APPENDIX C

SPECIMEN NOTES AND DATA

This appendix contains specific information for each specimen such as locality, stratigraphic unit, etc. All $\delta^{13}C$ and $\delta^{18}O$ data that was collected is also contained within, sorted in several different ways, as well as previously published data from Russian and North American brachiopods. All δ13C and δ18O are given in ‰ (V-PDB).

Contents:

C1) Specimen/Locality Information*

	Stage	Horizon (Formation)	Locality#	Lithology / Depositional Environment	Coordinates	Other	Taxon	Specimen ID	Age
Permian	Kungurian	Saraninian (Lower Saraninian Member)	Nizhneizginsk village, Irgina River	argillaceous micrite / interreef muds	56° 52.1'N, 57° 25.0'E		*Kalitvella sp.*	SQ17b	274.8
								SQ17a	274.8
			Chikali quarry, Sylva River, Kungur city	biomicrite / small 'reef' and bedded limestone	57° 23'N, 57° 05.9'E	17 m +	*Stensocsisma mutabilis*	KQ8-2	274.5
								KQ8-1	274.5
					57° 23'N, 57° 05.9'E	0.5 m - base of quarry	*Chaoiella*	KQ1-2	275
								KQ1-1	275
	Artinskian	Sarginskian	Mechetlino section, beside Yuresan River, near Mechetlino village	gravelly shell concentrates and poorly sorted argillaceous sands / debris flow into flysch basin (non-reef)	55° 22'N, 57° 59'E	12 m below Artinskian-Kungurian boundary, at 36 m above base of section	*Stenoscisma mutabilis*	AY2-6	275.7
								AY2-5	275.7
							Kalitvella sp.	AY2-4b	275.7
								AY2-4a	275.7
								AY2-3	275.7
							Chaoiella	AY2-2	275.7
								AY2-1	275.7
			Lebayshye quarry, Chatlik village	biomicrite & biosparite / small reef with abundant fossils	56° 48.1'N, 57° 43.7'E	*9 m above base of quarry*	*Chaoiella*	CQ3-2	276
								CQ3-1	276
						3 m above base of quarry	*Stenoscisma mutabilis*	CQ15-2	276.3
								CQ15-1	276.3
							Kalitvella sp.	CQ12-2	276.3
								CQ12-1	276.3
						5 m above base of quarry	*Chaoiella*	CQ13-2	276.5
								CQ13-1	276.5
		Irginskian	Sarana village, near spring on Ufa River, 200 m upstream from road to river from Sarana Resort	argillaceous micrite with shells / bedded limestone	56° 30.3'N, 57° 41.9'E		*Chaoiella*	AS4-6	278.6
								AS4-5	278.6
							Stenoscisma mutabilis	AS4-4	278.6
								AS4-3	278.6
							Kalitvella sp.	AS4-2	278.6
								AS4-1	278.6
		Burzevskian	Maly tau shikhan, Sterlitamak	biomicrite & biosparite / reef with abundant fossils	53° 33.9'N, 56° 04.4'E		*Kochiproductus porrectus*	AA1-4	283
								AA1-3	283
							Kalitvella sp.	AA1-2	283
								AA1-1	283
	Sakmarian	Tastubskian	Yurak tau shikhan, Sterlitamak	biomicrite & biosparite / reef with abundant fossils	53° 44.3'N, 56° 06.1'E		*Stenoscisma mutabilis*	ST1-4	293
								ST1-3	293
							Purdonella nikitini	ST1-2	293
								ST1-1	293
							Kalitvella sololovi	KY-2	293
								KY-1	293
	Asselian	Shikhanskian	Tra tau shikhan, Sterlitamak	biomicrite & biosparite / reef with abundant fossils	53° 33.2'N, 56° 05.9'E		*Stenoscisma mutabilis*	BT1-6	296
								BT1-5	296
							Chaoiella	BT1-4	296
								BT1-3	296
							Purdonella nikitini	BT1-2	296
								BT1-1	296
							Kalitvella sololovi	BT1-K2	296
								BT1-K1	296

*Samples were collected during field work done by Dr. Thomas Yancey and Dr. Boris Chuvashov. The information on this page was obtained from these individuals.

All samples are from the mid-Urals in Russia.
Ages are from Gradstein et al. 2004.

C2) Specimen Characterization and Notes

Specimen ID	Hand Sample	Microstructure	CL	Analysis Status	Notes
SQ17b	good	preserved	SMFL	analyzed	Shell shows bright luminescence along internal fractures/lineations. (These are very thin and insignificant in area, but were still avoided when drilling sample.)
SQ17a	good	preserved	SMFL	analyzed	Shell shows bright luminescence along internal fractures/lineations. (These are very thin and insignificant in area, but were still avoided when drilling sample.)
KQ8-2	good	preserved	SMFL	analyzed	Shell shows bright luminescence along internal fractures/lineations. (These areas were avoided when drilling sample.)
KQ8-1	good	preserved	SMFL	analyzed	Shell shows bright luminescence along shell margin. (These areas were avoided when drilling sample.)
KQ1-2	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
KQ1-1	good	preserved	LCBL	analyzed	Shell displays low-contrast CL banding.
AY2-6	good	preserved	SMFL	analyzed	Shell shows bright luminescence along internal fractures/lineations. (These areas were avoided when drilling sample.)
AY2-5	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
AY2-4b	good	preserved	SMFL	analyzed	Shell shows bright luminescence along shell margin and internal fractures/lineations. (These areas were avoided when drilling sample.)
AY2-4a	good	preserved	SMFL	analyzed	Shell shows bright luminescence along shell margin and internal fractures/lineations. (These areas were avoided when drilling sample.)
AY2-3	good	preserved	SMFL	analyzed	Shell shows bright luminescence along shell margin and internal fractures/lineations. (These areas were avoided when drilling sample.)
AY2-2	good	preserved	HCBL	analyzed	Shell displays high-contrast CL banding with lineations of brighter CL parallel to and especially along shell margins.
AY2-1	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
CQ3-2	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
CQ3-1	good	not preserved	L	not analyzed	Shell is opaque under plane light and nearly all of shell is luminescent under CL.
CQ15-2	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
CQ15-1	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.
CQ12-2	good	preserved	SMFL	analyzed	Shell shows bright luminescence along shell margin. (These areas were avoided when drilling sample.)
CQ12-1	good	preserved	SMFL	analyzed	Shell shows bright luminescence along shell margin. (These areas were avoided when drilling sample.)
CQ13-2	good	preserved	HCBL	analyzed	Shell displays high-contrast CL banding with widespread regions of low-contrast CL banding.
CQ13-1	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.
AS4-6	good	preserved	LCBL	analyzed	Shell displays low-contrast CL banding.
AS4-5	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
AS4-4	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
AS4-3	good	preserved	SMFL	analyzed	Shell shows bright luminescence along several lineations perpendicular to shell margin. (These areas were avoided when drilling sample.)
AS4-2	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
AS4-1	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
AA1-4	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
AA1-3	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
AA1-2	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
AA1-1	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.
ST1-4	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
ST1-3	poor			not analyzed	Poor shell potential for isotopic analysis (shell is too thin).
ST1-2	good	preserved	NL	analyzed	Good shell with only one small area of luminescence (which was avoided).
ST1-1	good	preserved	SMFL	analyzed	Shell shows bright luminescence along large lineations in the beak region. (These areas were avoided when drilling sample.)
KY-2	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.
KY-1	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.
BT1-6	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.
BT1-5	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.
BT1-4	good	preserved	LCBL	analyzed	Shell displays low-contrast CL banding.
BT1-3	good	preserved	LCBL	analyzed	Shell displays low-contrast CL banding.
BT1-2	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.
BT1-1	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.
BT1-K2	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.
BT1-K1	good	preserved	NL	analyzed	Good shell with very minor areas of luminescence.

