Data Repository Materials for "Stratigraphy and geochronology of the Tambien Group, Ethiopia: Evidence for globally synchronous carbon isotope change in the Neoproterozoic"

Contents

1 Geochronology methods and data

Zircons were isolated from bulk rock by standard mineral separation techniques. All zircons analyzed in this study employed the protocol and data reduction parameters outlined in Meyers et al. (2012). Two important points are outlined here: (1) prior to dissolution, zircons were subject to a modified chemical abrasion pretreatment for the effective elimination of Pb loss (Mattinson 2005); (2) the accuracy of the $^{238}U/^{206}Pb$ dates presented herein is controlled by the gravimetric calibration of the EARTHTIME U-Pb tracer employed in this study and the determination of the ^{238}U decay constant (Jaffey et al., 1971; Condon et al., 2007).

Results are summarized in Table DR1 and their interpretation is discussed in this section. For each sample between eleven and twenty single crystal/fragment U-Pb dates were determined, with each sample returning a spread in dates that exceeds the analytical precision on the single data point. There are two possible reasons for this: (1) real age variation with the sample containing zircons formed at/close to the eruption and/or prior to eruption of the ash (i.e., antecrystic or xenocrystic zircons; and/or (2) post-crystallization Pb-loss. Differentiating these potential controls on the U-Pb date variation is required in order to extract information that is pertinent to the age of the ash beds sampled. In this study, we have used a combination of morphology and cathodoluminescence (CL) imaging, in conjunction with the development of a moderate-n dataset, to guide the sampling of the youngest zircon. All zircons have undergone the chemical abrasion pretreatment in order to minimize the occurrence of Pb-loss. Many studies have demonstrated that this method is effective in producing highly concordant data that represent analyses of closed system materials, however minor occurrences of Pb-loss can occur. When Pb-loss has been identified in CA-ID-TIMS data it typically manifests as a single data point that is younger than the main population thought to represent zircons crystallized at eruption. Less frequently, a number of analyses will be inferred to record Pb-loss however they will

show scatter with nonoverlapping U-Pb dates reflecting the non-systematic magnitude of Pb-loss. As such, we use the coherence of a data set as a measure of whether those analyses reflect a meaningful (i.e., U-Pb is closed system) population and negates any confusion between youngest U-Pb date and youngest zircon. Using these guidelines, we base our interpreted U-Pb data on a coherent population of youngest U-Pb dates. The inference is that the youngest population will not reflect any open-system behavior, and that older dates represent the incorporation of older pre-eruptive zircon. Selection of the youngest population is necessarily subjective and statistical parameters (MSWD, probability of fit) can be used as a guide, however these are dependent upon the precision of the single data point analyses. We interpreted U-Pb (zircon) ages based upon a population (n >4, up to 7) of the youngest precise ^{238}U-^{206}Pb dates using the probability of fit as a guide.

Uncertainties associated with weighted mean ^{238}U-^{206}Pb dates are reported as ±x/y/z, where x is the analytical (internal) uncertainties, y includes systematic uncertainty associated with tracer calibration and z additionally includes systematic uncertainty associated with the ^{238}U decay constant. When comparing these dates with those from other U-Pb laboratories not using the EARTHTIME tracer, then ±y should be used. Comparisons with other chronometers should utilize ±z.

Table DR1: Summary of geochronology results

sample	description	lat (°N)	long (°E)	type of age	date
T1-12.3	grey tuff/volcaniclastic with lithic fragments and k-feldspar/quartz phenocrysts	14.0444	38.9554	maximum depositional age (youngest concordant single crystal ^{206}Pb/^{238}U date)	<821.2 ± 1.5 Ma
TS22	tuff with pumice fragments (photo in Fig. DR4H)	14.0382	39.1079	eruptive age (weighted mean ^{238}U-^{206}Pb date; n=5)	815.29 ± 0.32/0.46/0.99 Ma
T2	silicified green tuff with feldspar phenocrysts	14.0437	38.9733	eruptive age (weighted mean ^{238}U-^{206}Pb date; n=6)	788.72 ± 0.24/0.40/0.94 Ma
T1-1202	dark grey tuff with feldspar phenocrysts	14.0482	38.9757	eruptive age (weighted mean ^{238}U-^{206}Pb date; n=7)	787.38 ± 0.14/0.35/0.91 Ma
TS23	siltstone	14.0379	39.1298	maximum depositional age (youngest concordant single crystal ^{206}Pb/^{238}U date)	<794.2 ± 0.7 Ma
T22-453	volcaniclastic unit with abundant lithic clasts	13.8436	39.6397	maximum depositional age (youngest concordant single crystal ^{206}Pb/^{238}U date)	<776.9 ± 0.8 Ma

Notes: The uncertainties associated with the weighted mean dates are reported as ±X/Y/Z, where X is the internal (analytical) uncertainty in the absence of external errors, Y incorporates the U-Pb tracer calibration error and Z includes the tracer calibration error as well as decay constant errors. Youngest concordant grain dates are for grains where the percent discordance is <1%.

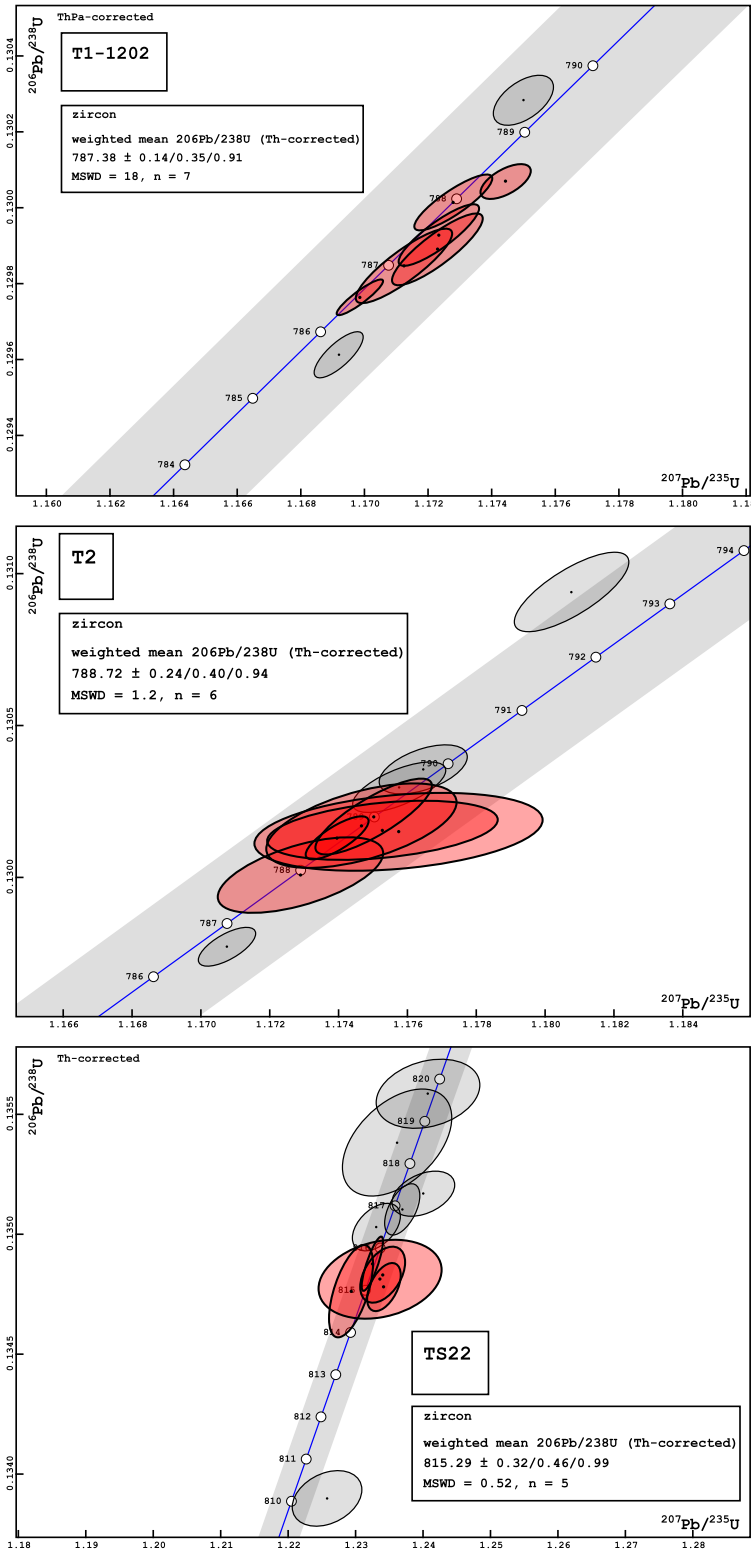

Figure DR1: Concordia plots for the U-Pb geochronology data interpreted as eruptive ages.

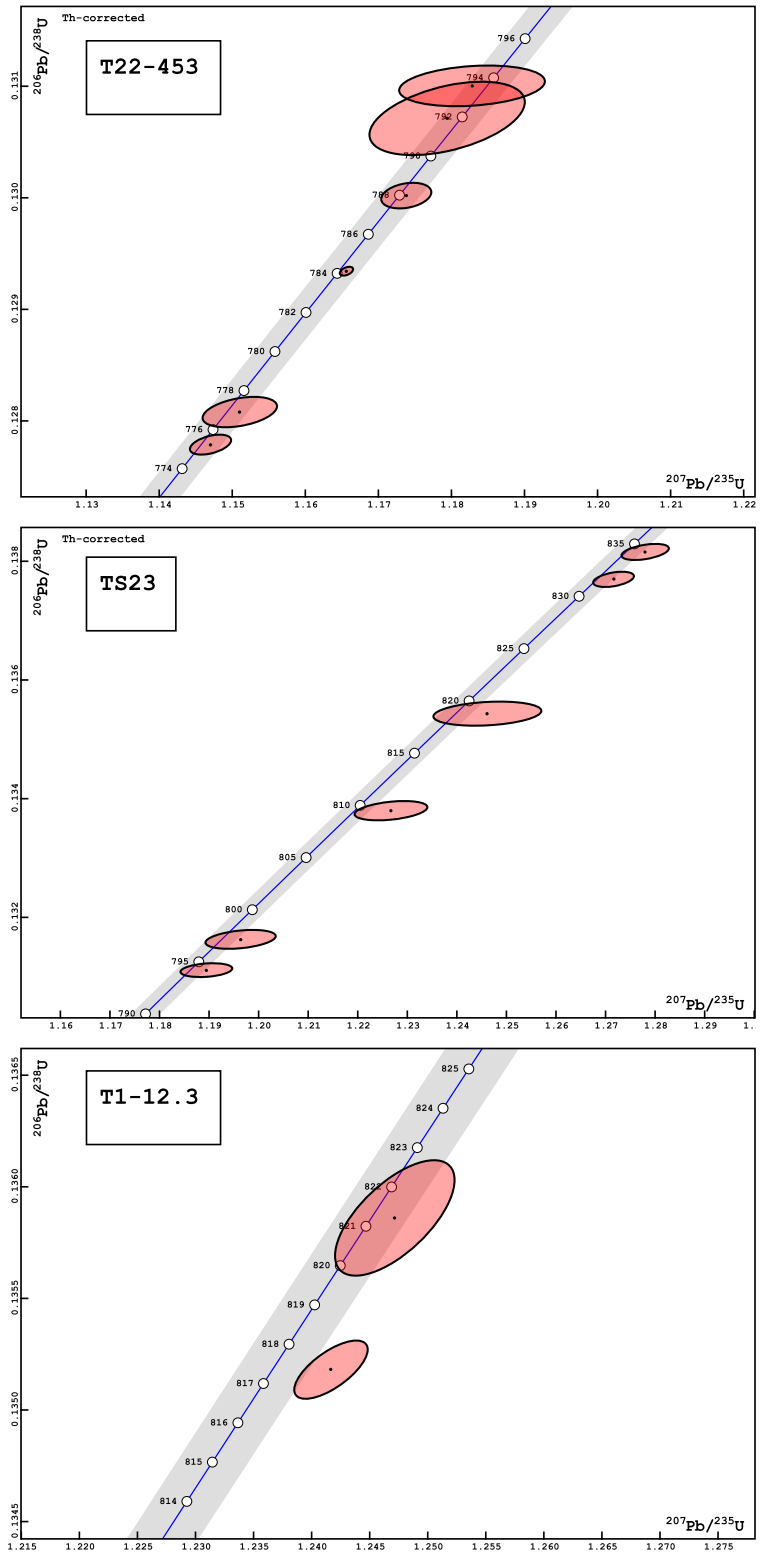

Figure DR2: Concordia plots for the U-Pb geochronology data where the youngest concordant analysis is treated as the maximum depositional age.

Table DR2: U-Pb data for analyzed zircons from samples T1-12.3 and TS23

	Dates (Ma)								Composition				Isotopic Ratios					
fraction	$\frac{^{206}Pb}{^{238}U<Th>}$[a]	± (2σ)	$\frac{^{207}Pb}{^{235}U}$[b]	± (2σ)	$\frac{^{207}Pb}{^{206}Pb}$[b]	± (2σ)	corr. coef.	%disc.[c]	$\frac{Th}{U}$[d]	Pb* (pg)[e]	Pb_c (pg)[f]	$\frac{Pb^*}{Pb_c}$[g]	$\frac{^{206}Pb}{^{204}Pb}$[g]	$\frac{^{206}Pb}{^{238}U<Th>}$[a,i]	± (2σ%)	$\frac{^{207}Pb}{^{235}U}$[i]	± (2σ%)	$\frac{^{207}Pb}{^{206}Pb}$[i]	± (2σ%)
T1-12.3																			
z1	821.21	1.47	822.12	2.3	824.6	6.7	0.66	0.41	0.45	8.80	0.57	15.5	954.0	0.135860	0.190	1.24716	0.41	0.06661	0.32
z2	817.35	0.74	819.64	1.4	825.8	4.2	0.69	1.03	0.37	10.42	0.48	21.5	1338.2	0.135181	0.097	1.24167	0.25	0.06665	0.20
z3	847.30	5.50	843.15	14.9	832.2	48.4	0.53	-1.81	0.58	10.40	4.59	2.3	149.7	0.140467	0.693	1.29417	2.61	0.06685	2.32
TS23																			
z1	797.16	0.91	798.91	3.3	804.0	11.8	0.34	0.87	0.35	8.47	0.65	13.1	833.2	0.131630	0.121	0.10719	0.13	0.12087	1.20
z2	818.78	1.15	821.67	4.9	829.7	17.8	0.23	1.33	0.34	8.31	1.05	7.9	511.0	0.135433	0.150	0.10539	0.14	0.14978	1.25
z3	834.23	0.77	835.96	2.1	840.8	7.1	0.44	0.79	0.55	12.99	0.54	24.0	1433.9	0.138157	0.098	0.16770	0.14	0.09815	1.28
z4	794.20	0.66	795.71	2.4	800.2	8.9	0.25	0.75	0.44	17.49	1.03	17.0	1046.4	0.131111	0.089	0.13561	0.13	0.08884	1.19
z5	809.49	0.92	812.84	3.3	822.2	11.8	0.36	1.55	0.79	7.46	0.52	14.5	823.5	0.133798	0.121	0.24138	0.13	0.12149	1.23
z6	831.62	0.73	833.11	1.8	837.3	6.2	0.42	0.69	0.66	11.47	0.44	26.2	1522.5	0.137695	0.093	0.20103	0.14	0.09324	1.27

Notes:

[a] Corrected for initial Th/U disequilibrium using radiogenic ^{208}Pb and Th/U[magma] = 2.80000.

[b] Isotopic dates calculated using the decay constants λ^{238} = 1.55125E-10 and λ^{235} = 9.8485E-10 (Jaffey et al., 1971).

[c] % discordance = 100 - (100 * ($^{206}Pb/^{238}U$ date) / ($^{207}Pb/^{206}Pb$ date))

[d] Th contents calculated from radiogenic ^{208}Pb and the $^{207}Pb/^{206}Pb$ date of the sample, assuming concordance between U-Th and Pb systems.

[e] Total mass of radiogenic Pb.

[f] Total mass of common Pb.

[g] Ratio of radiogenic Pb (including ^{208}Pb) to common Pb.

[h] Measured ratio corrected for fractionation and spike contribution only.

[i] Measured ratios corrected for fractionation, tracer and blank.

