Repository 1: Prokoph, Villeneuve, Agterberg & Rachold:
Geochronology and calibration of global Milankovitch cyclicity at the Cenomanian-Turonian boundary

Data Repository: Ar-Ar data

Power[a]	Volume ^{39}Ar x10^{-11} cc	$^{36}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{38}Ar/^{39}Ar$	$^{40}Ar/^{39}Ar$	%^{40}Ar ATM	*$^{40}Ar/^{39}Ar$	f_{39}[b] (%)	Apparent Age Ma[c]
X1 Biotite; J=.0027485[d] (Z6389)									
Aliquot: A									
3.0*	0.70	0.0570±0.0017	0.062±122.904	0.084±0.003	54.508±0.403	30.9	37.671±0.498	5.5	177.74±2.24
3.9*	1.31	0.0085±0.0007	0.031±150.430	0.121±0.002	23.105±0.258	10.9	20.589±0.248	10.3	99.31±1.16
5.0	1.57	0.0062±0.0005	0.023±188.052	0.116±0.004	22.121±0.305	8.3	20.283±0.290	12.4	97.87±1.36
12.0	1.43	0.0079±0.0005	0.020±126.305	0.121±0.003	22.193±0.185	10.5	19.866±0.146	11.3	95.91±0.69
Aliquot: B									
3.0*	0.73	0.0343±0.0011	0.065±121.513	0.104±0.003	28.330±0.538	35.8	18.189±0.496	5.8	88.01±2.34
3.9	1.30	0.0069±0.0011	0.021±74.771	0.119±0.003	22.055±0.352	9.3	20.003±0.422	10.3	96.55±1.98
5.0	1.85	0.0043±0.0007	0.016±111.741	0.115±0.003	21.056±0.235	6.0	19.798±0.284	14.7	95.59±1.34
12.0	1.28	0.0057±0.0010	0.019±76.310	0.116±0.003	21.487±0.311	7.9	19.791±0.377	10.1	95.56±1.78
Aliquot: C									
3.0	0.39	0.0373±0.0063	0.173±140.883	0.122±0.003	31.054±0.600	35.5	20.036±1.819	3.1	96.71±8.55
3.9	0.23	0.0121±0.0036	0.187±208.943	0.132±0.004	23.659±1.018	15.1	20.087±0.815	1.8	96.95±3.83
5.0	0.74	0.0035±0.0014	0.066±90.787	0.122±0.003	21.292±0.361	4.9	20.250±0.397	5.9	97.71±1.87
12.0	1.12	0.0025±0.0010	0.053±67.431	0.121±0.004	20.609±0.247	3.6	19.861±0.295	8.9	95.89±1.39
X2 Biotite; J=.0027328[d] (Z6390)									
Aliquot: A									
2.4*	0.28	0.1303±0.0050	0.160±162.226	0.121±0.005	39.633±1.269	97.1	1.143±1.652	0.8	5.63±8.12
3.0*	0.36	0.0536±0.0031	0.112±138.065	0.078±0.006	25.935±1.221	61.1	10.083±1.317	1.0	49.04±6.32
3.9*	2.37	0.0060±0.0004	0.021±50.025	0.069±0.002	21.543±0.190	8.2	19.780±0.186	6.6	94.97±0.87
5.0	4.15	0.0035±0.0003	0.027±86.256	0.065±0.001	20.975±0.111	5.0	19.933±0.131	11.7	95.69±0.61
12.0	1.68	0.0089±0.0006	0.145±35.405	0.073±0.002	22.556±0.173	11.7	19.914±0.187	4.7	95.60±0.87
Aliquot: B									
3.0*	0.84	0.0659±0.0023	0.077±137.381	0.097±0.003	25.974±0.439	75	6.488±0.745	2.4	31.71±3.61
3.9*	1.81	0.0051±0.0006	0.021±87.232	0.073±0.002	20.823±0.206	7.3	19.305±0.229	5.1	92.75±1.07
5.0	4.38	0.0025±0.0002	0.015±52.541	0.066±0.001	20.745±0.128	3.5	20.011±0.124	12.3	96.06±0.58
12.0	3.48	0.0026±0.0002	0.057±57.337	0.081±0.001	20.644±0.106	3.7	19.882±0.094	9.8	95.45±0.44
Aliquot: C									
3.0*	1.04	0.0420±0.0017	0.048±85.813	0.098±0.004	23.513±0.397	52.7	11.117±0.572	2.9	53.99±2.74
3.9*	1.00	0.0086±0.0009	0.031±97.149	0.067±0.002	22.137±0.344	11.5	19.596±0.319	2.8	94.12±1.50
5.0	4.83	0.0022±0.0002	0.016±83.443	0.068±0.001	20.807±0.115	3.1	20.166±0.112	13.6	96.78±0.52
12.0	1.81	0.0038±0.0006	0.052±55.147	0.068±0.002	21.288±0.274	5.3	20.162±0.295	5.1	96.76±1.38
Aliquot: D									
3.0*	0.76	0.0560±0.0017	0.123±69.003	0.098±0.003	25.268±0.454	65.5	8.729±0.576	2.1	42.53±2.77
3.9*	1.13	0.0058±0.0010	0.064±136.995	0.071±0.001	20.807±0.250	8.3	19.079±0.310	3.2	91.69±1.45
5.0	2.30	0.0029±0.0006	0.051±81.107	0.069±0.002	21.131±0.214	4.1	20.267±0.250	6.5	97.25±1.17
12.0	3.39	0.0027±0.0002	0.029±81.757	0.067±0.001	21.062±0.082	3.8	20.261±0.063	9.5	97.23±0.30
X2b Biotite; J=.0027485[d] (Z6391)									
Aliquot: A									
2.4*	0.29	0.0444±0.0025	0.083±208.899	0.106±0.003	19.511±0.709	67.3	6.380±0.293	1.1	31.36±1.43
3.0*	0.68	0.0117±0.0010	0.040±202.144	0.040±0.001	29.307±0.333	11.8	25.861±0.162	2.7	123.88±0.75
3.5	0.62	0.0069±0.0012	0.028±100.524	0.066±0.001	21.641±0.355	9.4	19.602±0.187	2.4	94.67±0.88
3.9	0.73	0.0058±0.0010	0.022±206.197	0.068±0.002	21.608±0.314	8.0	19.887±0.200	2.9	96.01±0.94
4.2	0.82	0.0030±0.0010	0.017±93.241	0.072±0.004	20.919±0.415	4.2	20.032±0.389	3.2	96.69±1.83
5.0	1.31	0.0011±0.0009	0.045±89.632	0.074±0.003	20.365±0.217	1.5	20.052±0.262	5.1	96.79±1.23
6.0	1.02	0.0010±0.0013	0.039±93.065	0.062±0.001	20.038±0.224	1.4	19.750±0.332	4.0	95.37±1.56
12.0*	0.11	0.0074±0.0099	0.153±132.414	0.059±0.011	28.645±2.541	7.6	26.455±2.890	0.4	126.63±13.36
Aliquot: B									
3.0*	0.55	0.0330±0.0021	0.065±27.322	0.078±0.002	23.372±0.463	41.7	13.633±0.566	2.2	66.37±2.71
3.9	1.23	0.0023±0.0012	0.023±123.582	0.065±0.003	20.810±0.303	3.2	20.144±0.414	4.8	97.22±1.95