Hand samples, after cutting with an Isomet saw, were checked to determine if there was "good" potential for shell analysis (i.e. shell is thick), and were otherwise labeled "poor".

Integrity of shell microstructure is checked under plane-polarized light (See Appendix B for photographs taken).

Cathodoluminescnce (CL) is used to check the chemical preservation of the shells using the following scheme (See Appendix B for photographs taken):
L - luminescent; shell is dominantly luminescent under CL light; very little or no non-luminescent areas
LCBL - low-contrast banded luminescence; shell displays alternating bands of strong-luminescence/weak-luminescence under CL light
HCBL - high-contrast banded luminescence; shell displays alternating bands of luminescence/non-luminescence under CL light
SMFL - shell margin and fracture luminescence; shell mostly non-luminescent under CL light, with some luminescent areas along shell margin or fractures within shell
NL - non-luminescent; shell completely non-luminescent under CL light; no luminescent areas

C3) Summarized Specimen Data

1. Data from all specimens | **2. Data from NL and SMFL specimens** | **3. Data from LCBL and HCBL samples**

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
SQ17b	274.8	2	5.88	0.16	-0.86	0.33	274.8	2	5.88	0.16	-0.86	0.33						
SQ17a	274.8	3	5.47	0.18	-0.99	0.33	274.8	3	5.47	0.18	-0.99	0.33						
KQ8-2	274.5	1	5.84		0.25		274.5	1	5.84		0.25							
KQ8-1	274.5	2	6.02	0.11	0.44	0.02	274.5	2	6.02	0.11	0.44	0.02						
KQ1-1	275	3	4.78	0.44	-2.18	0.60							275	3	4.78	0.44	-2.18	0.60
AY2-6	275.7	3	6.11	0.38	-0.45	0.91	275.7	3	6.11	0.38	-0.45	0.91						
AY2-4b	275.7	2	6.16	0.01	-1.27		275.7	2	6.16	0.01	-1.27							
AY2-4a	275.7	3	5.41	0.13	-1.64	0.05	275.7	3	5.41	0.13	-1.64	0.05						
AY2-3	275.7	3	5.93	0.33	-0.18	0.07	275.7	3	5.93	0.33	-0.18	0.07						
AY2-2	275.7	3	4.65	0.20	-3.14	0.21							275.7	3	4.65	0.20	-3.14	0.21
CQ15-1	276.3	3	5.17	0.12	-2.23	0.16	276.3	3	5.17	0.12	-2.23	0.16						
CQ12-2	276.3	4	6.01	0.13	-2.25	0.09	276.3	4	6.01	0.13	-2.25	0.09						
CQ12-1	276.3	3	5.76	0.11	-2.05	0.03	276.3	3	5.76	0.11	-2.05	0.03						
CQ13-2	276.5	6	4.26	0.38	-2.25	0.12							276.5	6	4.26	0.38	-2.25	0.12
CQ13-1	276.5	4	4.79	0.06	-2.16	0.05	276.5	4	4.79	0.06	-2.16	0.05						
AS4-6	278.6	4	3.29	0.30	-3.22	0.13							278.6	4	3.29	0.30	-3.22	0.13
AS4-3	278.6	3	4.32	0.09	-2.90	0.12	278.6	3	4.32	0.09	-2.90	0.12						
AA1-1	283	6	4.68	0.09	-2.17	0.10	283	6	4.68	0.09	-2.17	0.10						
ST1-2	293	5	5.04	0.06	-2.80	0.05	293	5	5.04	0.06	-2.80	0.05						
ST1-1	293	6	4.59	0.12	-2.69	0.16	293	6	4.59	0.12	-2.69	0.16						
KY-2	293	8	5.68	0.05	-2.60	0.12	293	8	5.68	0.05	-2.60	0.12						
KY-1	293	6	4.50	0.07	-2.51	0.12	293	6	4.50	0.07	-2.51	0.12						
BT1-6	296	1	5.55		-2.32		296	1	5.55		-2.32							
BT1-5	296	5	6.35	0.13	-2.26	0.08	296	5	6.35	0.13	-2.26	0.08						
BT1-4	296	4	3.26	0.09	-2.26	0.11							296	4	3.26	0.09	-2.26	0.11
BT1-3	296	2	3.67	0.47	-2.40	0.40							296	2	3.67	0.47	-2.40	0.40
BT1-2	296	6	6.20	0.18	-2.65	0.15	296	6	6.20	0.18	-2.65	0.15						
BT1-1	296	5	5.66	0.13	-2.86	0.13	296	5	5.66	0.13	-2.86	0.13						
BT1-K2	296	3	5.67	0.21	-2.20	0.15	296	3	5.67	0.21	-2.20	0.15						
BT1-K1	296	8	5.65	0.13	-3.38	0.42	296	8	5.65	0.13	-3.38	0.42						
AVG		30*	5.21	0.17	-2.01	0.19		24*	5.52	0.13	-1.86	0.17		6*	3.99	0.31	-2.57	0.26
STD			0.86		1.00				0.59		1.05				0.67		0.48	

4. Data from matrix

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
SQ17	274.8	1	2.56		-2.39	
KQ8-2	274.5	1	5.57		-3.60	
KQ8-1	274.5	1	5.34		-3.26	
KQ1-1	275	1	6.00		-3.87	
AY2-6	275.7	2	1.94	0.07	-4.76	0.95
AY2-4	275.7	2	-7.79	3.61	-2.09	2.71
AY2-3	275.7	2	-0.12	0.37	-5.80	0.13
CQ15-1	276.3	1	5.24		-2.05	
CQ12-2	276.3	1	5.25		-2.35	
CQ12-1	276.3	1	5.17		-1.63	
CQ13-1	276.5	1	3.08		-4.16	
AS4-6	278.6	1	2.94		-4.75	
AS4-3	278.6	1	2.75		-5.12	
AA1-1	283	2	3.65	0.18	-3.05	0.35
ST1-2	293	1	4.89		-1.20	
ST1-1	293	2	5.10	0.03	-1.33	0.05
KY-2	293	2	4.99	0.03	-0.87	0.04
KY-1	293	1	5.04		-0.81	
BT1-6	296	1	5.58		-1.98	
BT1-5	296	3	5.89	0.15	-1.30	0.30
BT1-4	296	1	5.55		-1.63	
BT1-3	296	1	5.76		-1.08	
BT1-1	296	1	5.66		-1.84	
BT1-K2	296	1	5.78		-1.29	
BT1-K1	296	2	5.51	0.02	-3.77	0.35
AVG		25*	4.05	0.56	-2.64	0.61
STD			2.90		1.47	

Ages are from Gradstein et al. (2004).
AVG = mean
STD = 1σ

*N column displays the number of samples analyzed from each specimen However, in the bottom row the value corresponds to the total number of specimens, not the total number of analyses.