Table DR3: U-Pb data for analyzed zircons from sample TS22

	Dates (Ma)								Composition				Isotopic Ratios						
fraction	$\frac{^{206}Pb}{^{238}U<Th>}$[a]	± (2σ)	$\frac{^{207}Pb}{^{235}U}$[b]	± (2σ)	$\frac{^{207}Pb}{^{206}Pb}$[b]	± (2σ)	corr. coef.	%disc.[c]	$\frac{Th}{U}$[d]	Pb* (pg)[e]	Pb_c (pg)[f]	$\frac{Pb^*}{Pb_c}$[g]	$\frac{^{206}Pb}{^{204}Pb}$[g]	$\frac{^{206}Pb}{^{238}U<Th>}$[a,i]	± (2σ%)	$\frac{^{207}Pb}{^{235}U}$[i]	± (2σ%)	$\frac{^{207}Pb}{^{206}Pb}$[i]	± (2σ%)
TS22																			
z1	815.63	0.64	815.47	0.7	815.3	1.6	0.83	-0.03	0.39	136.84	0.62	220.1	13540.4	0.134877	0.084	1.23248	0.13	0.06631	0.07
z2	816.92	0.61	817.48	1.2	819.2	3.8	0.54	0.29	0.47	31.80	0.72	44.2	2672.8	0.135104	0.079	1.23691	0.21	0.06644	0.18
z3	819.65	0.82	819.22	3.5	818.3	12.6	0.25	-0.16	0.44	21.23	1.84	11.6	718.4	0.135586	0.106	1.24074	0.62	0.06641	0.60
z4	818.50	1.27	817.14	3.7	813.7	12.5	0.46	-0.58	0.36	20.13	1.33	15.2	955.6	0.135382	0.165	1.23615	0.66	0.06626	0.60
z5	814.98	1.09	814.03	1.5	811.7	4.5	0.59	-0.40	0.37	61.78	1.69	36.5	2272.3	0.134763	0.143	1.22932	0.27	0.06620	0.21
z6	815.08	0.57	816.25	1.1	819.7	3.7	0.49	0.57	0.35	56.99	1.39	41.1	2563.5	0.134780	0.074	1.23420	0.20	0.06645	0.17
z7	817.29	0.53	818.90	2.1	823.5	7.4	0.39	0.77	0.49	24.07	1.13	21.3	1295.6	0.135169	0.070	1.24005	0.37	0.06657	0.35
z8	810.07	0.66	812.41	2.4	819.1	8.4	0.31	1.11	0.47	31.81	1.82	17.5	1070.0	0.133899	0.086	1.22577	0.42	0.06643	0.40
z9	815.26	0.93	815.99	4.1	818.2	15.0	0.24	0.37	0.60	20.61	1.95	10.6	634.9	0.134812	0.122	1.23363	0.74	0.06640	0.72
z10	816.50	0.56	815.74	1.6	813.9	5.5	0.46	-0.31	0.44	18.89	0.55	34.6	2113.5	0.135030	0.073	1.23308	0.29	0.06627	0.26
z11	815.37	0.66	816.17	1.5	818.6	5.1	0.44	0.40	0.39	16.12	0.35	46.4	2872.3	0.134831	0.087	1.23401	0.27	0.06642	0.24

Notes:

[a] Corrected for initial Th/U disequilibrium using radiogenic ^{208}Pb and Th/U[magma] = 2.80000.

[b] Isotopic dates calculated using the decay constants λ^{238} = 1.55125E-10 and λ^{235} = 9.8485E-10 (Jaffey et al., 1971).

[c] % discordance = 100 - (100 * ($^{206}Pb/^{238}U$ date) / ($^{207}Pb/^{206}Pb$ date))

[d] Th contents calculated from radiogenic ^{208}Pb and the $^{207}Pb/^{206}Pb$ date of the sample, assuming concordance between U-Th and Pb systems.

[e] Total mass of radiogenic Pb.

[f] Total mass of common Pb.

[g] Ratio of radiogenic Pb (including ^{208}Pb) to common Pb.

[h] Measured ratio corrected for fractionation and spike contribution only.

[i] Measured ratios corrected for fractionation, tracer and blank.

Table DR4: U-Pb data for analyzed zircons from sample T2

	Dates (Ma)								Composition				Isotopic Ratios						
fraction	$^{206}Pb/^{238}U<Th>^{a}$	± (2σ)	$^{207}Pb/^{235}U^{b}$	± (2σ)	$^{207}Pb/^{206}Pb^{b}$	± (2σ)	corr. coef.	%disc.[c]	Th/U[d]	Pb* (pg)[e]	Pb_c (pg)[f]	Pb*/Pb_c[g]	$^{206}Pb/^{204}Pb^{g}$	$^{206}Pb/^{238}U<Th>^{a,i}$	± (2σ%)	$^{207}Pb/^{235}U^{i}$	± (2σ%)	$^{207}Pb/^{206}Pb^{i}$	± (2σ%)
T2																			
z1	788.92	0.79	788.82	1.3	788.8	4.1	0.55	-0.01	0.33	75.52	2.08	36.4	2291.6	0.130185	0.107	1.17466	0.24	0.06548	0.20
z2	788.81	0.73	789.33	2.0	791.0	7.1	0.30	0.29	0.30	29.91	1.48	20.2	1289.9	0.130165	0.098	1.17574	0.36	0.06555	0.34
z3	788.69	0.40	788.50	0.4	788.2	1.0	0.78	-0.05	0.31	63.10	0.40	156.2	9808.8	0.130145	0.054	1.17396	0.08	0.06546	0.05
z4	787.99	0.71	788.00	1.1	788.2	3.5	0.58	0.04	0.32	54.05	1.04	51.8	3261.5	0.130023	0.096	1.17289	0.20	0.06546	0.17
z5	793.31	0.75	791.67	0.8	787.3	2.0	0.75	-0.75	0.31	22.33	0.18	127.6	8020.9	0.130955	0.100	1.18077	0.14	0.06543	0.09
z6	789.09	0.71	788.99	0.8	788.9	1.8	0.82	-0.01	0.33	66.29	0.43	154.4	9661.9	0.130215	0.096	1.17502	0.14	0.06548	0.08
z7	786.65	0.36	787.00	0.4	788.2	1.1	0.68	0.21	0.28	83.28	0.27	307.5	19471.9	0.129787	0.049	1.17076	0.07	0.06546	0.05
z8	789.98	0.46	789.66	0.6	789.0	2.0	0.51	-0.11	0.32	76.55	0.57	135.2	8469.2	0.130371	0.062	1.17646	0.11	0.06548	0.09
z9	789.65	0.47	789.34	0.6	788.7	1.8	0.66	-0.11	0.29	55.22	0.61	90.4	5718.2	0.130312	0.064	1.17576	0.12	0.06548	0.09
z10	788.83	0.56	789.11	1.6	790.1	5.6	0.36	0.17	0.34	42.60	1.64	25.9	1631.2	0.130170	0.075	1.17527	0.29	0.06552	0.27

Notes:

[a] Corrected for initial Th/U disequilibrium using radiogenic ^{208}Pb and Th/U[magma] = 2.80000.

[b] Isotopic dates calculated using the decay constants λ^{238} = 1.55125E-10 and λ^{235} = 9.8485E-10 (Jaffey et al., 1971).

[c] % discordance = 100 - (100 * ($^{206}Pb/^{238}U$ date) / ($^{207}Pb/^{206}Pb$ date))

[d] Th contents calculated from radiogenic ^{208}Pb and the $^{207}Pb/^{206}Pb$ date of the sample, assuming concordance between U-Th and Pb systems.

[e] Total mass of radiogenic Pb.

[f] Total mass of common Pb.

[g] Ratio of radiogenic Pb (including ^{208}Pb) to common Pb.

[h] Measured ratio corrected for fractionation and spike contribution only.

[i] Measured ratios corrected for fractionation, tracer and blank.

Table DR5: U-Pb data for analyzed zircons from sample T1-1202

	Dates (Ma)								Composition				Isotopic Ratios					
fraction	$\frac{^{206}Pb}{^{238}U<Th>}$[a]	± (2σ)	$\frac{^{207}Pb}{^{235}U}$[b]	± (2σ)	$\frac{^{207}Pb}{^{206}Pb}$[b]	± (2σ)	corr. coef.	%disc.[c]	$\frac{Th}{U}$[d]	Pb* (pg)[e]	Pb_c (pg)[f]	$\frac{Pb^*}{Pb_c}$[g]	$\frac{^{206}Pb}{^{204}Pb}$[g]	$\frac{^{206}Pb}{^{238}U<Th>}$[a,i]	± (2σ%)	$\frac{^{207}Pb}{^{235}U}$[i]	± (2σ%)	$\frac{^{207}Pb}{^{206}Pb}$[i]	± (2σ%)
T1-1202																			
z1	786.36	0.57	787.29	0.8	789.9	1.0	1.07	0.45	0.39	56.67	0.61	93.1	5706.2	0.129750	0.077	1.17137	0.14	0.06551	0.05
z2	785.57	0.35	786.27	0.4	788.3	0.9	0.77	0.34	0.28	137.49	0.43	320.8	20434.8	0.129613	0.047	1.16919	0.07	0.06546	0.04
z3	787.15	0.54	787.72	0.7	789.3	1.5	0.86	0.28	0.28	62.28	0.59	105.7	6670.7	0.129890	0.073	1.17230	0.12	0.06549	0.07
z4	786.43	0.27	786.58	0.3	787.0	0.7	0.91	0.07	0.29	75.76	0.48	159.3	10133.6	0.129764	0.036	1.16986	0.06	0.06542	0.03
z5	786.91	0.56	787.23	0.7	788.1	1.6	0.87	0.16	0.32	55.81	0.74	75.8	4741.6	0.129847	0.076	1.17125	0.13	0.06546	0.07
z6	788.17	0.26	788.72	0.4	790.3	1.1	0.61	0.27	0.26	41.51	0.19	215.3	13800.1	0.130069	0.035	1.17444	0.07	0.06552	0.05
z7	787.37	0.46	787.74	0.6	788.8	1.3	0.86	0.18	0.30	126.38	0.42	301.0	18880.2	0.129928	0.062	1.17234	0.11	0.06548	0.06
z8	787.86	0.42	787.95	0.6	788.2	1.3	0.86	0.05	0.31	204.60	0.92	221.8	13883.6	0.130014	0.057	1.17280	0.10	0.06546	0.06
z9	789.39	0.38	788.98	0.4	787.8	1.4	0.53	-0.20	0.30	38.41	0.28	136.0	8619.4	0.130283	0.051	1.17500	0.08	0.06545	0.07
z10	777.79	0.28	780.83	0.3	789.5	1.0	0.64	1.49	0.28	62.99	0.50	125.7	8016.4	0.128250	0.038	1.15760	0.06	0.06550	0.04

Notes:

[a] Corrected for initial Th/U disequilibrium using radiogenic ^{208}Pb and Th/U[magma] = 2.80000.

[b] Isotopic dates calculated using the decay constants λ^{238} = 1.55125E-10 and λ^{235} = 9.8485E-10 (Jaffey et al., 1971).

[c] % discordance = 100 - (100 * ($^{206}Pb/^{238}U$ date) / ($^{207}Pb/^{206}Pb$ date))

[d] Th contents calculated from radiogenic ^{208}Pb and the $^{207}Pb/^{206}Pb$ date of the sample, assuming concordance between U-Th and Pb systems.

[e] Total mass of radiogenic Pb.

[f] Total mass of common Pb.

[g] Ratio of radiogenic Pb (including ^{208}Pb) to common Pb.

[h] Measured ratio corrected for fractionation and spike contribution only.

[i] Measured ratios corrected for fractionation, tracer and blank.

Table DR6: U-Pb data for analyzed zircons from sample T22-453

	Dates (Ma)								Composition				Isotopic Ratios						
fraction	$\frac{^{206}Pb}{^{238}U<Th>}$[a]	± (2σ)	$\frac{^{207}Pb}{^{235}U}$[b]	± (2σ)	$\frac{^{207}Pb}{^{206}Pb}$[b]	± (2σ)	corr. coef.	%disc.[c]	$\frac{Th}{U}$[d]	Pb* (pg)[e]	Pb_c (pg)[f]	$\frac{Pb^*}{Pb_c}$[g]	$\frac{^{206}Pb}{^{204}Pb}$[g]	$\frac{^{206}Pb}{^{238}U<Th>}$[a,i]	± (2σ%)	$\frac{^{207}Pb}{^{235}U}$[i]	± (2σ%)	$\frac{^{207}Pb}{^{206}Pb}$[i]	± (2σ%)
T22-453																			
z1	793.59	1.04	792.63	4.6	790.1	17.3	0.22	-0.43	0.85	64.47	6.97	9.3	525.6	0.130992	0.139	1.18282	0.84	0.06552	0.82
z2	816.02	0.41	816.79	1.0	819.1	3.9	0.11	0.38	0.76	12.57	0.22	56.5	3178.5	0.134934	0.053	1.23539	0.18	0.06643	0.18
z3	775.23	0.51	775.84	1.3	777.8	4.7	0.45	0.34	0.42	37.78	1.14	33.3	2045.3	0.127773	0.070	1.14702	0.25	0.06514	0.22
z4	812.48	0.85	814.16	3.9	818.9	14.3	0.20	0.80	0.82	12.29	1.11	11.1	630.0	0.134312	0.111	1.22961	0.70	0.06643	0.68
z5	817.50	1.25	818.21	5.8	820.3	21.1	0.19	0.36	0.76	25.78	3.57	7.2	422.9	0.135193	0.163	1.23852	1.03	0.06647	1.01
z6	791.92	1.88	791.04	5.0	788.8	17.2	0.45	-0.39	0.41	4.48	0.51	8.9	558.8	0.130697	0.252	1.17941	0.90	0.06548	0.82
z7	787.98	0.65	788.43	1.6	789.9	5.9	0.27	0.26	0.46	39.15	1.40	27.9	1698.5	0.130006	0.088	1.17382	0.29	0.06551	0.28
z8	776.90	0.78	777.73	2.4	780.4	8.7	0.38	0.46	0.25	25.11	1.47	17.0	1104.1	0.128064	0.106	1.15103	0.44	0.06522	0.41
z9	784.11	0.23	784.60	0.4	786.2	1.5	0.45	0.28	0.46	74.65	0.63	118.7	7175.2	0.129328	0.031	1.16563	0.08	0.06540	0.07

Notes:

[a] Corrected for initial Th/U disequilibrium using radiogenic ^{208}Pb and Th/U[magma] = 2.80000.

[b] Isotopic dates calculated using the decay constants λ^{238} = 1.55125E-10 and λ^{235} = 9.8485E-10 (Jaffey et al., 1971).

[c] % discordance = 100 - (100 * ($^{206}Pb/^{238}U$ date) / ($^{207}Pb/^{206}Pb$ date))

[d] Th contents calculated from radiogenic ^{208}Pb and the $^{207}Pb/^{206}Pb$ date of the sample, assuming concordance between U-Th and Pb systems.

[e] Total mass of radiogenic Pb.

[f] Total mass of common Pb.

[g] Ratio of radiogenic Pb (including ^{208}Pb) to common Pb.

[h] Measured ratio corrected for fractionation and spike contribution only.

[i] Measured ratios corrected for fractionation, tracer and blank.

2 Stratigraphic nomenclature and data

The stratigraphic nomenclature used herein predominantly follows that developed by Beyth (1972) with some updates and integration with subsequent publications. The work of Beyth (1972) was the first to formalize stratigraphic nomenclature and is a summary of mapping in the region from 1968 to 1972 conducted by Michael Beyth as well as many geologists of the Geological Survey of Ethiopia (see map citations for details). Short summaries of the lithological terminology used in the text and figures are provided below.

Tsaliet Group

This group was called the "Tsaliet Metavolcanics" by Beyth (1972) and has subsequently been referred to as the "Tsaliet Group" (Alene et al., 2006; Avigad et al., 2007; Miller et al., 2009). The lithology, distribution, name derivation, type area and boundary are as described in Beyth (1972).

Tambien Group

As developed in Beyth (1972) and used in subsequent publications (e.g. Beyth et al. (2003); Alene et al. (2006); Avigad et al. (2007)), we use the lithostratigraphic group name of "Tambien Group" to refer to all the Neoproterozoic sediments exposed in the northern Tigray region above the basal contact with the Tsaliet Group and ending with the diamictite of the Negash Formation.

Werii Formation

The lithology, distribution, name derivation, type area and boundary are as described in Beyth (1972) with the only difference being that Beyth (1972) and subsequent researchers (e.g. Beyth et al. (2003); Miller et al. (2009)) have used the formation name of "Werii Slate." We use "Werii Formation" instead given that, in addition to fine-grained siliciclastic metasediments, there are intercalated volcanic tuffs within the formation.

Assem Formation

The lithology, distribution, name derivation, type area and boundary are as described in Beyth (1972) with the only difference being that Beyth (1972) and subsequent researchers (e.g. Beyth et al. (2003); Miller et al. (2009)) have used the formation name of "Assem Limestone." We use "Assem Formation" instead given that the formation contains minor dolostone as well as horizons of intercalated fine-grained siliclastics in the east Mai Kenetal, east Tsedia and west Chemit synclinoria.

Tsedia Formation

The lithology, distribution, name derivation, type area and boundary are as described in Beyth (1972) with the only difference being that Beyth (1972) and subsequent researchers (e.g. Beyth et al. (2003); Miller et al. (2009)) have used the formation name of "Tsedia Slate." We use "Tsedia Formation" instead given that the formation contains minor carbonate beds in addition to fine-grained siliciclastic sedimentary rock.