5.0	2.79	0.0013±0.0005	0.011±101.440	0.058±0.002	20.439±0.159	1.9	20.053±0.187	10.9	96.79±0.88
12.0	0.97	0.0025±0.0009	0.021±103.217	0.053±0.002	20.882±0.327	3.6	20.130±0.305	3.8	97.15±1.43
Aliquot: C									
2.4*	0.21	0.0900±0.0065	0.172±176.881	0.117±0.007	32.807±1.913	81.1	6.203±2.356	0.8	30.50±11.49
3.0*	0.33	0.0355±0.0040	0.100±90.375	0.079±0.006	27.412±1.172	38.3	16.927±1.424	1.3	82.04±6.75
3.9	1.63	0.0067±0.0007	0.019±233.636	0.068±0.002	21.915±0.223	9.1	19.922±0.257	6.4	96.17±1.21
5.0	1.81	0.0050±0.0004	0.031±72.166	0.066±0.001	21.506±0.148	6.9	20.022±0.124	7.1	96.65±0.58
12.0	0.33	0.0414±0.0031	0.269±61.934	0.097±0.006	32.143±0.910	38.0	19.914±0.953	1.3	96.13±4.48
Aliquot: D									
2.4*	0.54	0.0780±0.0033	0.217±167.768	0.106±0.007	28.002±1.222	82.3	4.960±1.467	2.1	24.43±7.18
3.0*	0.94	0.0201±0.0017	0.102±48.784	0.068±0.005	21.733±0.483	27.3	15.795±0.621	3.7	76.67±2.95
3.9	2.02	0.0048±0.0006	0.043±84.185	0.069±0.001	21.282±0.204	6.7	19.858±0.238	7.9	95.88±1.12
5.0	5.04	0.0021±0.0003	0.032±77.110	0.065±0.002	20.806±0.212	3.0	20.178±0.220	19.8	97.38±1.03
12.0	1.55	0.0040±0.0008	0.107±64.296	0.063±0.001	21.065±0.273	5.6	19.877±0.312	6.1	95.96±1.47