LCBL or HCBL specimen

C4) All Specimen $\delta^{13}C$ Data

	Stage	Locality	Taxon	Specimen ID	Age	δ13C (1)	δ13C (2)	δ13C (3)	δ13C (4)	δ13C (5)	δ13C (6)	δ13C (7)	δ13C (8)	N	AVG	STD	Prec-ision
Permian	Kungurian	Nizhneizginsk	*Kalitvella sp.*	SQ17b	274.8	5.99	5.77							2.00	5.88	0.16	0.06
				SQ17a	274.8	5.59	5.56	5.26						3.00	5.47	0.18	0.06
		Kungur	*Stensocsisma mutabilis*	KQ8-2	274.5	5.84								1.00	5.84	0.00	0.06
				KQ8-1	274.5	6.09	5.94							2.00	6.02	0.11	0.03
			Chaoiella	KQ1-1	275	4.33	5.20	4.81						3.00	4.78	0.44	0.06
	Artinskian	Mechetlino (paleo-shelf)	*Stenoscisma mutabilis*	AY2-6	275.7	5.68	6.39	6.26						3.00	6.11	0.38	0.06
			Kalitvella sp.	AY2-4b	275.7	6.15	6.16							2.00	6.16	0.01	0.02
				AY2-4a	275.7	5.36	5.32	5.56						3.00	5.41	0.13	0.02
				AY2-3	275.7	5.63	5.87	6.28						3.00	5.93	0.33	0.02
			Chaoiella	AY2-2	275.7	4.46	4.63	4.86						3.00	4.65	0.20	0.07
		Chatlik (paleo-reef)	*Stenoscisma mutabilis*	CQ15-1	276.3	5.09	5.31	5.11						3.00	5.17	0.12	0.06
			Kalitvella sp.	CQ12-2	276.3	6.19	5.89	5.96	5.99					4.00	6.01	0.13	0.04
				CQ12-1	276.3	5.89	5.73	5.67						3.00	5.76	0.11	0.04
			Chaoiella	CQ13-2	276.5	4.64	4.64	4.07	4.49	3.75	3.99			6.00	4.26	0.38	0.03
				CQ13-1	276.5	4.72	4.77	4.83	4.84					4.00	4.79	0.06	0.03
		Sarana	*Chaoiella*	AS4-6	278.6	3.13	2.95	3.51	3.57					4.00	3.29	0.30	0.04
			Stenoscisma mutabilis	AS4-3	278.6	4.42	4.30	4.25						3.00	4.32	0.09	0.04
		Sterlitamak	*Kalitvella sp.*	AA1-1	283	4.85	4.66	4.64	4.61	4.61	4.69			6.00	4.68	0.09	0.08
	Sakmarian	Sterlitamak	*Purdonella nikitini*	ST1-2	293	4.95	5.12	5.03	5.05	5.03				5.00	5.04	0.06	0.03
				ST1-1	293	4.61	4.58	4.50	4.46	4.56	4.81			6.00	4.59	0.12	0.08
			Kalitvella sololovi	KY-2	293	5.71	5.70	5.75	5.65	5.65	5.62	5.73	5.66	8.00	5.68	0.05	0.03
				KY-1	293	4.50	4.37	4.48	4.56	4.56	4.55			6.00	4.50	0.07	0.08
	Asselian	Sterlitamak	*Stenoscisma mutabilis*	BT1-6	296	5.55								1.00	5.55	0.00	0.02
				BT1-5	296	6.29	6.29	6.23	6.36	6.56				5.00	6.35	0.13	0.02
			Chaoiella	BT1-4	296	3.34	3.13	3.28	3.27					4.00	3.26	0.09	0.06
				BT1-3	296	4.00	3.34							2.00	3.67	0.47	0.06
			Purdonella nikitini	BT1-2	296	5.87	6.23	6.26	6.40	6.20	6.25			6.00	6.20	0.18	0.07
				BT1-1	296	5.45	5.65	5.78	5.72	5.69				5.00	5.66	0.13	0.06
			Kalitvella sololovi	BT1-K2	296	5.49	5.61	5.90						3.00	5.67	0.21	0.03
				BT1-K1	296	5.86	5.68	5.74	5.59	5.60	5.44	5.54	5.76	8.00	5.65	0.13	0.02

Each specimen was sampled as many times as was practical. δ13C (1 - 8) are the data from these different sampling locations (See Appendix B). LCBL or HCBL specimen

Ages are from Gradstein et al. (2004).
N = number of different samples analyzed from each specimen.
AVG = mean
STD = 1σ
Precision = 1σ of the NBS-19 samples that were analyzed alternately with the carbonate samples of this study.

C5) All Specimen $\delta^{18}O$ Data

	Stage	Locality	Taxon	Specimen ID	Age	δ18O (1)	δ18O (2)	δ18O (3)	δ18O (4)	δ18O (5)	δ18O (6)	δ18O (7)	δ18O (8)	N	AVG	STD	Prec-ision*
Permian	Kungurian	Nizhneizginsk	*Kalitvella sp.*	SQ17b	274.8	-1.09	-0.62							2.00	-0.86	0.33	0.08
				SQ17a	274.8	-0.94	-1.35	-0.69						3.00	-0.99	0.33	0.08
		Kungur	*Stensocsisma mutabilis*	KQ8-2	274.5	0.25								1.00	0.25	0.00	0.08
				KQ8-1	274.5	0.45	0.42							2.00	0.44	0.02	0.10
			Chaoiella	KQ1-1	275	-1.86	-2.87	-1.82						3.00	-2.18	0.60	0.08
	Artinskian	Mechetlino (paleo-shelf)	*Stenoscisma mutabilis*	AY2-6	275.7	0.60	-0.92	-1.03						3.00	-0.45	0.91	0.08
			Kalitvella sp.	AY2-4b	275.7	-1.27	-1.27							2.00	-1.27	0.00	0.10
				AY2-4a	275.7	-1.62	-1.70	-1.60						3.00	-1.64	0.05	0.10
				AY2-3	275.7	-0.25	-0.17	-0.12						3.00	-0.18	0.07	0.10
			Chaoiella	AY2-2	275.7	-3.38	-3.02	-3.02						3.00	-3.14	0.21	0.11
		Chatlik (paleo-reef)	*Stenoscisma mutabilis*	CQ15-1	276.3	-2.38	-2.06	-2.24						3.00	-2.23	0.16	0.08
			Kalitvella sp.	CQ12-2	276.3	-2.13	-2.25	-2.36	-2.27					4.00	-2.25	0.09	0.06
				CQ12-1	276.3	-2.04	-2.09	-2.03						3.00	-2.05	0.03	0.06
			Chaoiella	CQ13-2	276.5	-2.35	-2.43	-2.12	-2.26	-2.14	-2.18			6.00	-2.25	0.12	0.10
				CQ13-1	276.5	-2.16	-2.18	-2.09	-2.22					4.00	-2.16	0.05	0.10
		Sarana	*Chaoiella*	AS4-6	278.6	-3.38	-3.09	-3.14	-3.27					4.00	-3.22	0.13	0.06
			Stenoscisma mutabilis	AS4-3	278.6	-2.89	-2.79	-3.03						3.00	-2.90	0.12	0.06
		Sterlitamak	*Kalitvella sp.*	AA1-1	283	-2.01	-2.15	-2.18	-2.28	-2.16	-2.26			6.00	-2.17	0.10	0.08
	Sakmarian	Sterlitamak	*Purdonella nikitini*	ST1-2	293	-2.76	-2.76	-2.89	-2.81	-2.80				5.00	-2.80	0.05	0.10
				ST1-1	293	-2.99	-2.69	-2.70	-2.56	-2.60	-2.57			6.00	-2.69	0.16	0.08
			Kalitvella sololovi	KY-2	293	-2.52	-2.58	-2.82	-2.41	-2.65	-2.64	-2.65	-2.55	8.00	-2.60	0.12	0.10
				KY-1	293	-2.58	-2.54	-2.64	-2.57	-2.43	-2.31			6.00	-2.51	0.12	0.08
	Asselian	Sterlitamak	*Stenoscisma mutabilis*	BT1-6	296	-2.32								1.00	-2.32	0.00	0.10
				BT1-5	296	-2.31	-2.24	-2.35	-2.28	-2.14				5.00	-2.26	0.08	0.10
			Chaoiella	BT1-4	296	-2.34	-2.22	-2.12	-2.36					4.00	-2.26	0.11	0.08
				BT1-3	296	-2.11	-2.68							2.00	-2.40	0.40	0.08
			Purdonella nikitini	BT1-2	296	-2.37	-2.80	-2.72	-2.67	-2.67	-2.65			6.00	-2.65	0.15	0.11
				BT1-1	296	-2.65	-2.85	-2.92	-2.90	-3.00				5.00	-2.86	0.13	0.08
			Kalitvella sololovi	BT1-K2	296	-2.34	-2.23	-2.04						3.00	-2.20	0.15	0.10
				BT1-K1	296	-3.37	-2.82	-3.60	-3.24	-3.45	-3.87	-3.89	-2.80	8.00	-3.38	0.42	0.10