Mai Kenetal Formation

The lithology, name derivation, and type area are as described in Beyth (1972). Beyth (1972) and subsequent researchers (e.g. Beyth et al. (2003); Miller et al. (2009)) have used the formation name of "Mai Kenetal Limestone." We use "Mai Kenetal Formation" instead given that "formation" rather than an explicit lithology is consistent with our preferred terminology for other formations in the Tambien Group. We also note that the distribution of the formation is broader than that described in Beyth (1972) as the formation occurs within the Tekeze Dam region (Fig. DR3 and as mapped by Hailu and Sime (2000) on the Adi Arkay map sheet).

Amota Formation

This formation was defined as the Amota Slate by Hailu and Sime (2000) on the Adi Arkay map sheet where it is described as a "slate with light blue egg-shaped reduction spots." We have also found the formation to be exposed within the Negash Synclinorium (see Figure DR3) where it was originally mapped as undifferentiated Tambien Group Arkin et al. (1971) and where it has subsequently been referred to as the "Lower Slate" (Alene et al., 2006; Miller et al., 2009).

Didikama Formation

The lithology and name derivation of this mixed carbonate and siliciclastic formation are as in (Garland, 1980). Previously, on the Mekele map sheet (Arkin et al., 1971) the Amota Formation, Didikama Formation, Matheos Formation and Marian Bohkahko Formation (informal) were mapped as undifferentiated Tambien Group (also referred to in this manner within Beyth (1972)). New stratigraphic sections allow for these formations to be delineated within the Negash syncline. Garland (1980) proposed that the Didikama be considered as above the Tambien Group and be referred to as the "Negash Facies." Instead, we follow Beyth (1972) and consider these sedimentary rocks within the Negash Syncline (comprised for the Amota, Didikama, Matheos and Marian Bohkahko Formations) to be part of the Tambien Group as has also been done by other workers (e.g. Alene et al. (2006), Miller et al. (2009)).

Matheos Formation

The limestone of the Matheos Formation was originally mapped in the Adigrat map sheet Garland (1978) and briefly described in Garland (1980). In the Mekele map sheet, it was mapped as undifferentiated Tambien Group, however a detailed map of the Negash syncline in Beyth (1972) delineated between "black detrital limestone" (which constitutes the Matheos Formation) and overlying "pebbly slate" (which constitutes the Negash Formation). As can be seen in Figure DR3, the formation is dominated by limestone grainstone with horizons of molar tooth structures, horizons that are ooilitic, beds that are comprised of rip-up clast breccia and minor stromatolites. As noted by Garland (1980), the only known occurrence of the formation is within the Negash Syncline.

Marian Bohkahko Formation

Above the Matheos Formation and below the Negash Formation is a sequence of fine-grained clast-free siliclastic sedimentary rocks with interbedded carbonates (see sections T23, T29 and T30 in Figure DR3). These sedimentary rocks have previously been referred to as the "upper slate" (Miller et al., 2003) and the "transitional member" (Miller et al., 2009). Miller et al. (2009) grouped the Matheos Formation as defined here with the Marian Bohkahko Formation and the Negash Formation diamictite referring to all as the Matheos Formation. Given the distinct assemblage of lithologies unique to the Matheos, Marian Bohkahko and Negash Formations (Figure DR3) considering them as individual formations is prudent. The Marian Bohkahko Formation is only known to be exposed within the Negash Syncline and its best known exposure is in northwest core of the syncline in the vicinity of a spring and associated large travertine deposit that is known to the local community as Marian Bohkahko leading to the informal name of the Marian Bohkahko Formation. Given the lack of formal geographic names in the interior of the syncline, we use this informal terminology herein.

Negash Formation

The uppermost formation of the Tambien Group was described as a pebbly slate in Beyth (1972) and considered as the "Diamictite Member" of the Tambien Group in Miller et al. (2009). Given the uniqueness of this interval of strata, this diamictite should be considered a standalone formation distinct from the underlying Marian Bohkahko and Matheos Formations. This approach follows most closely to that of Alene et al. (2006) who called the unit the "Negash diamictite" which we slightly modify here to be Negash Formation.

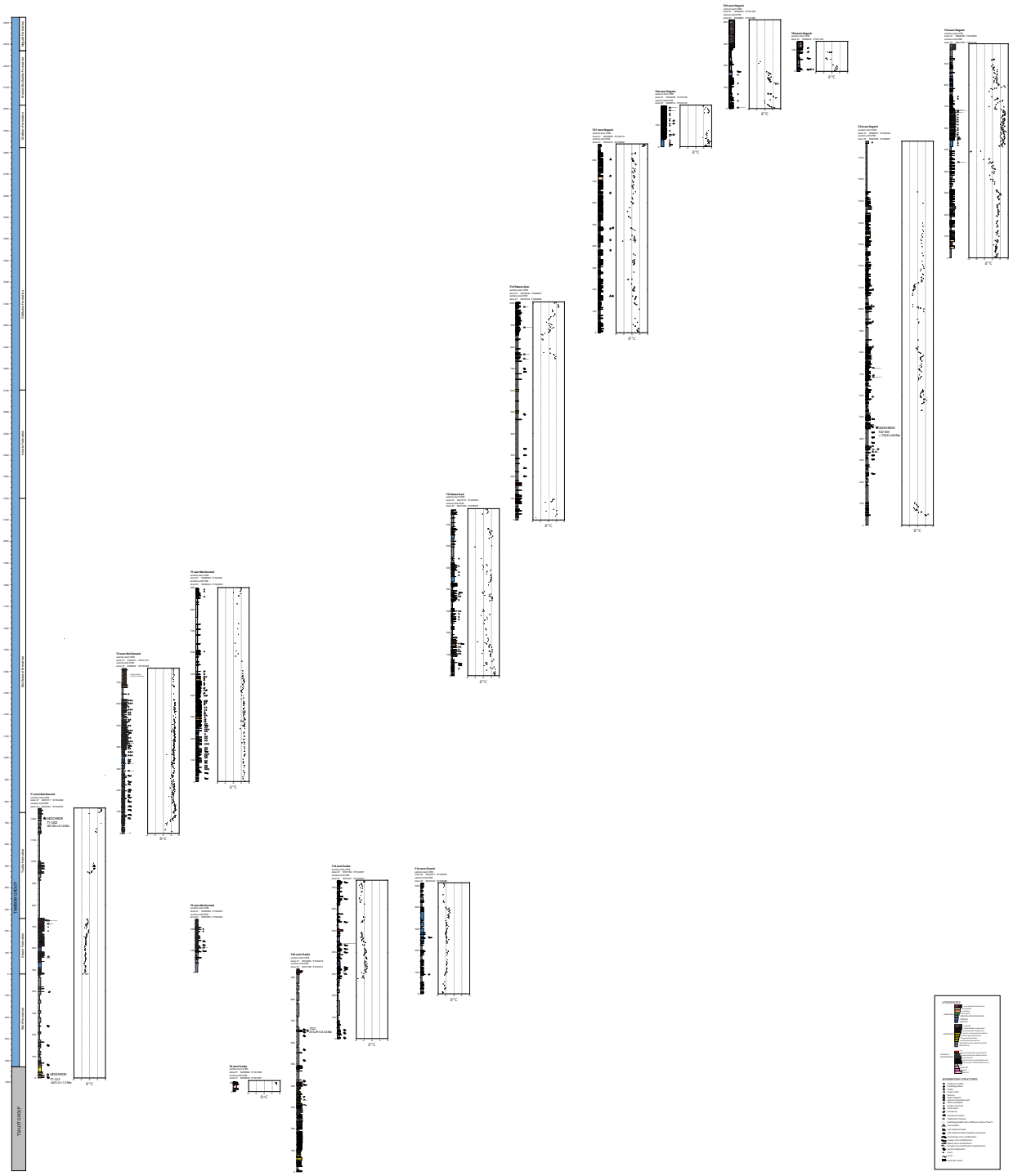

Figure DR3: Measured lithostratigraphic sections covering 11,451 meters of stratigraphy used to construct the simplified stratigraphic columns shown in Figure 1 of the main text along with the $\delta^{13}C$ data used for each section (1,648 data points). Location of the sections are given in UTM coordinates using the WGS84 ellipsoid. Given that this figure is a scaleable vector graphic, you can use the zoom function of your PDF viewer and zoom in so that the stratigraphic logs and carbon isotope data become legible.

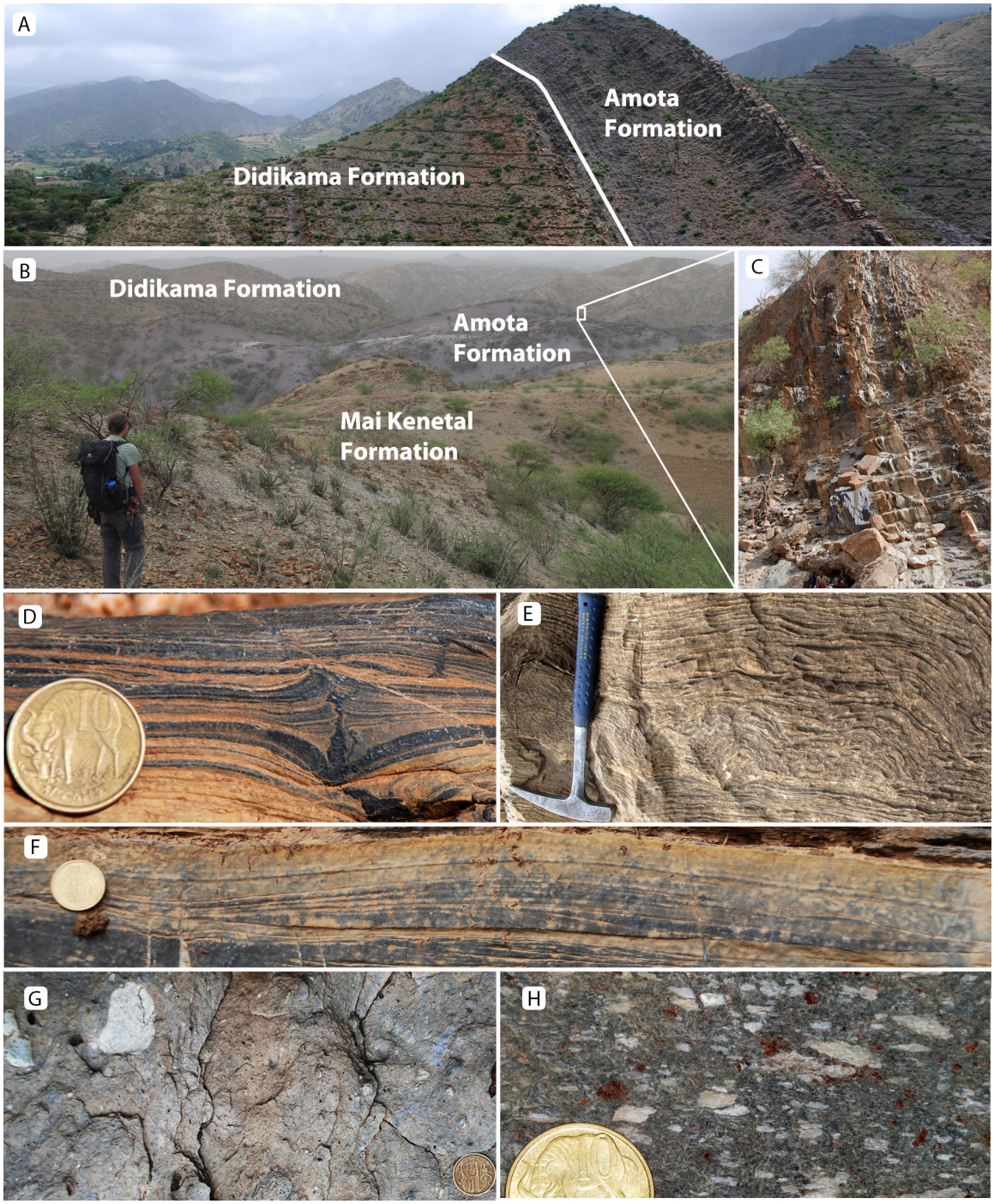

Figure DR4: Photographs from the Tambien Group. A) Outcrop photo from the east limb of the Negash Syncline. B) Panorama in the Tekeze Dam region with a zoom-in photo of the Didikama Formation in (C). Note the men in the shade at the base of (C) for scale. D) Molar tooth structures within the Mai Kenetal Formation. E) Linked domal stromatolites in the Assem Formation on the west limb of the Mai Kenetal Synclinorium. F) Hummocky cross-stratification in limestone ribbonite facies of the Mai Kenetal Formation. G) Carbonate, granitoid and mafic volcanic clasts within the diamictite unit at the top of the stratigraphy in the Negash Syncline interpreted to correspond to the Sturtian glaciation. H) Welded volcanic tuff with pumice fragments from the Werri Formation on the east limb of the Tsedia Syncline (sample TS22). The Ethiopian 10 birr coin used for scale has a diameter for 2.3 cm. The length of the rock hammer in (E) is 40 cm.

3 Monte Carlo approach to age estimation/interpolation

The age of beds between two dated tuffs can be estimated using a Monte Carlo approach as described in Guex et al. (2012). In this approach, 10^6 simulated dates are generated from each date using a normal distribution and the uncertainty on the weighted mean. From these simulated dates, 10^6 depositional rates are calculated to estimate the age and associated 2σ age uncertainty associated with any stratigraphic level between the dated tuffs. This approach requires the crude assumption that the depositional rate between the dated units is constant.

A similar approach also provides a simple way to estimate the uncertainty on duration between two dates wherein the difference between 10^6 simulated dates taken from a normal distribution using the age certainties can be calculated to determine the associated 2σ uncertainty on duration. This approach was taken for the quoted uncertainties related to duration that are presented in the main text.

In the main text, the Monte Carlo interpolation approach is used to provide estimates for the maximum and minimum duration of the Bitter Springs stage that are more tightly constrained than using solely dates themselves. As can be seen in Figure DR3, the TS22 tuff in the T20 west Tsedia section approximately corresponds to meter level 220 in the T1 stratigraphic section taking the base of the Assem Formation to be chronostratigraphically correlated between sections T1 and T20. This correlation is justified within the envisioned depositional framework wherein carbonate production to the west in the shallow-water environment preserved in section T1 is transported to the deeper part of the shelf/upper slope that is represented in section T20. The age constraint of the TS22 ash from within the T20 section projected onto the T1 section, and the age of the stratigraphic level of 1202 meters within the T1 section (the T1-1202 date) can be used to construct an age model for the stratigraphy between these tuffs.

An application of this approach in the main text was presented wherein an age was determined for the first carbonate bed within the T1 section with a positive $\delta^{13}C$ value that occurs at meter level 946.7 (within the Tsedia Formation). The resulting estimated age for T1-946.7 using the TS22 and T1-1202 dates was 794.64 $\pm$ 0.13 Ma, and this age was paired with the 811.51 $\pm$ 0.25 Ma pre-BSS date from the Fifteen Mile Group to give a maximum BSS duration estimate of 16.9 $\pm$ 0.3 Myr. The same approach was used to determine estimates for the ages of the lowermost Assem Formation bed (T1-480 with an estimate of 807.9 $\pm$ 0.2 Ma) and the uppermost Assem Formation bed in the T1 section (T1-947 with an estimate of 800.6 $\pm$ 0.2 Ma). These age estimates can be combined to estimate a minimum duration of 7.3 $\pm$ 0.6 Myr for the Bitter Springs Stage. This estimate is a minimum duration for the BSS given that carbonates throughout the Assem Formation have negative $\delta^{13}C$ values and that we interpret the BSS to have started before and ended after deposition of the Assem Formation.

4 Carbon isotope methods and data

Carbonate powders were heated to 110 °C to remove water. Samples were then placed in individual borosilicate reaction viles and reacted at 72 °C with 5 drops of H_3PO_4 in a GasBench II preparation device coupled directly to the inlet of a Thermo DeltaPlus continuous flow isotope ratio mass spectrometer. $\delta^{13}C$ and $\delta^{18}O$ data were acquired simultaneously and are reported in the standard delta notation as the ‰ difference from the VPDB standard. Precision and accuracy of data are monitored through analysis of 21 standards which are run for every 59 samples. Measured precision is 0.1‰ (1σ) for both $\delta^{13}C$ and $\delta^{18}O$.

