L/SNL	L	L		NL f	6.13	-0.37
IA144	*Prospira cf. greenockensis*	p+f	NL/SL	L	L		NL p	5.31	-0.17
IA145	*Prospira cf. greenockensis*	p	NL/SL	L	L		NL p	6.01	-0.27
IA146-a-1+2	*Prospira cf. greenockensis*	p+f	NL/SL	L	L		NL cf	5.30	-1.29
IA146-a-3							NL p	5.91	-0.56
IA146-b-1							NL p	5.72	-0.55
IA146-b-2							L m	5.75	-3.54

Kinderhookian, Gilmore City Fm., limestone (Midwest Quarry, IA)									
IA197-1	*Prospira greenockensis*	p	NL	L			NL p	5.67	-0.16
IA197-2							NL p	5.14	0.35
IA198-1	*Prospira greenockensis*	cf	NL/SL	L			NL f	4.87	-0.97
IA198-2							L m	3.43	-3.57
IA199-1	*Prospira greenockensis*	cf	NL/SL	L			NL f	5.22	-0.33
IA199-2							NL f	5.60	-0.66
IA199-3							L m	3.50	-3.44
IA200-a-1	*Prospira greenockensis*	p+f	NL/SL	L	L		NL p	5.25	-0.74
IA200-b-1							NL f	5.13	-0.49
IA200-b-2							L m	3.91	-3.17
Kinderhookian, Wassonville Fm., dolomitic limestone (Keota Quarry, IA)									
IA152-1	*Spirifer 21579*	p	NL/SL	L	L		NL/SL p	2.92	-2.77
IA152-2							L m	1.82	-4.28
IA153-1	*Spirifer 21579*	p	NL/SL	L	L	Silicn.	NL/SL p	3.22	-3.27
IA153-2							L m	2.17	-4.64
IA154-1	*Spirifer 21579*	f	NL/SL	L	L	Silicn.	NL/SL f	2.64	-3.40
IA154-2							L m	1.95	-4.93
IA154-3							DL/SNL c	0.25	-8.20
IA155-1	*Spirifer 21579*	p	NL/SL	L	L	Silicn.	NL/SL p	3.05	-2.77
IA155-2							L/SNL m	1.51	-5.38
IA156-1	*Spirifer 21579*	p+f	NL/SL	L	L		NL/SL p	2.90	-3.08
IA156-2							L m	1.47	-4.81
IA158	*Spirifer 21579*	p	NL	L		Silicn.	NL p	2.98	-2.98
IA162-1	*Spirifer 21579*	p	NL/SL	L	L		NL p	3.08	-2.78
IA162-2							L m	0.96	-6.02
IA164	*Spirifer 21579*	p+f	NL	L	L	Silicn.	NL p	3.11	-2.77
IA168	*Spirifer 21579*	p+f	NL/SL	L	L		NL p	2.24	-3.07
IA173-1	*Composita sp.*	p+f	NL/SL	L	DL		NL p	2.98	-2.66
IA173-2							L c	-5.52	-8.28
IA174	*Composita sp.*	p	NL/SL	L	SP		NL p	3.24	-2.51
Kinderhookian, Starrs Cave Fm., oolitic limestone (Starrs Cave Park, IA)									
IA175-1	*Spirifer 21579*	p	L/SNL	L	L		NL/SL p	2.54	-3.17
IA175-2							L shell	3.16	-3.13
IA178-1	*Spirifer 21579*	p	NL/SL	L	L		NL/SL p	2.11	-3.48
IA179-1	*Spirifer 21579*	p	NL/SL	L	L		NL/SL p	2.40	-2.55
IA179-2							L m	1.12	-4.78
IA187-1	*Spirifer ?*	p	L/SNL	L	L		NL/SL p	2.20	-2.02
IA187-2							L/SNL f	1.82	-3.83
IA188-1	*Spirifer?*	p	NL/SL	L	L		NL/SL p	2.22	-2.84
IA188-2							L m	1.18	-4.48
IA189-1	*Spirifer?*	p	NL/SL	L	L		NL p	2.32	-3.06
IA189-2							L m	1.09	-4.28
IA190-1	*Spirifer?*	p	NL/SL	L	L		NL p	2.33	-4.02
IA190-2							L m	1.65	-4.17
IA190-3							NL p	3.04	-3.23
IA191-1	*Spirifer?*	p	NL/SL	L	L		NL p	1.74	-3.02
IA191-2							L m	1.15	-4.24