Each specimen was sampled as many times as was practical. δ18O (1 - 8) are the data from these different sampling locations (See Appendix B). LCBL or HCBL specimen

Ages are from Gradstein et al. (2004).
N = number of different samples analyzed from each specimen.
AVG = mean
STD = 1σ
Precision = 1σ of the NBS-19 samples that were analyzed alternately with the carbonate samples of this study.

C6) All Matrix $\delta^{13}C$ and $\delta^{18}O$ Data

	Stage	Locality	Taxon	Specimen ID	Age	Prec-ision*	N	δ13C (X1)	δ13C (X2)	δ13C (X3)	δ13C AVG	δ13C STD	Prec-ision*	N	δ18O (X1)	δ18O (X2)	δ18O (X3)	δ18O AVG	δ18O STD
Permian	Kungurian	Nizhneizginsk	*Kalitvella sp.*	SQ17	274.8 274.8	0.06	1	2.56			2.56	0.00	0.08	1	-2.39			-2.39	0.00
		Kungur	*Stensocsisma mutabilis*	KQ8-2	274.5	0.06	1	5.57			5.57	0.00	0.08	1	-3.6			-3.60	0.00
				KQ8-1	274.5	0.03	1	5.34			5.34	0.00	0.1	1	-3.26			-3.26	0.00
			Chaoiella	KQ1-1	275	0.06	1	6			6.00	0.00	0.08	1	-3.87			-3.87	0.00
	Artinskian	Mechetlino (paleo-shelf)	*Stenoscisma mutabilis*	AY2-6	275.7	0.06	2	1.99	1.89		1.94	0.07	0.08	2	-4.09	-5.43		-4.76	0.95
			Kalitvella sp.	AY2-4	275.7 275.7	0.02	2	-10.34	-5.23		-7.79	3.61	0.1	2	-0.17	-4		-2.09	2.71
				AY2-3	275.7	0.02	2	-0.38	0.14		-0.12	0.37	0.1	2	-5.89	-5.71		-5.80	0.13
			Chaoiella	AY2-2	275.7									0					
		Chatlik (paleo-reef)	*Stenoscisma mutabilis*	CQ15-1	276.3	0.06	1	5.24			5.24	0.00	0.08	1	-2.05			-2.05	0.00
			Kalitvella sp.	CQ12-2	276.3	0.04	1	5.25			5.25	0.00	0.06	1	-2.35			-2.35	0.00
				CQ12-1	276.3	0.04	1	5.17			5.17	0.00	0.06	1	-1.63			-1.63	0.00
			Chaoiella	CQ13-2	276.5									0					
				CQ13-1	276.5	0.03	1	3.08			3.08	0.00	0.1	1	-4.16			-4.16	0.00
		Sarana	*Chaoiella*	AS4-6	278.6	0.04	1	2.94			2.94	0.00	0.06	1	-4.75			-4.75	0.00
			Stenoscisma mutabilis	AS4-3	278.6	0.04	1	2.75			2.75	0.00	0.06	1	-5.12			-5.12	0.00
		Sterlitamak	*Kalitvella sp.*	AA1-1	283	0.08	2	3.77	3.52		3.65	0.18	0.08	2	-2.8	-3.29		-3.05	0.35
	Sakmarian	Sterlitamak	*Purdonella nikitini*	ST1-2	293	0.03	1	4.89			4.89	0.00	0.1	1	-1.2			-1.20	0.00
				ST1-1	293	0.08	2	5.08	5.12		5.10	0.03	0.08	2	-1.36	-1.29		-1.33	0.05
			Kalitvella sololovi	KY-2	293	0.03	2	4.97	5.01		4.99	0.03	0.1	2	-0.89	-0.84		-0.87	0.04
				KY-1	293	0.08	1	5.04			5.04	0.00	0.08	1	-0.81			-0.81	0.00
	Asselian	Sterlitamak	*Stenoscisma mutabilis*	BT1-6	296	0.02	1	5.58			5.58	0.00	0.1	1	-1.98			-1.98	0.00
				BT1-5	296	0.02	3	5.76	6.05	5.85	5.89	0.15	0.1	3	-1.37	-1.55	-0.97	-1.30	0.30
			Chaoiella	BT1-4	296	0.06	1	5.55			5.55	0.00	0.08	1	-1.63			-1.63	0.00
				BT1-3	296	0.06	1	5.76			5.76	0.00	0.08	1	-1.08			-1.08	0.00
			Purdonella nikitini	BT1-2	296									0					
				BT1-1	296	0.06	1	5.66			5.66	0.00	0.08	1	-1.84			-1.84	0.00
			Kalitvella sololovi	BT1-K2	296	0.03	1	5.78			5.78	0.00	0.1	1	-1.29			-1.29	0.00
				BT1-K1	296	0.02	2	5.52	5.49		5.51	0.02	0.1	2	-3.52	-4.02		-3.77	0.35

δ13C (X1 - X3) and δ18O (X1 - X3) are samples taken from the matrix surrounding each shell analyzed.

Ages are from Gradstein et al. 2004
Precision = 1σ of the NBS-19 samples that were analyzed alternately with the carbonate samples of this study.
N = number of different analyses done on each rock.