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T1	479.9	-0.5	-3.6	-10.2
T1	480.4	0.0	-1.9	-10.1
T1	480.8	0.4	-0.9	-7.1
T1	486.1	5.7	-2.7	-12.5
T1	491.9	11.5	-2.1	-11.0
T1	492.3	11.9	-2.1	-10.6
T1	494.3	13.9	-2.2	-10.3
T1	497.7	17.3	-2.3	-9.8
T1	500.6	20.2	-2.3	-9.7
T1	508.5	28.1	-2.2	-8.8
T1	514.1	33.7	-2.0	-8.4
T1	516.5	36.1	-2.0	-7.9
T1	519.2	38.8	-2.3	-8.2
T1	526.9	46.5	-2.9	-7.7
T1	528.3	47.9	-2.7	-8.1
T1	536.1	55.7	-2.5	-7.7
T1	540.6	60.2	-2.1	-8.0
T1	543.3	62.9	-2.1	-7.4
T1	545.8	65.4	-2.0	-8.3
T1	546.1	65.7	-2.2	-7.9
T1	552.3	71.9	-1.9	-8.4
T1	552.6	72.2	-2.2	-8.8
T1	556.2	75.8	-2.1	-8.9
T1	562.7	82.3	-2.3	-9.8
T1	565.9	85.5	-2.2	-9.2
T1	568.8	88.4	-2.4	-10.1
T1	569.1	88.7	-2.2	-9.0
T1	573.1	92.7	-1.9	-9.1
T1	576.0	95.6	-2.0	-11.3
T1	578.4	98.0	-2.2	-10.8
T1	588.2	107.8	-2.3	-11.4
T1	593.5	113.1	-2.5	-11.3
T1	593.7	113.3	-2.4	-10.5
T1	597.5	117.1	-2.2	-11.2
T1	605.1	124.7	-2.5	-8.4
T1	606.9	126.5	-2.3	-9.4
T1	607.8	127.4	-2.5	-9.3
T1	614.6	134.2	-1.9	-7.9
T1	617.0 *mts*	136.6	-2.0	-8.3
T1	617.0	136.6	-1.9	-8.5

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T1	618.9	138.5	-2.1	-10.2
T1	622.8	142.4	-1.9	-11.7
T1	623.2	142.8	-2.0	-11.0
T1	627.6	147.2	-1.9	-10.7
T1	632.2	151.8	-1.9	-10.7
T1	636.6	156.2	-1.9	-10.4
T1	638.4	158.0	-2.2	-11.9
T1	643.4	163.0	-1.8	-13.3
T1	646.6	166.2	-2.1	-16.4
T1	647.0	166.6	-2.1	-15.5
T1	649.2	168.8	-2.0	-12.0
T1	649.3	168.9	-2.0	-12.4
T1	650.1	169.7	-1.7	-7.9
T1	650.8	170.4	-1.7	-7.8
T1	651.4	171.0	-2.9	-7.8
T1	654.8	174.4	-1.5	-4.7
T1	657.9	177.5	-1.4	-4.1
T1	660.7	180.3	-1.8	-5.2
T1	662.6	182.2	-1.3	-5.4
T1	666.3	185.9	-1.6	-5.4
T1	670.2	189.8	-0.9	-6.5
T1	672.8	192.4	-0.6	-4.6
T1	676.1	195.7	-0.5	-5.3
T1	680.3	199.9	-0.6	-5.0
T1	683.6	203.2	-0.5	-5.1
T1	689.3	208.9	-1.7	-6.6
T1	694.1	213.7	-2.6	-5.9
T1	698.2	217.8	-1.5	-7.1
T1	703.2	222.8	-1.6	-11.0
T1	706.3	225.9	-2.0	-16.3
T1	709.2	228.8	-2.0	-8.1
T1	709.3	228.9	-1.6	-9.4
T1	711.3	230.9	-0.9	-8.5
T1	713.1	232.7	-0.9	-7.5
T1	714.1	233.7	-1.3	-15.4
T1	715.0	234.6	-1.2	-7.7
T1	721.5	241.1	-0.7	-12.1
T1	727.9	247.5	-0.9	-8.5
T1	732.1	251.7	-1.2	-11.4
T1	734.6	254.2	-1.4	-12.9
T1	946.7	466.3	0.2	-15.5
T1	949.2	468.8	-0.2	-16.3
T1	951.8	471.4	0.9	-14.8
T1	952.0	471.6	1.0	-16.0
T1	952.3	471.9	-1.0	-15.9
T1	952.4	472.0	0.9	-15.5
T1	957.7	477.3	1.3	-15.2
T1	965.0	484.6	2.0	-15.7
T1	965.6	485.2	2.2	-15.2
T1	966.6	486.2	2.2	-15.3
T1	966.7	486.3	2.4	-14.5

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T1	967.2	486.8	2.0	-13.9
T1	968.1	487.7	2.6	-15.3
T1	969.4	489.0	2.7	-14.6
T1	970.0	489.6	2.3	-14.5
T1	976.5	496.1	1.7	-14.3
T1	977.4	497.0	2.6	-13.5
T1	978.0	497.6	2.2	-14.3
T1	978.3	497.9	2.8	-13.8
T1	978.6	498.2	2.0	-13.1
T1	980.2	499.8	2.1	-13.5
T1	980.6	500.2	2.5	-14.3
T1	982.6	502.2	2.5	-13.7
T1	983.3	502.9	2.5	-12.9
T1	984.1	503.7	1.8	-13.6
T1	992.7	512.3	2.0	-13.6
T1	1135.8	655.4	3.3	-12.9
T1	1137.0	656.6	3.4	-11.9
T1	1139.2	658.8	2.8	-12.3
T1	1151.2	670.8	3.4	-11.8
T1	1176.6	696.2	5.8	-11.3
T1	1222.7	742.3	-0.3	-10.5
T1	1227.5	747.1	4.7	-10.3
T1	1231.5	751.1	5.6	-12.1
T1	1233.3	752.9	5.9	-12.6
T1	1235.0	754.6	6.0	-11.7
T1	1236.5	756.1	5.9	-11.3
T1	1240.8	760.4	6.1	-12.3
T1	1243.9	763.5	5.7	-11.0
T1	1246.7	766.3	4.8	-9.9
T3	1.0	651.0	3.0	-10.5
T3	8.7	658.7	4.2	-10.5
T3	17.3	667.3	0.9	-7.3
T3	39.4	689.4	1.6	-10.2
T3	46.0	696.0	1.3	-7.8
T3	48.9	698.9	1.9	-11.0
T3	54.7	704.7	3.5	-10.7
T3	57.3	707.3	3.4	-8.9
T3	60.7	710.7	5.0	-11.8
T3	64.3	714.3	3.5	-8.6
T3	65.6	715.6	4.5	-9.2
T3	68.2	718.2	4.5	-9.8
T3	69.7	719.7	4.9	-9.5
T3	72.8	722.8	5.5	-10.6
T3	74.7	724.7	6.1	-10.8
T3	77.0	727.0	5.4	-10.0
T3	79.4	729.4	5.9	-9.3
T3	81.3	731.3	6.1	-10.0
T3	83.3	733.3	6.0	-9.7
T3	84.5	734.5	6.4	-10.1
T3	94.0	744.0	5.5	-9.4
T3	96.7	746.7	4.9	-8.0

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T3	98.5	748.5	5.2	-8.1
T3	102.0	752.0	5.2	-8.9
T3	103.5	753.5	5.9	-8.7
T3	105.4	755.4	5.9	-9.3
T3	108.0	758.0	6.0	-9.2
T3	109.1	759.1	6.4	-8.9
T3	110.9	760.9	6.2	-9.1
T3	113.3	763.3	5.7	-8.8
T3	114.9	764.9	6.1	-8.8
T3	116.7	766.7	5.9	-8.8
T3	118.4	768.4	6.0	-8.3
T3	121.2	771.2	6.1	-8.5
T3	123.2	773.2	5.9	-7.6
T3	125.6	775.6	5.8	-8.8
T3	127.1	777.1	5.8	-8.6
T3	129.9	779.9	5.6	-8.6
T3	131.1	781.1	6.2	-8.5
T3	134.1	784.1	5.7	-8.2
T3	137.3	787.3	5.6	-8.7
T3	138.3	788.3	5.6	-8.0
T3	139.9	789.9	4.7	-8.4
T3	142.5	792.5	4.5	-7.9
T3	144.7	794.7	5.1	-8.1
T3	146.2	796.2	5.3	-8.3
T3	148.6	798.6	5.4	-8.3
T3	150.8	800.8	5.1	-8.0
T3	154.4	804.4	4.8	-7.7
T3	157.7	807.7	5.1	-8.5
T3	164.0	814.0	4.9	-7.5
T3	166.4	816.4	4.8	-8.1
T3	168.4	818.4	4.1	-7.1
T3	170.6	820.6	2.8	-5.7
T3	173.0	823.0	5.1	-8.4
T3	176.6	826.6	5.3	-7.4
T3	178.3	828.3	4.8	-7.3
T3	180.2	830.2	4.5	-7.4
T3	182.5	832.5	5.3	-7.9
T3	185.0	835.0	4.8	-7.9
T3	187.0	837.0	5.4	-7.9
T3	188.8	838.8	4.5	-7.8
T3	191.2	841.2	4.5	-8.1
T3	193.8	843.8	5.7	-7.2
T3	198.2	848.2	4.9	-7.7
T3	199.6	849.6	5.2	-8.4
T3	201.5	851.5	5.9	-7.9
T3	203.5	853.5	5.6	-8.7
T3	207.3	857.3	5.4	-7.9
T3	209.9	859.9	3.5	-6.7
T3	212.4	862.4	5.4	-8.2
T3	214.6	864.6	5.0	-7.8
T3	216.4	866.4	5.5	-7.9

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T3	218.4	868.4	5.7	-7.9
T3	220.3	870.3	5.6	-8.2
T3	222.4	872.4	4.8	-7.9
T3	223.7	873.7	5.4	-8.1
T3	225.9	875.9	4.7	-8.3
T3	227.6	877.6	5.6	-8.8
T3	229.9	879.9	5.5	-8.6
T3	231.5	881.5	4.3	-7.4
T3	237.5	887.5	4.7	-8.5
T3	239.1	889.1	5.3	-8.7
T3	240.6	890.6	4.1	-6.6
T3	246.3	896.3	4.9	-9.0
T3	248.3	898.3	5.2	-8.4
T3	254.5	904.5	3.6	-6.9
T3	258.8	908.8	4.6	-8.4
T3	262.9	912.9	4.6	-8.9
T3	264.5	914.5	5.0	-9.0
T3	266.8	916.8	4.3	-7.9
T3	268.3	918.3	4.9	-8.6
T3	270.7	920.7	4.1	-8.1
T3	277.5	927.5	5.1	-8.9
T3	280.1	930.1	4.9	-9.1
T3	281.3	931.3	5.3	-8.9
T3	288.7	938.7	5.6	-8.8
T3	290.1	940.1	5.4	-8.5
T3	299.7	949.7	5.5	-9.5
T3	304.7	954.7	5.2	-9.0
T3	308.4	958.4	4.7	-9.0
T3	313.6	963.6	4.8	-9.1
T3	316.2	966.2	4.1	-8.2
T3	318.7	968.7	4.5	-8.1
T3	321.9	971.9	4.8	-9.0
T3	322.2	972.2	5.5	-9.0
T3	322.2 *mts*	972.2	5.5	-8.6
T3	322.9	972.9	5.5	-8.6
T3	322.9 *mts*	972.9	5.5	-8.6
T3	323.1	973.1	4.6	-8.2
T3	326.6	976.6	4.8	-9.1
T3	327.2	977.2	4.2	-8.2
T3	330.1	980.1	3.9	-7.9
T3	332.9	982.9	5.3	-8.9
T3	334.5	984.5	5.2	-8.9
T3	336.3	986.3	5.1	-9.6
T3	337.2	987.2	5.2	-8.8
T3	337.2 *mts*	987.2	5.2	-8.8
T3	337.7	987.7	5.4	-9.9
T3	341.0	991.0	5.6	-9.0
T3	343.1	993.1	5.5	-9.0
T3	344.9	994.9	5.8	-8.5
T3	344.9 *mts*	994.9	5.8	-8.5
T3	345.0	995.0	5.5	-9.0

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T3	348.9	998.9	5.7	-8.7
T3	350.3	1000.3	5.5	-8.9
T3	351.6	1001.6	5.3	-8.9
T3	358.5	1008.5	5.4	-8.2
T3	362.8	1012.8	5.2	-7.8
T3	362.8 *mts*	1012.8	5.2	-7.8
T3	362.8	1012.8	5.4	-8.6
T3	363.6	1013.6	1.6	-5.5
T3	364.7	1014.7	4.5	-6.9
T3	368.1	1018.1	5.1	-8.0
T3	371.1	1021.1	5.1	-8.1
T3	373.1	1023.1	5.5	-7.8
T3	374.4	1024.4	5.2	-8.6
T3	377.3	1027.3	5.0	-7.9
T3	380.1	1030.1	5.0	-8.2
T3	382.5	1032.5	4.8	-8.1
T3	383.1	1033.1	5.8	-7.3
T3	384.0	1034.0	4.8	-7.3
T3	384.0 *mts*	1034.0	4.8	-7.3
T3	385.4	1035.4	5.1	-8.0
T3	388.0	1038.0	5.0	-8.4
T3	389.5	1039.5	5.3	-8.2
T3	391.1	1041.1	5.1	-9.0
T3	393.9	1043.9	5.3	-7.9
T3	395.1	1045.1	5.5	-7.6
T3	397.6	1047.6	5.6	-8.4
T3	400.8	1050.8	5.4	-8.4
T3	403.8	1053.8	5.5	-8.7
T3	405.5	1055.5	5.0	-8.6
T3	408.4	1058.4	5.3	-7.8
T3	410.2	1060.2	5.4	-8.7
T3	411.7	1061.7	5.5	-7.8
T3	414.7	1064.7	5.5	-8.8
T3	417.1	1067.1	5.3	-8.6
T3	418.7	1068.7	5.3	-8.6
T3	421.9	1071.9	5.3	-7.9
T3	425.7	1075.7	5.9	-5.8
T3	425.7 *mts*	1075.7	5.9	-5.8
T3	426.7	1076.7	5.5	-7.8
T3	429.1	1079.1	5.0	-8.0
T3	432.6	1082.6	5.8	-7.8
T3	433.1	1083.1	5.3	-4.9
T3	433.1 *mts*	1083.1	5.3	-4.9
T3	434.2	1084.2	5.4	-7.7
T3	437.3	1087.3	5.7	-7.1
T3	440.8	1090.8	5.8	-6.7
T3	443.6	1093.6	6.0	-6.2
T3	446.4	1096.4	5.9	-6.5
T3	449.5	1099.5	5.6	-7.0
T3	450.7	1100.7	5.5	-7.3
T3	453.3	1103.3	5.5	-7.6

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T3	455.0	1105.0	5.6	-8.2
T3	457.1	1107.1	5.8	-7.9
T3	458.8	1108.8	5.9	-8.8
T3	460.8	1110.8	5.6	-9.0
T3	462.8	1112.8	5.5	-9.0
T3	466.7	1116.7	5.5	-8.7
T3	470.0	1120.0	5.8	-8.5
T3	470.5	1120.5	4.1	-5.7
T3	470.5 *mts*	1120.5	4.1	-5.7
T3	471.2	1121.2	5.2	-7.5
T3	474.9	1124.9	5.7	-6.3
T3	477.5	1127.5	5.0	-6.9
T3	478.5	1128.5	5.6	-7.1
T3	482.2	1132.2	4.8	-6.8
T3	484.4	1134.4	5.9	-7.1
T3	486.2	1136.2	5.7	-6.4
T3	489.6	1139.6	5.6	-6.7
T3	490.3	1140.3	5.8	-4.9
T3	490.3 *mts*	1140.3	5.8	-4.9
T3	490.5	1140.5	6.0	-6.3
T3	493.0	1143.0	5.7	-6.7
T3	499.8	1149.8	5.7	-7.0
T3	503.0	1153.0	4.6	-6.7
T3	505.4	1155.4	5.5	-7.5
T3	510.8	1160.8	5.6	-7.0
T3	511.8	1161.8	5.8	-7.6
T3	515.2	1165.2	6.0	-7.5
T3	519.7	1169.7	5.5	-7.9
T3	521.0	1171.0	5.6	-7.3
T3	526.3	1176.3	5.5	-7.0
T3	527.8	1177.8	5.4	-7.3
T3	536.0	1186.0	6.1	-6.6
T3	542.3	1192.3	5.2	-6.5
T3	549.1	1199.1	6.1	-6.9
T3	552.0	1202.0	11.8	-7.8
T3	552.0 *mts*	1202.0	11.8	-7.8
T3	557.2	1207.2	5.7	-7.1
T3	561.8	1211.8	5.9	-7.4
T3	563.3	1213.3	6.2	-6.7
T3	563.3 *mts*	1213.3	6.2	-6.7
T3	564.2	1214.2	5.7	-7.1
T3	569.3	1219.3	5.6	-7.1
T3	572.0	1222.0	5.9	-7.3
T3	574.1	1224.1	5.3	-7.0
T3	578.8	1228.8	5.9	-7.5
T3	579.8	1229.8	5.9	-6.7
T3	580.8	1230.8	5.7	-8.1
T3	584.3	1234.3	5.4	-7.2
T3	589.8	1239.8	5.8	-6.6
T3	589.8	1239.8	5.9	-6.0
T3	589.8 *mts*	1239.8	5.9	-6.0