Kinderhookian, Glen Park Fm., limestone (Irish Hollow, Hamburg, IL)									
ILL114-1	*Syringothyris extenuata*	f	L/SNL	L		thin	NL/SL f	0.63	-4.79
ILL114-2							L m	1.09	-4.63
ILL115-1	*Syringothyris extenuata*	f	NL/SL	L	L	Silicn.	NL/SL f	0.95	-5.14
ILL115-2							L m	0.94	-4.72
ILL116-a-1	*Syringothyris extenuata*	f	NL/SL	L	L	Silicn.	NL cf	1.08	-5.53
ILL116-a-2							NL f	1.01	-5.50
ILL116-b-1							NL cf	1.28	-5.48
ILL116-b-2							NL f	0.91	-5.49
ILL116-b-3							L m	-0.18	-5.69
ILL117-c-1	*Syringothyris extenuata*	gf	NL/SL	L		Silicn.	NL f	1.57	-5.90
ILL117-c-2							NL f	1.12	-6.08
ILL118-1	*Syringothyris extenuata*	cf	NL/SL	L			NL f	1.03	-4.90
ILL118-2							L m	0.67	-4.41
ILL120-1	*Syringothyris extenuata*	f	NL/SL	L		Silicn.	NL/SL u	1.19	-5.00
ILL120-2							L m	0.75	-5.03
ILL121-1	*Syringothyris extenuata*	u	NL/SL		L	Silicn.	NL/SL u	1.54	-5.46
ILL121-2							NL/SL u	1.13	-5.57
ILL123-a-1	*Syringothyris extenuata*	cf	NL/SL	L		Silicn.	NL f	0.67	-5.19
ILL123-a-2							L m	3.41	-4.28
ILL124-a-1	*Syringothyris extenuata*	f	NL	L		Silicn.	NL/SL f	1.02	-6.30
ILL124-a-2+3							L m	0.49	-4.69
ILL124-b-1							NL f	1.26	-6.17
ILL124-b-2							NL f	1.29	-4.60
ILL129-1	*Syringothyris extenuata*	cf	NL	L	L		NL f	1.77	-5.72
ILL129-2							L m	1.03	-4.69

Note: Detailed information of the samples we personally collected are as follows: In ascending order, the Kinderhookian Stage sampling intervals include Glen Park Fm. (Irish Hollow, Hamburg, Illinois), Starrs Cave Fm. (Starrs Cave Park, 1/2 mile north of Burlington, Iowa), Wassonville Fm. (Keota quarry, 1 mile SE of Keota, Iowa), and Gilmore City Fm. (Hallett and Midwest quarries, Gilmore City, Iowa). The Osagian Stage sampling intervals include Fern Glen Fm. (Rt. 21 roadcut, southwest edge of greater St. Louis, Missouri), Burlington Fm. (Keota quarry, 1 mile SE of Keota, Iowa), and Edwardsville Fm. (Etter Farms, Martinsville, Indiana). The Meramecian Stage sampling intervals include Warsaw Fm. (Meramec River bridge and Pink Elephant site, SW edge of metropolitan St. Louis, Missouri) and Ullin Fm. (Columbia roadcut, 1 mile SE of town Columbia, Illinois). The Chesterian sampling intervals are Pella Fm. (Oskaloosa quarry, 4 miles NNE of Oskaloosa; and Taylor quarry, 5 miles SSE of Delta, Iowa), Ridenhower Fm. (Vogel School, 5 miles NE of Waterloo, Illinois), Chlore Fm. (Robb's Station RR cut, 35 mile SE of Carbondale, Illinois), Fraileys Fm. (Intersection of Rt. 146 and I-57, 20 miles SSE of Carbondale, Illinois), Pitkin Fm. (Adair-Cherokee county line, 14 miles SE of Tahlequah, Oklahoma), and Kincaid Fm. (Millstone Bluff quarry, 35 miles SE of Carbondale, Illinois). The Morrowan Stage sampling interval is Sausbee Fm. (Chisum quarry, 3.5 miles NW of Gore; Webbers Falls section, 3.5 miles NW of Webbers Falls; and Singin T Acres section, 9 miles SSE of Tahlequah, Oklahoma). The Desmoinesian samples, in ascending order, were collected from Dickerson Fm. (Dickerson beds, Martin Ranch, southwest of Dennis Bridge, Texas), Lazy Bend Fm. (Dennis Bridge, southwest of Weatherford, Texas), Lower Grindstone Creek Fm. (Weatherford quarry, west of Weatherford, Texas), and Upper Grindstone Creek Fm. (junction of Rt. 4 and I 20, west of Weatherford, Texas).

*Number after dash represents the number of the sample area (field of view). "a", "b", etc. distinguish samples from the same field of view. Capital letters indicate additional samples to existed sample numbers.

†MS = microstructure; p = prismatic, f = fibrous, cf = coarsely fibrous, gf = granular fibrous, u = unclear, op = opaque.

§L.C. = luminescence character; NL = nonluminescent, SL = slightly luminescent, L = luminescent, SNL = slightly nonluminescent

#M = matrix

**M. A. = material analyzed; c = cement, m = matrix

††Silicn. = silicification