C7) NL and SMFL Data Sorted by Stratigraphic Horizon

1. Kungurian Data (Nizhneizginsk and Kungur)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
SQ17b	274.8	2	5.88	0.16	-0.86	0.33
SQ17a	274.8	3	5.47	0.18	-0.99	0.33
KQ8-2	274.5	1	5.84		0.25	
KQ8-1	274.5	2	6.02	0.11	0.44	0.02
KQ1-1						
AY2-6						
AY2-4b						
AY2-4a						
AY2-3						
AY2-2						
CQ15-1						
CQ12-2						
CQ12-1						
CQ13-2						
CQ13-1						
AVG	274.65	4*	5.80	0.15	-0.29	0.23
STD			0.23		0.74	

2. Late Artinskian Data (Mechetlino and Chatlik)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
SQ17b						
SQ17a						
KQ8-2						
KQ8-1						
KQ1-1						
AY2-6	275.7	3	6.11	0.38	-0.45	0.91
AY2-4b	275.7	2	6.16	0.01	-1.27	0.00
AY2-4a	275.7	3	5.41	0.13	-1.64	0.05
AY2-3	275.7	3	5.93	0.33	-0.18	0.07
AY2-2						
CQ15-1	276.3	3	5.17	0.12	-2.23	0.16
CQ12-2	276.3	4	6.01	0.13	-2.25	0.09
CQ12-1	276.3	3	5.76	0.11	-2.05	0.03
CQ13-2						
CQ13-1	276.5	4	4.79	0.06	-2.16	0.05
AVG	276.03	8*	5.67	0.16	-1.53	0.17
STD			0.49		0.82	

Ages are from Gradstein et al. (2004).
N = number of different samples analyzed from each specimen.
AVG = mean
STD = 1σ
Precision = 1σ of the NBS-19 samples that were analyzed alternately with the carbonate samples of this study.

*N column displays the number of samples analyzed from each specimen However, in the bottom row the value corresponds to the total number of specimens, not the total

LCBL or HCBL specimen

7. Average Inter-Sample STD (by Horizon)

δ13C	0.40
δ18O	0.53

3. Middle Artinskian Data (Sarana)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
AS4-6						
AS4-3	278.6	3	4.32	0.09	-2.90	0.12
AVG	(only 1 sample)					
STD						

4. Early Artinskian Data (Sterlitimak)

Specimen ID	Age	N	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
AA1-1	283	6*	4.68	0.09	-2.17	0.10
ST1-2						
ST1-1						
KY-2						
KY-1						
BT1-6						
BT1-5						
BT1-4						
BT1-3						
BT1-2						
BT1-1						
BT1-K2						
BT1-K1						
AVG	(only 1 sample)					
STD						

5. Sakmarian Data (Sterlitimak)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
AA1-1						
ST1-2	293	5	5.04	0.06	-2.80	0.05
ST1-1	293	6	4.59	0.12	-2.69	0.16
KY-2	293	8	5.68	0.05	-2.60	0.12
KY-1	293	6	4.50	0.07	-2.51	0.12
BT1-6						
BT1-5						
BT1-4						
BT1-3						
BT1-2						
BT1-1						
BT1-K2						
BT1-K1						
AVG	293.00	4*	4.95	0.08	-2.65	0.11
STD			0.54		0.12	

6. Asselian Data (Sterlitimak)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
AA1-1						
ST1-2						
ST1-1						
KY-2						
KY-1						
BT1-6	296	1	5.55		-2.32	
BT1-5	296	5	6.35	0.13	-2.26	0.08
BT1-4						
BT1-3						
BT1-2	296	6	6.20	0.18	-2.65	0.15
BT1-1	296	5	5.66	0.13	-2.86	0.13
BT1-K2	296	3	5.67	0.21	-2.20	0.15
BT1-K1	296	8	5.65	0.13	-3.38	0.42
AVG	296.00	6*	5.85	0.16	-2.61	0.19
STD			0.34		0.45	

C8) NL and SMFL Data Sorted by Locality

1. Nizhneizginsk and Kungur Data (Kungurian)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
SQ17b	274.8	2	5.88	0.16	-0.86	0.33
SQ17a	274.8	3	5.47	0.18	-0.99	0.33
KQ8-2	274.5	1	5.84		0.25	
KQ8-1	274.5	2	6.02	0.11	0.44	0.02
KQ1-1						
AY2-6						
AY2-4b						
AY2-4a						
AY2-3						
AY2-2						
AVG	274.65	4*	5.80	0.15	-0.29	0.23
STD			0.23		0.74	

2. Mechetlino Data (Late Artinskian non-reef lithology)

Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
275.7	3	6.11	0.38	-0.45	0.91
275.7	2	6.16	0.01	-1.27	0.00
275.7	3	5.41	0.13	-1.64	0.05
275.7	3	5.93	0.33	-0.18	0.07
275.70	4*	5.90	0.21	-0.89	0.26
		0.34		0.68	

Ages are from Gradstein et al. (2004).
N = number of different samples analyzed from each specimen.
AVG = mean
STD = 1σ
Precision = 1σ of the NBS-19 samples that were analyzed alternately with the carbonate samples of this study.

*N column displays the number of samples analyzed from each specimen However, in the bottom row the value corresponds to the total number of specimens, not the total

LCBL or HCBL specimen

3. Chatlik Data (Late Artinskian reef lithology)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
CQ15-1	276.3	3	5.17	0.12	-2.23	0.16
CQ12-2	276.3	4	6.01	0.13	-2.25	0.09
CQ12-1	276.3	3	5.76	0.11	-2.05	0.03
CQ13-2						
CQ13-1	276.5	4	4.79	0.06	-2.16	0.05
AS4-6						
AS4-3						
AVG	276.35	4*	5.43	0.11	-2.17	0.09
STD			0.55		0.09	

4. Sarana Data (Middle Artinskian)

Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
278.6	3	4.32	0.09	-2.90	0.12
(only 1 sample)					

5. Sterlitamak Data (Early Artinskian)

Specimen ID	Age	N	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
AA1-1	283	6*	4.68	0.09	-2.17	0.10
ST1-2						
ST1-1						
KY-2						
KY-1						
BT1-6						
BT1-5						
BT1-4						
BT1-3						
BT1-2						
BT1-1						
BT1-K2						
BT1-K1						
AVG	(only 1 sample)					
STD						

6. Sterlitamak Data (Sakmarian)

Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
293	5	5.04	0.06	-2.80	0.05
293	6	4.59	0.12	-2.69	0.16
293	8	5.68	0.05	-2.60	0.12
293	6	4.50	0.07	-2.51	0.12
293.00	4*	4.95	0.08	-2.65	0.11
		0.54		0.12	

7. Sterlitamak Data (Asselian)

Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
296	1	5.55		-2.32	
296	5	6.35	0.13	-2.26	0.08
296	6	6.20	0.18	-2.65	0.15
296	5	5.66	0.13	-2.86	0.13
296	3	5.67	0.21	-2.20	0.15
296	8	5.65	0.13	-3.38	0.42
296.00	6*	5.85	0.16	-2.61	0.19
		0.34		0.45	

C9) Matrix Data Sorted by Stratigraphic Horizon

Ages are from Gradstein et al. (2004).
AVG = mean
STD = 1σ

*N column displays the number of analyses done on each sample. However, in the bottom row the value corresponds to the total number of samples (# Samples), not the total number of analyses.