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T3	593.9	1243.9	5.9	-6.7
T3	598.6	1248.6	5.8	-7.4
T3	602.4	1252.4	5.6	-6.4
T3	602.5	1252.5	5.8	-4.0
T3	602.5 *mts*	1252.5	5.8	-4.0
T3	605.3	1255.3	6.0	-6.8
T3	615.6	1265.6	5.5	-8.1
T3	616.6	1266.6	5.5	-6.4
T3	618.7	1268.7	5.3	-7.3
T3	645.1	1295.1	5.2	-4.6
T3	677.6	1327.6	5.7	-6.1
T3	678.4	1328.4	5.3	-5.5
T3	678.4 *mts*	1328.4	5.3	-5.5
T3	679.9	1329.9	5.5	-6.1
T3	682.2	1332.2	5.3	-5.3
T3	685.8	1335.8	4.6	-4.7
T3	702.1	1352.1	5.1	-6.2
T3	711.6	1361.6	5.1	-6.1
T3	717.2	1367.2	4.6	-5.7
T3	725.2	1375.2	5.2	-5.8
T3	732.2	1382.2	5.5	-5.8
T3	736.4	1386.4	5.0	-5.9
T3	746.2	1396.2	5.1	-5.6
T3	753.3	1403.3	5.2	-5.7
T3	759.0	1409.0	5.0	-6.4
T6	34.7	-465.3	6.2	-16.2
T6	35.7	-464.3	6.0	-15.3
T6	37.2	-462.8	6.1	-14.2
T6	38.0	-462.0	6.0	-15.9
T6	41.0	-459.0	6.2	-14.7
T6	42.1	-457.9	5.4	-16.3
T7	2.4	892.4	5.7	-12.8
T7	13.1	903.1	4.9	-10.3
T7	21.3	911.3	4.9	-8.9
T7	32.1	922.1	5.4	-9.0
T7	40.5	930.5	5.8	-8.9
T7	42.5	932.5	5.5	-9.6
T7	50	940	5.1	-9.2
T7	63.8	953.8	5.4	-10.8
T7	74.2	964.2	5.6	-10.0
T7	74.5	964.5	5.6	-9.5
T7	84.6	974.6	5.0	-9.2
T7	90.7	980.7	4.9	-8.6
T7	90.7 *mts*	980.7	5.2	-8.7
T7	93.6	983.6	5.0	-8.0
T7	103.4	993.4	4.9	-8.6
T7	119.3	1009.3	5.4	-10.5
T7	119.8	1009.8	5.6	-9.6
T7	124.9	1014.9	5.6	-9.4
T7	128.2	1018.2	6.0	-9.9
T7	139.7	1029.7	5.7	-9.5

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T7	141.4	1031.4	5.6	-8.8
T7	152.6	1042.6	5.7	-8.6
T7	161.3	1051.3	5.5	-11.0
T7	174	1064	5.5	-8.4
T7	180.6 *mts*	1070.6	4.4	-7.4
T7	180.6	1070.6	5.7	-7.5
T7	184.4	1074.4	5.5	-8.5
T7	195.1	1085.1	5.1	-8.5
T7	196.8	1086.8	5.6	-9.4
T7	210.3	1100.3	5.5	-10.0
T7	211.3	1101.3	5.6	-9.4
T7	225	1115	5.2	-9.0
T7	229.7	1119.7	5.6	-10.3
T7	245.7 *mts*	1135.7	3.5	-8.0
T7	245.7	1135.7	5.8	-8.4
T7	246.3	1136.3	5.9	-8.9
T7	253.9	1143.9	5.6	-8.6
T7	257.7	1147.7	5.3	-7.9
T7	259.9	1149.9	5.6	-7.9
T7	260.3	1150.3	4.8	-8.6
T7	261.1	1151.1	5.0	-8.4
T7	264.4	1154.4	5.5	-9.5
T7	268	1158	5.8	-9.5
T7	269.7	1159.7	5.8	-9.4
T7	273.6	1163.6	5.4	-8.6
T7	279.6	1169.6	4.9	-9.2
T7	281.3	1171.3	3.9	-9.3
T7	281.3 *mts*	1171.3	4.8	-5.3
T7	284.6	1174.6	5.8	-8.3
T7	287.7	1177.7	5.7	-7.4
T7	287.7 *mts*	1177.7	6.0	-6.4
T7	293.4	1183.4	5.4	-6.7
T7	293.4 *mts*	1183.4	5.7	-7.4
T7	298.2	1188.2	5.5	-7.7
T7	305.7	1195.7	5.0	-10.0
T7	308	1198	5.1	-11.4
T7	312.6	1202.6	5.8	-10.0
T7	316.1	1206.1	5.2	-10.0
T7	321.7	1211.7	5.5	-10.0
T7	324.1	1214.1	4.9	-11.0
T7	324.1 *mts*	1214.1	5.9	-10.5
T7	328	1218	5.8	-10.8
T7	333.4	1223.4	5.0	-11.1
T7	338.6	1228.6	5.1	-10.9
T7	342.3	1232.3	5.5	-6.6
T7	353	1243	5.3	-8.0
T7	358	1248	5.2	-7.4
T7	362.6	1252.6	5.5	-8.9
T7	364.5	1254.5	5.1	-11.9
T7	365.9	1255.9	5.5	-7.0
T7	368.5	1258.5	5.3	-6.4

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T7	372.8	1262.8	5.2	-9.0
T7	382.8	1272.8	4.1	-12.3
T7	388.1	1278.1	5.1	-7.9
T7	397.8	1287.8	5.0	-5.5
T7	402.5	1292.5	4.1	-7.7
T7	413	1303	4.4	-5.6
T7	418.6	1308.6	3.9	-6.7
T7	422.8	1312.8	4.2	-8.4
T7	424	1314	4.0	-6.9
T7	429	1319	4.7	-9.3
T7	432	1322	5.0	-7.8
T7	436.7	1326.7	4.6	-8.1
T7	440.5	1330.5	3.7	-7.6
T7	440.5 *mts*	1330.5	5.1	-8.9
T7	449.2	1339.2	4.8	-7.5
T7	452.6	1342.6	4.7	-6.4
T7	458.1	1348.1	5.4	-4.6
T7	465.2	1355.2	5.3	-5.9
T7	465.2 *mts*	1355.2	5.8	-5.1
T7	470	1360	5.1	-4.4
T7	472.9	1362.9	5.4	-3.9
T7	475.4	1365.4	5.3	-4.6
T7	478.2	1368.2	4.5	-4.3
T7	482.1	1372.1	5.0	-4.7
T7	488.4	1378.4	4.5	-4.0
T7	488.8	1378.8	4.8	-4.9
T7	492.9	1382.9	4.7	-4.6
T7	501.8	1391.8	4.8	-4.8
T7	514.8	1404.8	4.7	-5.6
T7	559.4	1449.4	4.3	-5.2
T7	582.7	1472.7	1.0	-3.3
T7	593.8	1483.8	2.4	-1.9
T7	607.7	1497.7	1.5	-9.3
T7	643.3	1533.3	0.9	-1.2
T7	684	1574	2.5	-0.7
T7	710.3	1600.3	2.2	-2.0
T7	734.4	1624.4	2.6	-1.7
T7	826.3	1716.3	1.9	-2.9
T7	863.1	1753.1	2.8	-11.4
T7	864.5	1754.5	2.4	-10.7
T7	873.3	1763.3	3.6	-13.4
T7	878.3	1768.3	0.0	-12.0
T7	884.4	1774.4	3.3	-11.3
T7	887.5	1777.5	3.7	-11.8
T7	894.2	1784.2	4.0	-12.3
T7	899.5	1789.5	3.5	-10.5
T9	0.0	1380.0	5.9	-8.1
T9	5.3	1385.3	5.6	-8.2
T9	9.3	1389.3	5.4	-6.6
T9	10.5	1390.5	5.9	-7.8
T9	15.4	1395.4	5.2	-6.7

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T9	19.0	1399.0	5.8	-7.1
T9	25.4	1405.4	1.6	-8.0
T9	29.2	1409.2	5.8	-7.8
T9	32.4	1412.4	4.4	-7.4
T9	37.1	1417.1	3.3	-7.3
T9	40.0	1420.0	5.3	-9.4
T9	46.9	1426.9	0.3	-7.1
T9	50.7	1430.7	1.5	-8.0
T9	54.8	1434.8	1.8	-6.2
T9	58.5	1438.5	1.0	-9.3
T9	61.0	1441.0	1.5	-9.0
T9	66.7	1446.7	4.4	-9.1
T9	74.2	1454.2	5.2	-7.6
T9	90.3	1470.3	3.4	-10.6
T9	92.4	1472.4	3.3	-8.6
T9	94.8	1474.8	3.4	-9.0
T9	99.1	1479.1	3.4	-8.7
T9	101.0	1481.0	3.6	-8.4
T9	102.7	1482.7	-0.7	-8.4
T9	109.3	1489.3	4.4	-10.1
T9	111.3	1491.3	3.3	-8.9
T9	113.8	1493.8	2.9	-8.7
T9	117.7	1497.7	-0.1	-8.8
T9	119.9	1499.9	4.5	-9.7
T9	129.8	1509.8	4.2	-9.3
T9	131.6	1511.6	2.8	-8.4
T9	133.8	1513.8	4.2	-10.8
T9	136.3	1516.3	2.7	-8.7
T9	141.5	1521.5	3.2	-7.9
T9	143.9	1523.9	3.2	-13.1
T9	147.1	1527.1	1.4	-8.4
T9	149.0	1529.0	1.4	-11.5
T9	152.0	1532.0	0.6	-5.5
T9	156.6	1536.6	-3.0	-5.7
T9	158.3	1538.3	2.2	-5.2
T9	165.5	1545.5	2.5	-3.9
T9	173.4	1553.4	2.2	-2.6
T9	188.6	1568.6	1.4	-3.6
T9	212.1	1592.1	1.3	-3.3
T9	217.1	1597.1	1.0	-2.9
T9	241.4	1621.4	0.3	-5.0
T9	255.5	1635.5	0.4	-3.9
T9	258.3	1638.3	1.0	-8.0
T9	262.8	1642.8	2.1	-9.1
T9	270.1	1650.1	1.7	-10.2
T9	278.5	1658.5	-1.3	-8.5
T9	283.6	1663.6	3.2	-7.9
T9	295.6	1675.6	-0.5	-7.8
T9	298.9	1678.9	0.3	-7.0
T9	304.9	1684.9	-0.1	-8.2
T9	346.4	1726.4	3.2	-10.0

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T9	348.6	1728.6	4.3	-10.5
T9	355.3	1735.3	4.4	-11.6
T9	359.3	1739.3	4.4	-10.2
T9	362.0	1742.0	4.5	-9.9
T9	364.9	1744.9	3.5	-6.4
T9	367.8	1747.8	2.8	-7.2
T9	371.2	1751.2	0.6	-8.0
T9	374.0	1754.0	2.9	-4.7
T9	376.9	1756.9	3.8	-7.6
T9	380.9	1760.9	-0.2	-8.3
T9	385.5	1765.5	-0.6	-7.2
T9	389.5	1769.5	0.4	-7.2
T9	419.4	1799.4	2.5	-5.8
T9	432.0	1812.0	2.8	-5.3
T9	436.5	1816.5	3.5	-5.0
T9	440.0	1820.0	3.8	-7.6
T9	444.1	1824.1	3.6	-5.3
T9	448.1	1828.1	4.0	-5.2
T9	455.6	1835.6	3.9	-5.3
T9	461.6	1841.6	3.7	-13.5
T9	467.0	1847.0	3.9	-11.1
T9	470.0	1850.0	1.3	-6.5
T9	478.8	1858.8	1.7	-8.7
T9	482.4	1862.4	1.8	-8.1
T9	487.8	1867.8	3.6	-8.1
T9	491.8	1871.8	-0.4	-8.9
T9	502.2	1882.2	0.0	-8.2
T9	507.0	1887.0	2.0	-7.8
T9	509.8	1889.8	-0.4	-9.9
T9	514.1	1894.1	1.5	-8.6
T9	541.5	1921.5	-1.2	-10.3
T9	595.7	1975.7	-4.4	-7.6
T9	600.4	1980.4	4.2	-8.3
T9	634.7	2014.7	2.8	-7.1
T9	639.5	2019.5	3.9	-6.6
T9	645.1	2025.1	4.7	-6.7
T9	651.0	2031.0	3.4	-5.2
T9	657.1	2037.1	3.5	-5.7
T9	660.9	2040.9	3.3	-5.6
T9	664.0	2044.0	3.0	-5.1
T9	668.4	2048.4	4.2	-4.7
T9	669.7	2049.7	3.4	-5.0
T9	677.0	2057.0	2.8	-4.2
T9	678.2	2058.2	2.3	-5.2
T9	680.9	2060.9	2.4	-7.1
T9	747.1	2127.1	-0.5	-2.0
T9	748.9	2128.9	1.7	-3.9
T9	753.9	2133.9	2.1	-3.5
T9	757.4	2137.4	2.4	-2.1
T9	766.3	2146.3	2.0	-4.1
T9	768.3	2148.3	1.4	-3.9

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T10	10.3	2110.3	-6.5	-8.4
T10	18.1	2118.1	3.5	-5.0
T10	26.6	2126.6	4.2	-6.7
T10	40.9	2140.9	-1.3	-4.8
T10	43.3	2143.3	4.0	-5.6
T10	48.9	2148.9	2.4	-4.2
T10	82.3	2182.3	-1.7	-6.1
T10	84.9	2184.9	1.3	-2.7
T10	86.3	2186.3	1.8	-2.2
T10	92.1	2192.1	1.8	-4.9
T10	95.0	2195.0	2.1	-6.4
T10	96.8	2196.8	2.9	-4.3
T10	746.0	3056.0	3.3	-6.1
T10	750.1	3060.1	3.1	-5.9
T10	755.2	3065.2	3.6	-3.5
T10	762.9	3072.9	2.8	-3.1
T10	765.6	3075.6	2.5	-7.1
T10	770.9	3080.9	0.8	-6.7
T10	773.8	3083.8	-2.5	-7.8
T10	791.3	3101.3	0.7	-6.9
T10	833.0	3143.0	-2.9	-8.1
T10	836.6	3146.6	-3.4	-8.0
T10	855.8	3165.8	-3.0	-4.7
T10	857.7	3167.7	-3.7	-4.6
T10	862.8	3172.8	-2.0	-6.1
T10	867.0	3177.0	-0.3	-3.7
T10	870.4	3180.4	0.4	-3.4
T10	874.6	3184.6	0.7	-5.1
T10	878.0	3188.0	0.8	-4.2
T10	880.7	3190.7	-0.1	-4.6
T10	886.7	3196.7	1.7	-2.6
T10	890.2	3200.2	2.5	-1.7
T10	892.3	3202.3	0.9	-2.7
T10	899.7	3209.7	0.2	-4.9
T10	902.2	3212.2	1.6	-3.1
T10	905.8	3215.8	1.1	-4.8
T10	909.9	3219.9	0.0	-5.4
T10	914.3	3224.3	-1.1	-5.8
T10	925.7	3235.7	-0.3	-6.0
T10	931.3	3241.3	0.4	-4.5
T10	937.9	3247.9	0.9	-3.2
T10	940.3	3250.3	1.2	-5.6
T10	942.5	3252.5	2.4	-3.0
T10	950.2	3260.2	3.2	-4.2
T10	953.2	3263.2	3.0	-2.8
T10	964.5	3274.5	2.0	-3.8
T10	966.6	3276.6	2.0	-3.6
T10	971.4	3281.4	1.9	-7.7
T10	983.3	3293.3	5.0	-0.1
T10	987.7	3297.7	4.7	-7.0
T10	991.5	3301.5	5.0	-0.7

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T10	997.1	3307.1	4.7	-7.8
T10	1002.2	3312.2	3.0	-3.9
T10	1006.3	3316.3	3.7	-2.2
T16	4.0	-86.0	-5.6	-12.2
T16	6.6	-83.4	-5.5	-13.7
T16	9.0	-81.0	-5.8	-11.7
T16	22.3	-67.7	-4.8	-14.2
T16	25.5	-64.5	-4.4	-13.1
T16	27.7	-62.3	-4.4	-13.7
T16	37.5	-52.5	-4.9	-12.8
T16	39.3	-50.7	-4.8	-13.3
T16	45.6	-44.4	-5.4	-11.7
T16	54.6	-35.4	-4.7	-8.3
T16	86.9	-3.1	-4.8	-10.2
T16	91.8	1.8	-4.4	-9.8
T16	95.2	5.2	-4.0	-9.3
T16	98.2	8.2	-4.2	-12.4
T16	100.6	10.6	-3.4	-8.4
T16	104.1	14.1	-3.9	-8.0
T16	110.8	20.8	-3.7	-7.8
T16	115.0	25.0	-3.6	-10.3
T16	118.7	28.7	-3.5	-12.4
T16	132.2	42.2	-3.6	-6.5
T16	136.5	46.5	-3.8	-7.9
T16	143.0	53.0	-3.4	-12.3
T16	150.0	60.0	-3.6	-7.1
T16	156.7	66.7	-3.2	-11.5
T16	179.7	89.7	-3.6	-12.8
T16	186.8	96.8	-3.2	-12.0
T16	190.7	100.7	-3.5	-11.7
T16	195.0	105.0	-2.9	-12.4
T16	196.8	106.8	-2.8	-12.8
T16	201.9	111.9	-3.7	-11.6
T16	234.3	144.3	-3.5	-13.0
T16	239.5	149.5	-3.2	-11.9
T16	242.4	152.4	-3.9	-11.2
T16	246.3	156.3	-3.7	-11.6
T16	251.0	161.0	-2.7	-12.5
T16	254.9	164.9	-3.7	-11.1
T16	258.5	168.5	-3.7	-12.3
T16	261.3	171.3	-3.6	-13.1
T16	264.1	174.1	-3.8	-11.2
T16	266.9	176.9	-4.0	-10.9
T16	272.3	182.3	-4.1	-12.2
T16	275.6	185.6	-4.3	-12.3
T16	279.4	189.4	-3.9	-12.3
T16	282.4	192.4	-4.3	-10.4
T16	285.4	195.4	-3.9	-13.0
T16	289.0	199.0	-3.8	-11.8
T16	294.8	204.8	-3.6	-12.0
T16	299.3	209.3	-3.7	-10.8

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T16	303.1	213.1	-3.2	-11.7
T16	312.4	222.4	-2.8	-11.9
T16	315.2	225.2	-3.8	-11.8
T16	317.5	227.5	-3.5	-12.8
T16	322.0	232.0	-3.8	-11.4
T16	328.0	238.0	-3.9	-12.7
T16	330.8	240.8	-3.7	-11.9
T16	338.8	248.8	-4.2	-11.8
T16	350.4	260.4	-2.6	-12.7
T16	353.6	263.6	-3.1	-12.6
T16	356.2	266.2	-2.7	-12.3
T16	360.4	270.4	-2.6	-11.9
T16	363.6	273.6	-3.1	-10.8
T16	367.8	277.8	-2.8	-12.5
T16	372.0	282.0	-2.3	-12.8
T16	376.2	286.2	-2.0	-11.6
T16	380.4	290.4	-2.6	-12.4
T16	384.7	294.7	-2.3	-12.1
T16	387.6	297.6	-2.2	-10.8
T16	390.3	300.3	-3.0	-12.2
T16	393.0	303.0	-3.8	-8.6
T16	396.1	306.1	-2.5	-11.6
T16	400.0	310.0	-4.2	-11.5
T16	422.6	332.6	-5.0	-12.0
T16	425.7	335.7	-5.4	-12.1
T16	430.7	340.7	-5.3	-10.5
T16	458.1	368.1	-5.5	-11.2
T16	493.8	403.8	-5.3	-9.0
T16	498.8	408.8	-4.8	-9.5
T16	506.1	416.1	-5.0	-7.5
T16	510.3	420.3	-5.3	-7.7
T18	277.9	-22.1	-7.2	-11.5
T18	279.7	-20.3	-4.1	-12.6
T18	282.2	-17.8	-5.1	-10.1
T18	286.3	-13.7	-4.6	-11.8
T18	290.6	-9.4	-4.6	-13.4
T18	300.6	0.6	-4.3	-13.2
T18	306.1	6.1	-5.2	-11.5
T18	306.9	6.9	-3.0	-13.1
T18	309.8	9.8	-3.3	-10.6
T18	313.5	13.5	-3.2	-13.2
T18	318.0	18.0	-3.7	-11.5
T18	321.3	21.3	-3.0	-12.4
T18	323.9	23.9	-2.8	-12.8
T18	325.6	25.6	-2.6	-13.1
T18	330.9	30.9	-3.1	-9.8
T18	334.2	34.2	-2.5	-12.8
T18	336.4	36.4	-3.4	-12.0
T18	338.6	38.6	-2.9	-12.4
T18	343.1	43.1	-3.5	-10.0
T18	346.1	46.1	-2.6	-12.5

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T18	348.5	48.5	-3.5	-12.1
T18	352.4	52.4	-3.9	-10.6
T18	355.6	55.6	-3.0	-9.5
T18	358.8	58.8	-3.6	-12.7
T18	369.4	69.4	-2.6	-11.7
T18	372.1	72.1	-3.1	-11.9
T18	373.6	73.6	-2.7	-13.0
T18	376.6	76.6	-3.0	-13.1
T18	379.6	79.6	-3.2	-11.9
T18	387.2	87.2	-4.3	-12.4
T18	390.4	90.4	-3.7	-11.3
T18	392.8	92.8	-3.6	-11.1
T18	396.0	96.0	-3.7	-12.0
T18	398.8	98.8	-2.9	-10.9
T18	400.6	100.6	-3.6	-11.4
T18	403.8	103.8	-2.8	-11.7
T18	406.8	106.8	-3.1	-11.5
T18	409.3	109.3	-3.6	-11.9
T18	411.9	111.9	-3.3	-11.0
T18	415.3	115.3	-3.6	-11.2
T18	418.0	118.0	-4.0	-9.7
T18	431.9	131.9	-4.1	-11.6
T18	434.5	134.5	-3.9	-11.2
T18	436.4	136.4	-4.8	-11.2
T18	444.2	144.2	-3.4	-11.4
T18	445.4	145.4	-3.3	-11.3
T18	448.2	148.2	-4.3	-9.2
T18	451.2	151.2	-4.4	-10.6
T18	453.6	153.6	-5.2	-12.4
T18	456.0	156.0	-5.3	-9.4
T18	460.2	160.2	-5.2	-8.6
T18	462.4	162.4	-4.7	-11.6
T18	466.0	166.0	-4.5	-11.8
T18	468.4	168.4	-5.7	-10.1
T18	470.9	170.9	-5.1	-8.2
T18	474.9	174.9	-5.0	-9.4
T18	477.8	177.8	-5.2	-9.6
T18	480.7	180.7	-5.1	-9.3
T18	484.7	184.7	-5.0	-8.9
T18	488.2	188.2	-5.5	-8.2
T18	491.0	191.0	-5.3	-7.9
T18	493.7	193.7	-5.3	-12.0
T18	539.7	239.7	-5.4	-11.8
T18	541.7	241.7	-5.0	-11.5
T18	542.6	242.6	-4.7	-12.3
T18	545.6	245.6	-4.9	-11.4
T18	549.2	249.2	-4.1	-12.6
T18	561.6	261.6	-3.5	-12.8
T18	563.0	263.0	-4.4	-12.0
T18	564.6	264.6	-4.4	-12.1
T18	623.5	323.5	-3.9	-8.2

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T18	630.5	330.5	-5.8	-11.7
T18	635.3	335.3	-6.1	-11.9
T18	642.6	342.6	-5.5	-11.5
T18	648.2	348.2	-6.5	-12.0
T18	652.1	352.1	-6.4	-11.6
T18	664.8	364.8	-5.6	-12.1
T18	680.6	380.6	-5.3	-11.9
T18	682.2	382.2	-5.1	-11.9
T18	697.1	397.1	-4.9	-11.3
T18	698.4	398.4	-6.0	-11.3
T18	707.5	407.5	-4.9	-10.8
T18	710.6	410.6	-6.5	-12.1
T18	713.1	413.1	-5.3	-11.5
T18	715.7	415.7	-5.3	-11.2
T18	719.7	419.7	-5.5	-11.1
T18	725.2	425.2	-4.1	-11.8
T18	725.8	425.8	-4.2	-11.8
T18	728.6	428.6	-3.6	-12.2
T18	730.9	430.9	-4.2	-11.9
T22	44.3	2124.3	4.1	-6.2
T22	44.8	2124.8	4.4	-6.1
T22	45.5	2125.5	4.7	-6.6
T22	46.7	2126.7	4.1	-6.3
T22	50.0	2130.0	3.7	-5.0
T22	50.2	2130.2	5.3	-4.4
T22	56.8	2136.8	0.5	-5.7
T22	59.1	2139.1	1.8	-5.3
T22	59.7	2139.7	0.5	-6.0
T22	62.0	2142.0	2.0	-5.5
T22	68.2	2148.2	-1.0	-8.1
T22	68.9	2148.9	-0.2	-5.7
T22	70.9	2150.9	-0.9	-5.5
T22	73.6	2153.6	-0.4	-5.6
T22	75.3	2155.3	-1.6	-5.1
T22	81.4	2161.4	-1.9	-5.7
T22	84.7	2164.7	0.2	-5.5
T22	86.3	2166.3	0.3	-5.7
T22	91.7	2171.7	-0.4	-6.2
T22	96.4	2176.4	-0.6	-6.0
T22	100.7	2180.7	-1.6	-5.9
T22	104.0	2184.0	-1.5	-5.1
T22	529.8	2609.8	2.3	-3.9
T22	531.1	2611.1	2.1	-3.7
T22	532.5	2612.5	2.2	-3.7
T22	562.1	2642.1	2.2	-2.9
T22	563.5	2643.5	2.5	-3.6
T22	566.0	2646.0	3.1	-6.0
T22	569.1	2649.1	3.2	-5.8
T22	578.1	2658.1	4.7	-4.6
T22	580.3	2660.3	3.2	-3.7
T22	583.1	2663.1	3.8	-3.2

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T22	583.8	2663.8	3.2	-3.7
T22	591.3	2671.3	2.0	-3.6
T22	592.5	2672.5	1.4	-4.1
T22	595.3	2675.3	1.4	-8.8
T22	595.7	2675.7	1.5	-7.4
T22	602.0	2682.0	1.4	-7.4
T22	602.7	2682.7	3.0	-3.4
T22	608.7	2688.7	1.7	-6.6
T22	609.5	2689.5	1.7	-6.5
T22	613.5	2693.5	1.8	-6.6
T22	615.6	2695.6	2.7	-6.2
T22	618.1	2698.1	2.3	-4.1
T22	619.3	2699.3	2.9	-1.0
T22	621.6	2701.6	2.6	-1.2
T22	622.9	2702.9	2.7	-1.8
T22	625.1	2705.1	2.6	-2.6
T22	626.6	2706.6	2.6	-3.4
T22	672.3	2752.3	0.4	-4.1
T22	674.8	2754.8	0.5	-4.5
T22	678.2	2758.2	1.2	-4.0
T22	682.7	2762.7	0.5	-4.2
T22	685.0	2765.0	1.6	-4.2
T22	687.5	2767.5	1.9	-3.9
T22	695.2	2775.2	1.0	-4.1
T22	710.2	2790.2	1.9	-3.7
T22	715.5	2795.5	1.1	-3.9
T22	718.5	2798.5	1.1	-5.2
T22	721.1	2801.1	0.7	-5.7
T22	723.2	2803.2	0.8	-4.2
T22	730.1	2810.1	1.8	-3.7
T22	735.0	2815.0	2.1	-3.2
T22	737.7	2817.7	1.3	-4.0
T22	745.6	2825.6	1.9	-3.3
T22	756.7	2836.7	2.2	-2.1
T22	760.4	2840.4	2.2	-4.2
T22	765.6	2845.6	1.4	-3.1
T22	768.6	2848.6	1.5	-3.8
T22	773.3	2853.3	1.3	-2.7
T22	774.3	2854.3	1.6	-3.4
T22	775.9	2855.9	1.8	-2.3
T22	777.9	2857.9	1.8	-2.9
T22	779.2	2859.2	2.4	-3.3
T22	781.6	2861.6	2.7	-4.1
T22	786.7	2866.7	3.0	-4.6
T22	793.8	2873.8	1.3	-2.6
T22	795.3	2875.3	1.8	-2.2
T22	798.4	2878.4	1.0	-4.7
T22	799.6	2879.6	0.6	-5.1
T22	811.9	2891.9	-0.1	-5.5
T22	813.8	2893.8	0.1	-5.1
T22	816.7	2896.7	-0.4	-5.0

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T22	819.0	2899.0	-0.8	-5.5
T22	821.8	2901.8	0.1	-6.9
T22	824.8	2904.8	0.5	-4.5
T22	856.9	2936.9	0.3	-5.0
T22	934.5	3014.5	0.4	-4.4
T22	939.0	3019.0	0.6	-4.0
T22	953.3	3033.3	-0.1	-5.9
T22	987.9	3067.9	3.1	-3.7
T22	999.8	3079.8	3.2	-2.4
T22	1002.8	3082.8	1.7	-4.4
T22	1004.3	3084.3	0.5	-3.6
T22	1005.2	3085.2	1.4	-3.8
T22	1007.8	3087.8	-0.1	-4.0
T22	1010.0	3090.0	0.4	-6.1
T22	1011.4	3091.4	-2.4	-7.5
T22	1021.0	3101.0	-2.4	-5.9
T22	1063.8	3143.8	-2.6	-5.8
T22	1072.3	3152.3	-2.5	-7.0
T22	1084.4	3164.4	-2.3	-5.4
T22	1087.3	3167.3	-2.1	-6.8
T22	1088.5	3168.5	-2.1	-4.3
T22	1089.5	3169.5	-1.5	-4.9
T22	1090.5	3170.5	-2.0	-6.6
T22	1096.3	3176.3	-1.3	-5.8
T22	1097.1	3177.1	-1.5	-5.3
T22	1101.7	3181.7	-1.8	-5.9
T22	1102.6	3182.6	-1.3	-1.5
T22	1103.9	3183.9	-1.6	-5.1
T22	1106.7	3186.7	-1.8	-4.2
T22	1108.1	3188.1	-1.8	-4.4
T22	1112.7	3192.7	-1.6	-6.2
T22	1115.8	3195.8	-1.0	-6.5
T22	1119.5	3199.5	0.3	-4.4
T22	1123.1	3203.1	0.5	-4.8
T22	1125.8	3205.8	2.0	-3.6
T22	1129.1	3209.1	2.3	-4.0
T22	1132.6	3212.6	2.0	-5.0
T22	1134.8	3214.8	2.1	-2.7
T22	1140.7	3220.7	2.9	-3.9
T22	1142.3	3222.3	2.9	-4.4
T22	1145.6	3225.6	1.8	-4.0
T22	1147.0	3227.0	2.2	-3.5
T22	1158.9	3238.9	2.9	-3.6
T22	1161.7	3241.7	2.5	-4.2
T22	1176.7	3256.7	1.4	-3.7
T22	1184.2	3264.2	1.7	-3.1
T22	1188.1	3268.1	3.2	-3.6
T22	1197.8	3277.8	3.0	-3.0
T22	1205.3	3285.3	2.5	-3.4
T22	1221.3	3301.3	2.2	-5.4
T22	1246.8	3326.8	2.9	-3.4

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T22	1257.7	3337.7	2.4	-3.3
T22	1288.6	3368.6	2.3	-3.3
T22	1303.6	3383.6	2.1	-4.1
T22	1315.8	3395.8	1.9	-2.6
T22	1321.5	3401.5	1.7	-2.3
T22	1332.7	3412.7	2.5	-4.1
T22	1340.3	3420.3	2.1	-3.8
T22	1350.1	3430.1	2.5	-4.3
T22	1358.2	3438.2	3.0	-4.7
T22	1365.9	3445.9	2.6	-4.0
T22	1382.4	3462.4	2.7	-9.3
T22	1397.6	3477.6	2.5	-3.0
T22	1489.0	3569.0	2.7	-5.3
T22	1541.4	3621.4	0.0	-7.8
T23	0.3	3310.3	2.5	-4.7
T23	0.3	3310.3	2.5	-4.7
T23	4.3	3314.3	1.8	-5.9
T23	4.3	3314.3	1.8	-5.9
T23	6.2	3316.2	1.3	-5.6
T23	6.2	3316.2	1.3	-5.6
T23	9.0	3319.0	2.4	-8.5
T23	9.0	3319.0	2.4	-8.5
T23	12.9	3322.9	2.2	-6.7
T23	12.9	3322.9	2.2	-6.7
T23	15.8	3325.8	2.2	-4.1
T23	15.8	3325.8	2.2	-4.1
T23	18.8	3328.8	2.8	-4.4
T23	18.8	3328.8	2.8	-4.4
T23	25.1	3335.1	1.6	-5.0
T23	25.1	3335.1	1.6	-5.0
T23	30.2	3340.2	1.3	-4.7
T23	30.2	3340.2	1.3	-4.7
T23	31.7	3341.7	1.6	-4.3
T23	31.7	3341.7	1.6	-4.3
T23	34.7	3344.7	1.6	-4.9
T23	34.7	3344.7	1.6	-4.9
T23	37.8	3347.8	1.7	-4.2
T23	37.8	3347.8	1.7	-4.2
T23	39.7	3349.7	1.6	-4.2
T23	39.7	3349.7	1.6	-4.2
T23	43.4	3353.4	2.2	-4.2
T23	43.4	3353.4	2.2	-4.2
T23	44.5	3354.5	2.0	-3.8
T23	44.5	3354.5	2.0	-3.8
T23	47.3	3357.3	1.6	-3.6
T23	47.3	3357.3	1.6	-3.6
T23	49.5	3359.5	2.3	-7.9
T23	49.5	3359.5	2.3	-7.9
T23	51.5	3361.5	2.0	-7.2
T23	51.5	3361.5	2.0	-7.2
T23	53.3	3363.3	1.6	-5.3