#Data was removed because the values were extremely anomalous (see Appendix C6).

1. Kungurian Data (Nizhneizginsk and Kungur)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
SQ17	274.8	1	2.56		-2.39	
KQ8-2	274.5	1	5.57		-3.60	
KQ8-1	274.5	1	5.34		-3.26	
KQ1-1	275	1	6.00		-3.87	
AVG	274.70	4*	4.87		-3.28	
STD			1.56		0.64	

2. Late Artinskian Data (Mechetlino and Chatlik)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
AY2-6	275.7	2	1.94	0.07	-4.09	-5.43
AY2-4	275.7	#	#	#	#	#
AY2-3	275.7	2	-0.12	0.37	-5.80	0.13
CQ15-1	276.3	1	5.24		-2.05	
CQ12-2	276.3	1	5.25		-2.35	
CQ12-1	276.3	1	5.17		-1.63	
CQ13-1	276.5	1	3.08		-4.16	
AVG	276.07	6	3.43	0.22	-3.35	-2.65
STD			2.22		1.60	

3. Middle Artinskian Data (Sarana)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
AS4-6	278.6	1	2.94		-4.75	
AS4-3	278.6	1	2.75		-5.12	
AVG	278.60	2*	2.85		-4.94	
STD			0.13		0.26	

4. Early Artinskian Data (Sterlitimak)

Specimen ID	Age	N	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
AA1-1	283	2*	3.65	0.18	-3.05	0.35
ST1-2						
ST1-1						
KY-2						
KY-1						
BT1-6						
BT1-5						
BT1-4						
BT1-3						
BT1-1						
BT1-K2						
BT1-K1						
AVG	(only 1 sample)					
STD						

5. Sakmarian Data (Sterlitimak)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
ST1-2	293	1	4.89		-1.20	
ST1-1	293	2	5.10	0.03	-1.33	0.05
KY-2	293	2	4.99	0.03	-0.87	0.04
KY-1	293	1	5.04		-0.81	
AVG	293.00	4*	5.01	0.03	-1.05	0.04
STD			0.09		0.25	

6. Asselian Data (Sterlitimak)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
BT1-6	296	1	5.58		-1.98	
BT1-5	296	3	5.89	0.15	-1.30	0.30
BT1-4	296	1	5.55		-1.63	
BT1-3	296	1	5.76		-1.08	
BT1-1	296	1	5.66		-1.84	
BT1-K2	296	1	5.78		-1.29	
BT1-K1	296	2	5.51	0.02	-3.77	0.35
AVG	296.00	7*	5.67	0.08	-1.84	0.33
STD			0.14		0.91	

C10) Matrix Data Sorted by Locality

Ages are from Gradstein et al. (2004).
AVG = mean
STD = 1σ

*N column displays the number of analyses done on each sample. However, in the bottom row the value corresponds to the total number of samples (# Samples), not the total number of analyses.

#Data was removed because the values were extremely anomalous (see Appendix C6).

1. Nizhneizginsk and Kungur Data (Kungurian)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
SQ17	274.8	1	2.56		-2.39	
KQ8-2	274.5	1	5.57		-3.60	
KQ8-1	274.5	1	5.34		-3.26	
KQ1-1	275	1	6.00		-3.87	
AY2-6						
AY2-4						
AY2-3						
AVG	274.70	4*	4.87		-3.28	
STD			1.56		0.64	

2. Mechetlino Data (Late Artinskian non-reef lithology)

Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
275.7	2	1.94	0.07	-4.09	-5.43
275.7	#	#	#	#	#
275.7	2	-0.12	0.37	-5.80	0.13
275.70	3*	0.91	0.22	-4.95	-2.65
		1.46		1.21	

3. Chatlik Data (Late Artinskian reef lithology)

Specimen ID	Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
CQ15-1	276.3	1	5.24		-2.05	
CQ12-2	276.3	1	5.25		-2.35	
CQ12-1	276.3	1	5.17		-1.63	
CQ13-1	276.5	1	3.08		-4.16	
AS4-6						
AS4-3						
AVG	276.35	4*	4.69		-2.55	
STD			1.07		1.11	

4. Sarana Data (Middle Artinskian)

Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
278.6	1	2.94		-4.75	
278.6	1	2.75		-5.12	
278.60	2*	2.85		-4.94	
		0.13		0.26	

5. Sterlitamak Data (Early Artinskian)

Specimen ID	Age	N	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
AA1-1	283	2*	3.65	0.18	-3.05	0.35
ST1-2						
ST1-1						
KY-2						
KY-1						
BT1-6						
BT1-5						
BT1-4						
BT1-3						
BT1-1						
BT1-K2						
BT1-K1						
AVG	(only 1 sample)					
STD						

6. Sterlitamak Data (Sakmarian)

Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
293	1	4.89		-1.20	
293	2	5.10	0.03	-1.33	0.05
293	2	4.99	0.03	-0.87	0.04
293	1	5.04		-0.81	
293.00	4*	5.01	0.03	-1.05	0.04
		0.09		0.25	

7. Sterlitamak Data (Asselian)

Age	N*	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
296	1	5.58		-1.98	
296	3	5.89	0.15	-1.30	0.30
296	1	5.55		-1.63	
296	1	5.76		-1.08	
296	1	5.66		-1.84	
296	1	5.78		-1.29	
296	2	5.51	0.02	-3.77	0.35
296.00	7*	5.67	0.08	-1.84	0.33
		0.14		0.91	

C11) Data Sorted by Specimen Genus

1. *Kalitvella* Data

Specimen ID	Age	N	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
SQ17b	274.8	2	5.88	0.16	-0.86	0.33
SQ17a	274.8	3	5.47	0.18	-0.99	0.33
KQ8-2						
KQ8-1						
KQ1-1						
AY2-6						
AY2-4b	275.7	2	6.16	0.01	-1.27	0.00
AY2-4a	275.7	3	5.41	0.13	-1.64	0.05
AY2-3	275.7	3	5.93	0.33	-0.18	0.07
AY2-2						
CQ15-1						
CQ12-2	276.3	4	6.01	0.13	-2.25	0.09
CQ12-1	276.3	3	5.76	0.11	-2.05	0.03
CQ13-2						
CQ13-1						
AS4-6						
AS4-3						
AA1-1	283	6	4.68	0.09	-2.17	0.10
KY-2	293	8	5.68	0.05	-2.60	0.12
KY-1	293	6	4.50	0.07	-2.51	0.12
BT1-6						
BT1-5						
BT1-4						
BT1-3						
BT1-K2	296	3	5.67	0.21	-2.20	0.15
BT1-K1	296	8	5.65	0.13	-3.38	0.42
AVG	282.53		5.57	0.13	-1.84	0.15
STD			0.50		0.89	