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T23	53.3	3363.3	1.6	-5.3
T23	54.4	3364.4	1.8	-5.2
T23	54.4	3364.4	1.8	-5.2
T23	60.1	3370.1	0.6	-2.7
T23	60.1	3370.1	0.6	-2.7
T23	62.2	3372.2	2.0	-4.6
T23	62.2	3372.2	2.0	-4.6
T23	72.0	3382.0	2.6	-2.7
T23	72.0	3382.0	2.6	-2.7
T23	75.5	3385.5	2.0	-3.3
T23	75.5	3385.5	2.0	-3.3
T23	77.5	3387.5	2.9	-3.4
T23	77.5	3387.5	2.9	-3.4
T23	79.7	3389.7	1.4	-4.0
T23	79.7	3389.7	1.4	-4.0
T23	81.7	3391.7	2.2	-4.1
T23	81.7	3391.7	2.2	-4.1
T23	82.9	3392.9	2.6	-10.3
T23	82.9	3392.9	2.6	-10.3
T23	99.4	3409.4	3.3	-5.5
T23	99.4	3409.4	3.3	-5.5
T23	105.9	3415.9	2.3	-6.3
T23	105.9	3415.9	2.3	-6.3
T23	112.9	3422.9	2.6	-4.7
T23	112.9	3422.9	2.6	-4.7
T23	116.7	3426.7	1.9	-7.3
T23	116.7	3426.7	1.9	-7.3
T23	119.2	3429.2	2.6	-8.8
T23	119.2	3429.2	2.6	-8.8
T23	123.4	3433.4	2.5	-5.2
T23	123.4	3433.4	2.5	-5.2
T23	125.5	3435.5	2.9	-5.9
T23	125.5	3435.5	2.9	-5.9
T23	142.5	3452.5	2.2	-5.4
T23	142.5	3452.5	2.2	-5.4
T23	144.9	3454.9	2.7	-5.8
T23	144.9	3454.9	2.7	-5.8
T23	152.2	3462.2	2.5	-4.7
T23	152.2	3462.2	2.5	-4.7
T23	159.3	3469.3	2.0	-4.6
T23	159.3	3469.3	2.0	-4.6
T23	166.4	3476.4	2.3	-8.6
T23	166.4	3476.4	2.3	-8.6
T23	168.7	3478.7	2.3	-5.3
T23	168.7	3478.7	2.3	-5.3
T23	171.8	3481.8	2.7	-7.0
T23	171.8	3481.8	2.7	-7.0
T23	191.5	3501.5	2.4	-6.5
T23	191.5	3501.5	2.4	-6.5
T23	194.3	3504.3	2.2	-9.2
T23	194.3	3504.3	2.2	-9.2

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T23	199.5	3509.5	3.1	-10.6
T23	199.5	3509.5	3.1	-10.6
T23	203.0	3513.0	2.9	-10.3
T23	203.0	3513.0	2.9	-10.3
T23	209.5	3519.5	3.1	-10.4
T23	209.5	3519.5	3.1	-10.4
T23	212.1	3522.1	2.8	-5.2
T23	212.1	3522.1	2.8	-5.2
T23	215.6	3525.6	3.3	-9.5
T23	215.6	3525.6	3.3	-9.5
T23	220.4	3530.4	2.8	-10.5
T23	220.4	3530.4	2.8	-10.5
T23	222.2	3532.2	2.9	-11.1
T23	222.2	3532.2	2.9	-11.1
T23	230.6	3540.6	2.6	-10.1
T23	230.6	3540.6	2.6	-10.1
T23	233.4	3543.4	2.4	-10.4
T23	233.4	3543.4	2.4	-10.4
T23	237.3	3547.3	2.3	-9.2
T23	237.3	3547.3	2.3	-9.2
T23	242.3	3552.3	2.6	-6.1
T23	242.3	3552.3	2.6	-6.1
T23	244.8	3554.8	2.3	-6.3
T23	244.8	3554.8	2.3	-6.3
T23	248.6	3558.6	3.2	-5.7
T23	248.6	3558.6	3.2	-5.7
T23	250.3	3560.3	3.6	-6.6
T23	250.3	3560.3	3.6	-6.6
T23	268.9	3578.9	3.4	-5.9
T23	268.9	3578.9	3.4	-5.9
T23	273.2	3583.2	3.3	-5.7
T23	273.2	3583.2	3.3	-5.7
T23	275.3	3585.3	3.0	-5.0
T23	275.3	3585.3	3.0	-5.0
T23	280.6	3590.6	2.6	-5.2
T23	280.6	3590.6	2.6	-5.2
T23	282.9	3592.9	2.8	-5.3
T23	282.9	3592.9	2.8	-5.3
T23	286.1	3596.1	3.3	-6.3
T23	286.1	3596.1	3.3	-6.3
T23	290.9	3600.9	4.4	-8.9
T23	290.9	3600.9	4.4	-8.9
T23	292.0	3602.0	3.9	-8.9
T23	292.0	3602.0	3.9	-8.9
T23	295.6	3605.6	3.7	-6.3
T23	295.6	3605.6	3.7	-6.3
T23	297.5	3607.5	4.0	-8.5
T23	297.5	3607.5	4.0	-8.5
T23	302.4	3612.4	3.1	-5.6
T23	302.4	3612.4	3.1	-5.6
T23	305.2	3615.2	2.3	-4.6

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T23	305.2	3615.2	2.3	-4.6
T23	307.2	3617.2	2.4	-5.0
T23	307.2	3617.2	2.4	-5.0
T23	309.4	3619.4	2.3	-5.3
T23	309.4	3619.4	2.3	-5.3
T23	310.9	3620.9	1.9	-4.6
T23	310.9	3620.9	1.9	-4.6
T23	313.3	3623.3	2.2	-5.5
T23	313.3	3623.3	2.2	-5.5
T23	341.6	3651.6	1.1	-10.3
T23	341.6	3651.6	1.1	-10.3
T23	351.4	3661.4	1.1	-6.1
T23	351.4	3661.4	1.1	-6.1
T23	354.5	3664.5	0.1	-5.2
T23	354.5	3664.5	0.1	-5.2
T23	362.3	3672.3	0.2	-6.9
T23	362.3	3672.3	0.2	-6.9
T23	363.2	3673.2	-0.9	-7.7
T23	363.2	3673.2	-0.9	-7.7
T23	382.4	3692.4	-1.4	-5.7
T23	382.4	3692.4	-1.4	-5.7
T23	390.4	3700.4	0.7	-5.7
T23	390.4	3700.4	0.7	-5.7
T23	395.2	3705.2	-0.2	-4.1
T23	395.2	3705.2	-0.2	-4.1
T23	398.8	3708.8	0.9	-3.2
T23	398.8	3708.8	0.9	-3.2
T23	409.4	3719.4	1.5	-3.6
T23	409.4	3719.4	1.5	-3.6
T23	411.6	3721.6	1.0	-3.8
T23	411.6	3721.6	1.0	-3.8
T23	412.4	3722.4	0.8	-4.5
T23	412.4	3722.4	0.8	-4.5
T23	415.3	3725.3	-0.1	-4.8
T23	415.3	3725.3	-0.1	-4.8
T23	422.4	3732.4	-0.4	-1.4
T23	422.4	3732.4	-0.4	-1.4
T23	426.8	3736.8	0.4	-4.0
T23	426.8	3736.8	0.4	-4.0
T23	436.9	3746.9	-1.9	-7.7
T23	436.9	3746.9	-1.9	-7.7
T23	438.5	3748.5	-0.7	-8.3
T23	438.5	3748.5	-0.7	-8.3
T23	440.8	3750.8	-0.2	-5.9
T23	440.8	3750.8	-0.2	-5.9
T23	442.8	3752.8	0.3	-5.3
T23	442.8	3752.8	0.3	-5.3
T23	443.2	3753.2	-1.3	-7.0
T23	443.2	3753.2	-1.3	-7.0
T23	454.4	3764.4	-4.5	-5.4
T23	454.4	3764.4	-4.5	-5.4

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T23	455.8	3765.8	-1.8	-2.7
T23	455.8	3765.8	-1.8	-2.7
T23	458.4	3768.4	-1.5	-3.0
T23	458.4	3768.4	-1.5	-3.0
T23	490.7	3800.7	-11.1	-6.4
T23	490.7	3800.7	-11.1	-6.4
T23	492.0	3802.0	-10.8	-6.3
T23	492.0	3802.0	-10.8	-6.3
T23	493.4	3803.4	-6.0	-5.2
T23	493.4	3803.4	-6.0	-5.2
T23	514.1	3824.1	5.2	-3.7
T23	514.1	3824.1	5.2	-3.7
T23	516.1	3826.1	3.7	-4.9
T23	516.1	3826.1	3.7	-4.9
T23	518.0	3828.0	3.3	-4.4
T23	518.0	3828.0	3.3	-4.4
T23	520.5	3830.5	4.5	-5.0
T23	520.5	3830.5	4.5	-5.0
T23	523.6	3833.6	5.1	-3.9
T23	523.6	3833.6	5.1	-3.9
T23	526.1	3836.1	6.2	-3.0
T23	526.1	3836.1	6.2	-3.0
T23	526.4	3836.4	4.5	-6.9
T23	526.4	3836.4	4.5	-6.9
T23	527.8	3837.8	6.1	-4.6
T23	527.8	3837.8	6.1	-4.6
T23	530.3	3840.3	5.3	-4.7
T23	530.3	3840.3	5.3	-4.7
T23	533.4	3843.4	5.5	-3.9
T23	533.4	3843.4	5.5	-3.9
T23	535.9	3845.9	5.7	-4.4
T23	535.9	3845.9	5.7	-4.4
T23	539.0	3849.0	4.2	-4.2
T23	539.0	3849.0	4.2	-4.2
T23	542.3	3852.3	5.2	-2.8
T23	542.3	3852.3	5.2	-2.8
T23	544.2	3854.2	5.5	-3.6
T23	544.2	3854.2	5.5	-3.6
T23	544.7	3854.7	5.4	-3.3
T23	544.7	3854.7	5.4	-3.3
T23	546.5	3856.5	5.9	-3.2
T23	546.5	3856.5	5.9	-3.2
T23	549.7	3859.7	5.0	-4.9
T23	549.7	3859.7	5.0	-4.9
T23	551.6	3861.6	6.2	-3.5
T23	551.6	3861.6	6.2	-3.5
T23	554.8	3864.8	4.4	-3.3
T23	554.8	3864.8	4.4	-3.3
T23	557.5	3867.5	6.2	-2.8
T23	557.5	3867.5	6.2	-2.8
T23	559.2	3869.2	5.9	-3.3

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T23	559.2	3869.2	5.9	-3.3
T23	561.6	3871.6	6.0	-3.8
T23	561.6	3871.6	6.0	-3.8
T23	563.6	3873.6	4.0	-4.4
T23	563.6	3873.6	4.0	-4.4
T23	569.1	3879.1	6.1	-6.9
T23	569.1	3879.1	6.1	-6.9
T23	572.0	3882.0	4.5	-7.0
T23	572.0	3882.0	4.5	-7.0
T23	574.0	3884.0	5.8	-7.4
T23	574.0	3884.0	5.8	-7.4
T23	576.6	3886.6	5.4	-3.5
T23	576.6	3886.6	5.4	-3.5
T23	579.1	3889.1	4.3	-4.1
T23	579.1	3889.1	4.3	-4.1
T23	580.6	3890.6	5.8	-2.8
T23	580.6	3890.6	5.8	-2.8
T23	583.0	3893.0	7.0	-3.9
T23	583.0	3893.0	7.0	-3.9
T23	584.4	3894.4	5.5	-5.1
T23	584.4	3894.4	5.5	-5.1
T23	586.4	3896.4	6.2	-4.4
T23	586.4	3896.4	6.2	-4.4
T23	586.9	3896.9	5.8	-2.8
T23	586.9	3896.9	5.8	-2.8
T23	589.0	3899.0	4.9	-3.1
T23	589.0	3899.0	4.9	-3.1
T23	592.0	3902.0	4.9	-2.9
T23	592.0	3902.0	4.9	-2.9
T23	593.9	3903.9	5.5	-3.5
T23	593.9	3903.9	5.5	-3.5
T23	596.0	3906.0	4.6	-3.8
T23	596.0	3906.0	4.6	-3.8
T23	600.1	3910.1	5.4	-2.2
T23	600.1	3910.1	5.4	-2.2
T23	601.3	3911.3	4.8	-2.6
T23	601.3	3911.3	4.8	-2.6
T23	603.1	3913.1	4.8	-3.1
T23	603.1	3913.1	4.8	-3.1
T23	605.2	3915.2	4.4	-3.8
T23	605.2	3915.2	4.4	-3.8
T23	607.9	3917.9	6.2	-4.4
T23	607.9	3917.9	6.2	-4.4
T23	609.0	3919.0	6.0	-2.8
T23	609.0	3919.0	6.0	-2.8
T23	611.6	3921.6	5.0	-2.2
T23	611.6	3921.6	5.0	-2.2
T23	614.9	3924.9	5.4	-4.5
T23	614.9	3924.9	5.4	-4.5
T23	616.3	3926.3	4.1	-3.1
T23	616.3	3926.3	4.1	-3.1

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T23	616.6	3926.6	4.1	-4.8
T23	616.6	3926.6	4.1	-4.8
T23	620.0	3930.0	5.8	-4.7
T23	620.0	3930.0	5.8	-4.7
T23	622.9	3932.9	5.2	-2.0
T23	622.9	3932.9	5.2	-2.0
T23	625.5	3935.5	5.7	-5.3
T23	625.5	3935.5	5.7	-5.3
T23	626.7	3936.7	4.7	-2.8
T23	626.7	3936.7	4.7	-2.8
T23	629.4	3939.4	5.0	-2.5
T23	629.4	3939.4	5.0	-2.5
T23	631.7	3941.7	5.8	-5.1
T23	631.7	3941.7	5.8	-5.1
T23	635.3	3945.3	6.1	-3.9
T23	635.3	3945.3	6.1	-3.9
T23	637.4	3947.4	5.3	-4.6
T23	637.4	3947.4	5.3	-4.6
T23	638.7	3948.7	6.3	-5.3
T23	638.7	3948.7	6.3	-5.3
T23	641.3	3951.3	5.5	-2.3
T23	641.3	3951.3	5.5	-2.3
T23	643.4	3953.4	6.1	-2.6
T23	643.4	3953.4	6.1	-2.6
T23	645.2	3955.2	6.0	-2.4
T23	645.2	3955.2	6.0	-2.4
T23	647.8	3957.8	4.5	-3.5
T23	647.8	3957.8	4.5	-3.5
T23	653.4	3963.4	5.1	-3.0
T23	653.4	3963.4	5.1	-3.0
T23	656.8	3966.8	5.1	-2.9
T23	656.8	3966.8	5.1	-2.9
T23	658.8	3968.8	6.2	-4.9
T23	658.8	3968.8	6.2	-4.9
T23	659.8	3969.8	5.9	-3.1
T23	659.8	3969.8	5.9	-3.1
T23	660.5	3970.5	5.4	-2.8
T23	660.5	3970.5	5.4	-2.8
T23	662.4	3972.4	6.1	-4.8
T23	662.4	3972.4	6.1	-4.8
T23	663.1	3973.1	6.4	-5.0
T23	663.1	3973.1	6.4	-5.0
T23	667.3	3977.3	6.5	-4.9
T23	667.3	3977.3	6.5	-4.9
T23	671.0	3981.0	6.3	-5.2
T23	671.0	3981.0	6.3	-5.2
T23	672.5	3982.5	5.7	-5.3
T23	672.5	3982.5	5.7	-5.3
T23	674.4	3984.4	5.4	-5.6
T23	674.4	3984.4	5.4	-5.6
T23	677.0	3987.0	6.2	-5.2

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T23	677.0	3987.0	6.2	-5.2
T23	679.0	3989.0	5.5	-5.5
T23	679.0	3989.0	5.5	-5.5
T23	682.7	3992.7	5.7	-6.1
T23	682.7	3992.7	5.7	-6.1
T23	685.5	3995.5	4.5	-6.4
T23	685.5	3995.5	4.5	-6.4
T23	687.1	3997.1	2.1	-10.9
T23	687.1	3997.1	2.1	-10.9
T23	688.2	3998.2	1.6	-10.6
T23	688.2	3998.2	1.6	-10.6
T23	690.4	4000.4	1.2	-10.6
T23	690.4	4000.4	1.2	-10.6
T23	697.3	4007.3	1.4	-11.0
T23	697.3	4007.3	1.4	-11.0
T23	698.6	4008.6	5.8	-6.3
T23	698.6	4008.6	5.8	-6.3
T23	699.2	4009.2	-1.7	-9.5
T23	699.2	4009.2	-1.7	-9.5
T23	709.1	4019.1	1.8	-6.1
T23	709.1	4019.1	1.8	-6.1
T23	716.8	4026.8	2.8	-9.9
T23	716.8	4026.8	2.8	-9.9
T23	723.0	4033.0	3.8	-10.6
T23	723.0	4033.0	3.8	-10.6
T23	724.6	4034.6	5.0	-9.4
T23	724.6	4034.6	5.0	-9.4
T23	728.3	4038.3	5.2	-10.7
T23	728.3	4038.3	5.2	-10.7
T23	730.9	4040.9	1.3	-1.5
T23	730.9	4040.9	1.3	-1.5
T23	733.9	4043.9	2.1	-9.4
T23	733.9	4043.9	2.1	-9.4
T23	735.6	4045.6	2.8	-10.8
T23	735.6	4045.6	2.8	-10.8
T23	737.2	4047.2	2.5	-10.2
T23	737.2	4047.2	2.5	-10.2
T23	738.5	4048.5	2.5	-7.4
T23	738.5	4048.5	2.5	-7.4
T23	745.0	4055.0	-0.3	-10.4
T23	745.0	4055.0	-0.3	-10.4
T23	769.8	4079.8	-1.7	-4.8
T23	769.8	4079.8	-1.7	-4.8
T23	779.1	4089.1	0.1	-3.2
T23	779.1	4089.1	0.1	-3.2
T23	782.4	4092.4	-0.7	-6.2
T23	782.4	4092.4	-0.7	-6.2
T23	784.0	4094.0	1.1	-7.1
T23	784.0	4094.0	1.1	-7.1
T23	784.7	4094.7	2.1	-8.8
T23	784.7	4094.7	2.1	-8.8