2. *Stenoscisma* Data

Specimen ID	Age	N	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
SQ17b						
SQ17a						
KQ8-2	274.5	1	5.84		0.25	0.00
KQ8-1	274.5	2	6.02	0.11	0.44	0.02
KQ1-1						
AY2-6	275.7	3	6.11	0.38	-0.45	0.91
AY2-4b						
AY2-4a						
AY2-3						
AY2-2						
CQ15-1	276.3	3	5.17	0.12	-2.23	0.16
CQ12-2						
CQ12-1						
CQ13-2						
CQ13-1						
AS4-6						
AS4-3	278.6	3	4.32	0.09	-2.90	0.12
AA1-1						
KY-2						
KY-1						
BT1-6	296	1	5.55		-2.32	
BT1-5	296	5	6.35	0.13	-2.26	0.08
BT1-4						
BT1-3						
BT1-K2						
BT1-K1						
AVG	281.66		5.62	0.16	-1.35	0.22
STD			0.69		1.39	

3. *Chaoiella* Data

Specimen ID	Age	N	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
SQ17b						
SQ17a						
KQ8-2						
KQ8-1						
KQ1-1	275	3	4.78	0.44	-2.18	0.60
AY2-6						
AY2-4b						
AY2-4a						
AY2-3						
AY2-2	275.7	3	4.65	0.20	-3.14	0.21
CQ15-1						
CQ12-2						
CQ12-1						
CQ13-2	276.5	6	4.26	0.38	-2.25	0.12
CQ13-1	276.5	4	4.79	0.06	-2.16	0.05
AS4-6	278.6	4	3.29	0.30	-3.22	0.13
AS4-3						
AA1-1						
KY-2						
KY-1						
BT1-6						
BT1-5						
BT1-4	296	4	3.26	0.09	-2.26	0.11
BT1-3	296	2	3.67	0.47	-2.40	0.40
BT1-K2						
BT1-K1						
AVG	282.04		4.10	0.27	-2.52	0.23
STD			0.69		0.46	

4. *Purdonella* Data

Specimen ID	Age	N	$\delta^{13}C$ AVG	$\delta^{13}C$ STD	$\delta^{18}O$ AVG	$\delta^{18}O$ STD
ST1-2	293	5	5.04	0.06	-2.80	0.05
ST1-1	293	6	4.59	0.12	-2.69	0.16
BT1-2	296	6	6.20	0.18	-2.65	0.15
BT1-1	296	5	5.66	0.13	-2.86	0.13
AVG	294.50		5.37	0.12	-2.75	0.12
STD			0.71		0.10	

Ages are from Gradstein et al. (2004).
N = number of different samples analyzed from each specimen.
AVG = mean
STD = 1σ

*N column displays the number of samples analyzed from each specimen However, in the bottom row the value

LCBL or HCBL specimen

C12) Previously Published Data

1. Previously published Uralian brachiopod data

Specimen	Location	Age (STD 02)	$\delta^{13}C$	$\delta^{18}O$	Reference
ru 7	Usolka	295.62	4.94	-2.26	Korte et al. (2005)
ru 9	Usolka	294.36	4.52	-0.22	Korte et al. (2005)
ru 9	Usolka	294.36	3.56	-0.37	Korte et al. (2005)
ru 25	Usolka	294.06	4.60	-0.16	Korte et al. (2005)
ru 8	Usolka	293.77	4.72	-0.26	Korte et al. (2005)
ru 28	Usolka	293.07	4.34	0.08	Korte et al. (2005)
ru 29	Usolka	291.61	3.89	-0.10	Korte et al. (2005)
ru 10	Usolka	291.48	4.55	-0.94	Korte et al. (2005)
ru 11	Usolka	289.65	3.25	-1.06	Korte et al. (2005)
ru 12	Usolka	288.85	5.39	-1.62	Korte et al. (2005)
ru 13	Usolka	287.56	4.16	-2.85	Korte et al. (2005)
ru 13	Usolka	287.56	4.38	-2.57	Korte et al. (2005)
ru 20	Sakmara	285.50	4.30	-2.22	Korte et al. (2005)
ru 1	Dalnij Tjulkas	282.20	4.89	-3.25	Korte et al. (2005)
ru 1	Dalnij Tjulkas	282.20	4.15	-3.57	Korte et al. (2005)
ru 2	Dalnij Tjulkas	282.10	4.21	-3.22	Korte et al. (2005)
ru 3	Dalnij Tjulkas	281.90	3.12	-3.26	Korte et al. (2005)
ru 4	Dalnij Tjulkas	281.90	3.50	-3.43	Korte et al. (2005)
ru 4	Dalnij Tjulkas	281.90	4.26	-2.85	Korte et al. (2005)
RKI5-1	Alegozovo	272.00	4.77	-1.58	Grossman et al. (2008)
RKI5-2	Alegozovo	272.00	4.90	-1.42	Grossman et al. (2008)
RKI5-3	Alegozovo	272.00	4.85	-1.44	Grossman et al. (2008)
RKI5-4	Alegozovo	272.00	4.86	-1.41	Grossman et al. (2008)
RSS7-1	Sterlitamak	288.00	5.65	-0.90	Grossman et al. (2008)
RSS7-3	Sterlitamak	288.00	5.63	-0.81	Grossman et al. (2008)
RST27-1	Sterlitamak	291.00	5.11	-2.14	Grossman et al. (2008)
RST27-2	Sterlitamak	291.00	5.26	-2.18	Grossman et al. (2008)
RST27-3	Sterlitamak	291.00	5.22	-2.25	Grossman et al. (2008)
RST27-4	Sterlitamak	291.00	5.20	-2.12	Grossman et al. (2008)
RST27B-1	Sterlitamak	291.00	5.30	-2.20	Grossman et al. (2008)
RST27B-2	Sterlitamak	291.00	5.23	-2.18	Grossman et al. (2008)
RST27B-3	Sterlitamak	291.00	5.05	-2.11	Grossman et al. (2008)
RST27B-4	Sterlitamak	291.00	5.28	-2.17	Grossman et al. (2008)
RST29-1	Sterlitamak	291.00	5.47	-2.32	Grossman et al. (2008)
RST29-2	Sterlitamak	291.00	5.42	-2.34	Grossman et al. (2008)
RST29-3	Sterlitamak	291.00	5.43	-2.23	Grossman et al. (2008)
RST29-4	Sterlitamak	291.00	5.37	-2.11	Grossman et al. (2008)
RAK15-1	Sterlitamak	297.00	3.80	-1.41	Grossman et al. (2008)
RAK15-2	Sterlitamak	297.00	3.85	-1.35	Grossman et al. (2008)
RAK15-3	Sterlitamak	297.00	3.81	-1.37	Grossman et al. (2008)
RAK32-1	Sterlitamak	297.00	5.90	-1.72	Grossman et al. (2008)
RAK32-3	Sterlitamak	297.00	6.00	-1.82	Grossman et al. (2008)
RAK32-3	Sterlitamak	297.00	5.95	-1.64	Grossman et al. (2008)
RAK32-4	Sterlitamak	297.00	5.86	-1.83	Grossman et al. (2008)
RAK34-1	Sterlitamak	297.00	5.56	-1.79	Grossman et al. (2008)
RAK34-2	Sterlitamak	297.00	5.49	-1.76	Grossman et al. (2008)
RAK34-3	Sterlitamak	297.00	5.45	-1.77	Grossman et al. (2008)
RAK34-4	Sterlitamak	297.00	5.52	-1.63	Grossman et al. (2008)
RAK38-1	Sterlitamak	297.00	5.29	-1.94	Grossman et al. (2008)
RAK38-2	Sterlitamak	297.00	5.30	-2.08	Grossman et al. (2008)
RAK38-3	Sterlitamak	297.00	5.32	-2.20	Grossman et al. (2008)
RAK38-4	Sterlitamak	297.00	5.39	-1.98	Grossman et al. (2008)
RAK38B-1	Sterlitamak	297.00	5.20	-2.05	Grossman et al. (2008)
RAK38B-2	Sterlitamak	297.00	5.04	-2.01	Grossman et al. (2008)
RAK38B-3	Sterlitamak	297.00	5.27	-1.78	Grossman et al. (2008)
RAK38B-4	Sterlitamak	297.00	5.15	-1.76	Grossman et al. (2008)
RAK27-1	Sterlitamak	297.00	3.72	-2.52	Grossman et al. (2008)
RAK27-2	Sterlitamak	297.00	4.34	-2.21	Grossman et al. (2008)
RAK27-3	Sterlitamak	297.00	4.56	-2.17	Grossman et al. (2008)

1. (continued)

Specimen	Location	Age (GTS 04)	$\delta^{13}C$	$\delta^{18}O$	Reference
SS-1-96-1	Urals	274.30	6.40	1.01	Grossman et al. (2008)
SS-1-96-3	Urals	274.30	6.43	0.65	Grossman et al. (2008)
SS-1-96-4	Urals	274.30	6.69	0.31	Grossman et al. (2008)
SS6-96-12	Urals	274.20	6.32	0.44	Grossman et al. (2008)
SS6-96-13	Urals	274.20	6.52	0.31	Grossman et al. (2008)
SS6-96-14	Urals	274.20	5.72	0.51	Grossman et al. (2008)
SS6-96-15	Urals	274.20	6.53	0.26	Grossman et al. (2008)
SS6-96-16	Urals	274.20	5.85	0.02	Grossman et al. (2008)
SS7-96-5	Urals	274.30	4.83	-1.27	Grossman et al. (2008)
SS6-96-6	Urals	274.20	5.79	0.12	Grossman et al. (2008)
SS6-96-7	Urals	274.20	5.51	0.17	Grossman et al. (2008)
SS6-96-8	Urals	274.20	5.89	-0.23	Grossman et al. (2008)
SS6-96-9	Urals	274.20	5.97	-0.26	Grossman et al. (2008)
SS6-96-10	Urals	274.20	5.55	-0.34	Grossman et al. (2008)
SQ2-96-4	Urals	274.60	4.92	0.11	Grossman et al. (2008)
Ru-13-NL-1	Russia	269.00	3.34	0.67	Popp (1986)
Ru-14-1-NL-1	Russia	269.00	3.13	0.81	Popp (1986)
Ru-14-2-NL-1	Russia	269.00	3.41	-0.75	Popp (1986)
Ru-15-NL-1	Russia	269.00	3.35	0.95	Popp (1986)
Ru-16-NL-1	Russia	269.00	3.00	0.88	Popp (1986)
Ru-17-NL-1	Russia	269.00	3.88	1.48	Popp (1986)

2. Previously published North American brachiopod data

Specimen	Location	Age (GTS 04)	$\delta^{13}C$	$\delta^{18}O$	Reference
TXP001	Texas	272.00	2.86	-1.04	Grossman et al. (2008)
TXP002	Texas	272.00	3.10	-2.89	Grossman et al. (2008)
TXP003	Texas	272.00	4.63	-2.61	Grossman et al. (2008)
TXP004	Texas	272.00	3.72	-2.62	Grossman et al. (2008)
TXP005	Texas	272.00	3.90	-2.42	Grossman et al. (2008)
TXP006	Texas	272.00	4.12	-3.16	Grossman et al. (2008)
TXP007	Texas	272.00	4.25	-2.35	Grossman et al. (2008)
TXP008	Texas	272.00	3.96	-2.55	Grossman et al. (2008)
TXP074	Texas	275.00	1.90	-2.52	Grossman et al. (2008)
TXP077	Texas	275.00	2.25	-2.03	Grossman et al. (2008)
TXP065	Texas	284.00	5.84	-2.93	Grossman et al. (2008)
TXP023	Texas	295.00	3.17	-4.22	Grossman et al. (2008)
TXP023	Texas	295.00	3.17	-4.22	Grossman et al. (2008)
TXP024	Texas	295.00	5.73	-2.96	Grossman et al. (2008)
TXP025	Texas	295.00	5.76	-2.89	Grossman et al. (2008)
TXP028	Texas	295.00	3.27	-3.68	Grossman et al. (2008)
TXP068	Texas	295.00	5.47	-3.52	Grossman et al. (2008)
TXP052	Texas	296.00	5.07	-3.03	Grossman et al. (2008)
TXP053	Texas	296.00	5.38	-3.89	Grossman et al. (2008)
TXP012	Texas	296.50	5.60	-3.37	Grossman et al. (2008)
TXP013	Texas	296.50	5.38	-3.22	Grossman et al. (2008)
TXP014	Texas	296.50	4.85	-3.49	Grossman et al. (2008)
TXP054	Texas	296.50	5.64	-2.92	Grossman et al. (2008)
TXP057	Texas	296.50	4.54	-3.36	Grossman et al. (2008)
TXP018	Texas	297.00	4.18	-3.28	Grossman et al. (2008)
TXP020	Texas	297.00	2.39	-3.57	Grossman et al. (2008)

3. Non-Uralian data from Korte (2005) - all "bad" samples removed

Specimen	Location	Age (STD 02)	$\delta^{13}C$	$\delta^{18}O$
44403	Kansas	295.81	4.86	-1.37
36222	Kansas	295.42	4.87	-1.60
sb TG1 4.8-5.5	Svalbard	295.00	3.67	-2.33
bj Teltvika	Bjørnøya	292.00	3.70	-1.91
sb Nor 4	Svalbard	284.00	4.24	-1.84
bj HAM 1 16	Bjørnøya	281.75	3.41	-3.45
Roc 11	Sicily, Italy	276.00	3.95	-2.98
SC 27	Texas	273.91	4.35	-2.16
SC 30	Texas	273.83	3.29	-1.25

4. Running oxygen and carbon isotope means from **ALL** Korte et al. (2005) brachiopod data (5 Ma windows, 2 Ma steps)

Age (STD 02)	$\delta^{18}O$	$\delta^{13}C$
295.5	-0.94	4.45
293.5	-0.95	4.35
291.5	-0.70	4.08
289.5	-1.52	4.27
287.5	-2.06	4.30
285.5	-2.37	4.27
283.5	-3.01	4.01
281.5	-3.29	3.93
279.5	-3.25	3.57
277.5	-2.98	3.95
275.5	-2.13	3.86
273.5	-2.09	3.41
271.5	-2.26	3.50
269.5	-2.50	3.75
267.5	-2.25	4.56
265.5	-2.22	4.97
263.5	-2.44	4.76
261.5	-2.66	4.32
259.5	-2.82	4.03
257.5	-2.97	3.92
255.5	-3.03	3.98
253.5	-3.11	3.43
251.5	-3.04	3.25