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T23	788.7	4098.7	4.6	-8.9
T23	788.7	4098.7	4.6	-8.9
T23	789.5	4099.5	6.4	-9.4
T23	789.5	4099.5	6.4	-9.4
T23	795.1	4105.1	5.9	-9.4
T23	795.1	4105.1	5.9	-9.4
T23	797.9	4107.9	2.9	-9.3
T23	797.9	4107.9	2.9	-9.3
T23	800.3	4110.3	3.3	-9.1
T23	800.3	4110.3	3.3	-9.1
T23	803.1	4113.1	3.1	-9.4
T23	803.1	4113.1	3.1	-9.4
T23	806.8	4116.8	2.7	-10.1
T23	806.8	4116.8	2.7	-10.1
T23	808.8	4118.8	2.0	-9.9
T23	808.8	4118.8	2.0	-9.9
T23	812.4	4122.4	0.7	-10.4
T23	812.4	4122.4	0.7	-10.4
T23	814.4	4124.4	2.1	-10.1
T23	814.4	4124.4	2.1	-10.1
T23	818.5	4128.5	0.9	-7.6
T23	818.5	4128.5	0.9	-7.6
T23	820.6	4130.6	2.3	-4.5
T23	820.6	4130.6	2.3	-4.5
T23	825.0	4135.0	2.4	-9.5
T23	825.0	4135.0	2.4	-9.5
T23	827.4	4137.4	1.7	-9.5
T23	827.4	4137.4	1.7	-9.5
T23	828.9	4138.9	1.3	-6.8
T23	828.9	4138.9	1.3	-6.8
T23	832.3	4142.3	2.4	-10.2
T23	832.3	4142.3	2.4	-10.2
T23	835.9	4145.9	0.6	-6.3
T23	835.9	4145.9	0.6	-6.3
T23	837.6	4147.6	2.0	-7.4
T23	837.6	4147.6	2.0	-7.4
T23	845.3	4155.3	2.3	-11.5
T23	845.3	4155.3	2.3	-11.5
T23	848.7	4158.7	2.4	-9.5
T23	848.7	4158.7	2.4	-9.5
T23	852.7	4162.7	1.3	-9.6
T23	852.7	4162.7	1.3	-9.6
T23	856.0	4166.0	0.9	-8.6
T23	856.0	4166.0	0.9	-8.6
T23	861.1	4171.1	2.3	-10.9
T23	861.1	4171.1	2.3	-10.9
T23	866.3	4176.3	0.9	-9.3
T23	866.3	4176.3	0.9	-9.3
T23	869.5	4179.5	2.4	-11.1
T23	869.5	4179.5	2.4	-11.1
T23	872.3	4182.3	0.3	-8.5

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T23	872.3	4182.3	0.3	-8.5
T23	875.3	4185.3	0.5	-10.1
T23	875.3	4185.3	0.5	-10.1
T23	879.7	4189.7	0.4	-9.8
T23	879.7	4189.7	0.4	-9.8
T23	881.8	4191.8	1.0	-10.3
T23	881.8	4191.8	1.0	-10.3
T23	885.9	4195.9	-0.5	-9.4
T23	885.9	4195.9	-0.5	-9.4
T23	892.9	4202.9	0.3	-12.5
T23	892.9	4202.9	0.3	-12.5
T23	914.6	4224.6	-0.5	-8.8
T23	914.6	4224.6	-0.5	-8.8
T23	915.5	4225.5	-0.1	-10.7
T23	915.5	4225.5	-0.1	-10.7
T23	916.6	4226.6	0.7	-10.1
T23	916.6	4226.6	0.7	-10.1
T23	917.5	4227.5	1.0	-10.3
T23	917.5	4227.5	1.0	-10.3
T23	919.0	4229.0	0.6	-10.4
T23	919.0	4229.0	0.6	-10.4
T27	5.1	2621.1	3.5	-4.7
T27	6.2	2622.2	2.9	-6.8
T27	10.3	2626.3	3.0	-5.2
T27	11.8	2627.8	2.7	-5.8
T27	17.4	2633.4	3.7	-4.7
T27	20.1	2636.1	3.2	-6.2
T27	29.6	2645.6	1.8	-5.1
T27	31.7	2647.7	1.7	-4.7
T27	37.3	2653.3	0.7	-4.4
T27	47.9	2663.9	2.8	-5.7
T27	66.1	2682.1	1.8	-5.9
T27	108.6	2724.6	3.8	-7.7
T27	129.2	2745.2	2.5	-5.5
T27	131.4	2747.4	1.9	-4.4
T27	134.4	2750.4	1.4	-5.1
T27	138.6	2754.6	1.3	-4.9
T27	153.8	2769.8	1.6	-4.4
T27	156.1	2772.1	1.7	-4.2
T27	157.4	2773.4	1.7	-5.0
T27	161.3	2777.3	1.9	-4.9
T27	165.6	2781.6	2.2	-5.1
T27	167.4	2783.4	2.1	-5.6
T27	169.4	2785.4	0.4	-5.5
T27	192.7	2808.7	1.2	-3.3
T27	193.3	2809.3	1.1	-2.7
T27	194.9	2810.9	0.6	-2.5
T27	198.3	2814.3	0.6	-2.6
T27	200.8	2816.8	0.7	-2.4
T27	203.4	2819.4	1.2	-2.6
T27	204.5	2820.5	1.1	-2.7

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T27	209.8	2825.8	1.5	-2.4
T27	212.1	2828.1	1.3	-3.3
T27	225.4	2841.4	-0.2	-6.5
T27	245.1	2861.1	-2.1	-5.5
T27	246.3	2862.3	-1.7	-6.7
T27	247.7	2863.7	0.0	-6.0
T27	280.1	2896.1	1.1	-7.0
T27	314.7	2930.7	1.1	-7.2
T27	316.3	2932.3	1.0	-4.9
T27	319.4	2935.4	1.3	-5.9
T27	322.5	2938.5	1.3	-6.3
T27	324.9	2940.9	0.5	-7.8
T27	329.4	2945.4	1.4	-7.1
T27	332.6	2948.6	0.5	-6.8
T27	333.8	2949.8	0.9	-4.8
T27	337.9	2953.9	1.5	-5.6
T27	359.1	2975.1	1.7	-6.9
T27	363.8	2979.8	0.8	-7.1
T27	419.5	3035.5	1.6	-6.3
T27	423.3	3039.3	-4.6	-41.9
T27	425.5	3041.5	1.7	-5.7
T27	426.8	3042.8	1.0	-5.9
T27	428.2	3044.2	2.0	-6.0
T27	430.4	3046.4	-0.6	-6.4
T27	433.2	3049.2	1.3	-6.0
T27	434.9	3050.9	1.2	-5.7
T27	438.8	3054.8	1.3	-6.3
T27	444.6	3060.6	1.4	-6.5
T27	449.3	3065.3	0.1	-6.6
T27	473.0	3089.0	1.6	-6.9
T27	479.0	3095.0	0.6	-7.6
T27	482.4	3098.4	-0.2	-7.8
T27	484.7	3100.7	-0.4	-7.0
T27	530.4	3146.4	-0.6	-7.6
T27	536.1	3152.1	-1.4	-5.6
T27	538.0	3154.0	-1.7	-8.2
T27	561.0	3177.0	-2.2	-4.9
T27	579.2	3195.2	-1.1	-5.0
T27	596.1	3212.1	0.5	-10.2
T27	597.7	3213.7	0.7	-8.8
T27	600.7	3216.7	0.6	-5.5
T27	604.8	3220.8	-0.2	-7.8
T27	618.2	3234.2	0.5	-5.0
T27	624.0	3240.0	0.2	-6.1
T27	643.4	3259.4	0.7	-4.0
T27	651.3	3267.3	1.9	-0.6
T27	666.9	3282.9	0.7	-4.4
T27	672.9	3288.9	0.6	-4.2
T27	676.6	3292.6	0.1	-4.9
T27	679.2	3295.2	0.3	-5.3
T27	684.1	3300.1	0.9	-3.9

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T27	695.2	3311.2	0.7	-3.2
T27	696.3	3312.3	0.8	-3.0
T27	702.3	3318.3	0.4	-4.0
T27	716.0	3332.0	1.2	-3.8
T27	716.7	3332.7	1.2	-4.1
T27	722.0	3338.0	1.5	-4.3
T27	725.3	3341.3	0.8	-4.5
T27	726.1	3342.1	0.9	-4.5
T27	740.0	3356.0	0.8	-4.7
T27	743.5	3359.5	0.2	-5.5
T27	745.6	3361.6	1.7	-3.1
T27	750.3	3366.3	1.4	-6.1
T27	757.1	3373.1	1.6	-3.0
T27	760.4	3376.4	0.6	-3.6
T27	776.4	3392.4	2.1	-3.4
T27	780.9	3396.9	1.7	-2.7
T27	792.4	3408.4	1.0	-5.9
T27	793.3	3409.3	0.9	-6.5
T27	794.2	3410.2	0.4	-7.6
T27	794.7	3410.7	0.5	-6.4
T27	795.8	3411.8	0.7	-6.3
T27	800.2	3416.2	0.5	-0.2
T27	803.9	3419.9	-0.1	-2.2
T27	805.2	3421.2	0.4	-0.8
T27	826.9	3442.9	0.2	-4.3
T27	828.3	3444.3	1.5	-2.8
T27	829.2	3445.2	1.9	-2.6
T27	831.6	3447.6	1.9	-3.0
T27	860.7	3826.7	5.5	-6.9
T27	862.3	3828.3	5.8	-7.2
T27	863.7	3829.7	6.0	-6.2
T27	865.1	3831.1	6.3	-4.6
T27	866.6	3832.6	6.8	-4.7
T27	868.1	3834.1	6.2	-4.4
T27	870.1	3836.1	5.7	-5.2
T28	1.9	3825.9	4.5	-4.2
T28	1.9 *mts*	3825.9	5.7	-4.7
T28	4.4 *mts*	3828.4	4.8	-4.6
T28	4.4	3828.4	5.5	-4.2
T28	6.6	3830.6	5.0	-4.3
T28	6.6 *mts*	3830.6	6.7	-4.8
T28	15.0	3839.0	6.1	-3.4
T28	15.0 *mts*	3839.0	6.8	-3.5
T28	19.0	3843.0	6.5	-4.0
T28	19.0 *mts*	3843.0	6.6	-3.8
T28	23.8	3847.8	6.2	-3.3
T28	23.8 *mts*	3847.8	7.4	-4.0
T28	24.7	3848.7	6.1	-3.5
T28	24.7 *mts*	3848.7	6.8	-3.6
T28	31.9	3855.9	6.0	-3.8
T28	31.9 *mts*	3855.9	6.3	-4.1

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T28	38.0 *mts*	3862.0	5.0	-3.5
T28	38.0	3862.0	5.3	-3.8
T28	41.3 *mts*	3865.3	3.5	-3.7
T28	41.3	3865.3	5.6	-3.4
T28	51.7	3875.7	5.6	-3.5
T28	57.2	3881.2	5.2	-4.1
T28	61.4	3885.4	5.6	-3.7
T28	66.4	3890.4	5.6	-3.7
T28	74.9	3898.9	6.4	-4.3
T28	156.8 *mts*	3980.8	4.3	-4.3
T28	156.8	3980.8	6.2	-4.5
T28	158.5	3982.5	6.5	-4.5
T28	164.2	3988.2	6.7	-4.0
T28	167.5	3991.5	6.5	-5.0
T28	173.7 *mts*	3997.7	4.4	-5.2
T28	173.7	3997.7	6.1	-5.0
T28	174.7	3998.7	6.0	-4.7
T28	181.0	4005.0	5.1	-5.9
T28	186.8	4010.8	3.7	-8.3
T29	1.8	3996.8	5.1	-7.0
T29	3.6	3998.6	4.8	-7.8
T29	5.6	4000.6	4.1	-7.8
T29	6.7	4001.7	3.3	-9.9
T29	8.3	4003.3	3.0	-10.0
T29	9.1	4004.1	2.5	-10.0
T29	12.0	4007.0	2.3	-10.1
T29	15.4	4010.4	2.0	-10.1
T29	16.7	4011.7	1.7	-10.2
T29	17.5	4012.5	1.5	-10.6
T29	19.9	4014.9	1.2	-9.9
T29	25.1	4020.1	0.0	-8.8
T29	35.3	4030.3	-0.3	-10.5
T29	40.4	4035.4	2.6	-7.9
T29	49.0	4044.0	5.5	-10.4
T29	50.3	4045.3	5.9	-10.5
T29	53.6	4048.6	4.4	-10.0
T29	57.8	4052.8	4.2	-9.6
T29	66.5	4061.5	1.8	-8.6
T29	66.5 *mts*	4061.5	3.0	-9.6
T29	68.2	4063.2	2.8	-10.0
T29	68.2 *mts*	4063.2	3.2	-9.8
T29	68.5	4063.5	1.5	-9.9
T29	70.2	4065.2	1.7	-9.6
T29	112.4	4107.4	5.6	-8.6
T29	113.9	4108.9	6.6	-8.2
T29	114.8	4109.8	6.6	-7.3
T29	115.5	4110.5	6.7	-7.3
T29	116.7	4111.7	5.6	-7.9
T29	118.2	4113.2	4.8	-8.2
T29	122.4	4117.4	2.5	-7.8
T29	124.1	4119.1	3.0	-8.2

Table DR7: Isotopic data from Tambien Group carbonates

section	meter level	composite meter level	$\delta^{13}C_{carb}$	$\delta^{18}O_{carb}$
T29	125.7	4120.7	3.1	-8.2
T29	127.8	4122.8	2.6	-7.6
T29	129.4	4124.4	2.4	-8.2
T29	131.9	4126.9	2.2	-8.0
T29	133.0	4128.0	2.5	-8.3
T29	134.3	4129.3	2.5	-8.5
T29	135.4	4130.4	1.8	-8.6
T29	136.3	4131.3	2.4	-8.4
T29	137.6	4132.6	2.0	-8.5
T29	139.6	4134.6	1.8	-8.0
T29	140.9	4135.9	1.5	-8.2
T29	143.4	4138.4	1.6	-8.6
T29	145.2	4140.2	2.7	-8.6
T29	146.1	4141.1	3.2	-7.9
T29	152.4	4147.4	2.0	-8.8
T29	155.7	4150.7	1.6	-7.7
T29	159.3	4154.3	3.0	-9.6
T29	160.7	4155.7	2.5	-9.8
T29	162.7	4157.7	2.3	-9.4
T29	164.2	4159.2	2.6	-7.3
T29	166.3	4161.3	1.7	-9.1
T29	170.2	4165.2	0.9	-9.3
T29	209.0	4204.0	-3.2	-7.9
T29	216.6	4211.6	-2.3	-6.1
T30	1.4	4176.4	1.8	-7.8
T30	4.2	4179.2	1.2	-7.9
T30	9.6	4184.6	2.0	-8.7
T30	11.7	4186.7	2.7	-7.3
T30	16.8	4191.8	2.0	-8.6
T30	21.4	4196.4	2.7	-9.3
T30	25.6	4200.6	2.4	-9.8
T30	30.4	4205.4	0.6	-8.1
T30	55.2	4230.2	-2.4	-5.9
T30	56.3	4231.3	-0.7	-3.2
T30	60.3	4235.3	-2.7	-8.8
T30	60.8	4235.8	-3.0	-10.0
T30	85.7	4260.7	-1.3	-10.1
T30	86.7	4261.7	-0.5	-10.1
T30	87.3	4262.3	-0.4	-10.2
T30	88.0	4263.0	-0.2	-10.1
T30	88.7	4263.7	-1.3	-11.8
T30	89.4	4264.4	-0.6	-12.0
T30	89.9	4264.9	-2.2	-10.2
T30	108.0	4283.0	-3.5	-11.1

Notes: Samples with this superscript *mts* are powders sampled from the microspar cement of molar tooth structures rather than the bulk carbonate lithology (typically micritic matrix) as with the other samples.

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