X4 Biotite; J=.0027328[d] (Z6395)

Aliquot: A									
2.4*	0.13	0.1025±0.0063	0.120±74.894	0.189±0.014	37.487±1.988	80.8	7.189±1.532	0.3	35.10±7.41
3.0*	0.40	0.0469±0.0037	0.103±161.627	0.150±0.003	26.134±0.611	53.0	12.289±1.043	1.1	59.59±4.98
3.9*	0.63	0.0085±0.0012	0.043±154.043	0.180±0.005	21.365±0.463	11.7	18.862±0.377	1.6	90.67±1.77
5.0	1.30	0.0036±0.0006	0.021±69.147	0.179±0.005	21.072±0.198	5.0	20.010±0.159	3.4	96.05±0.75
12.0	2.65	0.0027±0.0003	0.029±131.634	0.171±0.002	20.579±0.165	3.9	19.785±0.148	6.9	95.00±0.69
Aliquot: B									
3.0*	0.26	0.1211±0.0040	0.130±71.638	0.169±0.005	42.653±1.140	83.9	6.877±1.227	0.7	33.59±5.94
3.9*	0.85	0.0160±0.0013	0.061±57.752	0.195±0.006	23.968±0.623	19.8	19.234±0.651	2.2	92.42±3.05
5.0	1.84	0.0029±0.0007	0.029±70.657	0.192±0.004	21.008±0.225	4.1	20.156±0.269	4.8	96.73±1.26
12.0	1.98	0.0022±0.0005	0.068±82.825	0.154±0.004	20.366±0.280	3.1	19.726±0.281	5.1	94.72±1.31
Aliquot: C									
2.4*	0.39	0.2667±0.0078	0.122±69.595	0.202±0.012	84.862±2.781	92.9	6.045±3.537	1.0	29.56±17.16
3.0*	2.03	0.0635±0.0022	0.067±101.710	0.115±0.002	34.598±0.371	54.3	15.827±0.739	5.3	76.39±3.49
3.9	1.58	0.0189±0.0005	0.041±29.512	0.164±0.003	25.653±0.325	21.8	20.057±0.316	4.1	96.27±1.48
5.0	6.79	0.0041±0.0002	0.018±68.554	0.174±0.002	21.457±0.143	5.7	20.240±0.153	17.6	97.13±0.72
12.0	5.16	0.0034±0.0002	0.041±57.810	0.161±0.002	20.812±0.224	4.8	19.809±0.226	13.3	95.11±1.06
Aliquot: D									
2.4*	0.35	0.1729±0.0054	0.153±101.450	0.160±0.003	59.842±0.926	85.4	8.740±1.652	0.9	42.59±7.95
3.0*	0.82	0.0380±0.0019	0.117±67.641	0.164±0.002	30.330±0.400	37.1	19.092±0.590	2.1	91.76±2.77
3.9	0.84	0.0148±0.0010	0.093±136.672	0.201±0.005	24.237±0.328	18.1	19.861±0.279	2.2	95.35±1.30
5.0	2.87	0.0024±0.0003	0.047±50.470	0.184±0.004	21.018±0.137	3.4	20.297±0.122	7.4	97.39±0.57
12.0	1.56	0.0033±0.0005	0.170±146.182	0.173±0.003	20.964±0.204	4.6	19.993±0.173	4.0	95.97±0.81
Aliquot: E									
2.4*	0.36	0.1484±0.0039	0.248±79.045	0.167±0.005	51.194±1.355	85.6	7.347±1.585	0.9	35.86±7.66
3.0*	0.55	0.0360±0.0021	0.235±135.678	0.185±0.005	26.217±0.824	40.6	15.566±0.891	1.4	75.16±4.21
3.9	0.65	0.0076±0.0015	0.100±100.943	0.195±0.004	22.406±0.387	10.0	20.157±0.383	1.7	96.74±1.79
5.0	1.69	0.0034±0.0004	0.052±73.736	0.191±0.004	21.042±0.211	4.8	20.036±0.184	4.4	96.17±0.86
12.0	2.98	0.0021±0.0003	0.078±76.757	0.191±0.001	20.678±0.115	3.0	20.066±0.114	7.7	96.31±0.53

X6 Biotite; J=.0027485[d] (Z6397)

Aliquot: A									
2.4*	0.14	0.2352±0.0141	0.110±195.759	0.166±0.010	86.696±3.670	80.2	17.206±5.170	0.6	83.36±24.48
3.0	0.30	0.0749±0.0027	0.035±288.577	0.202±0.007	42.299±0.692	52.3	20.168±0.481	1.4	97.33±2.26
3.9	1.14	0.0096±0.0007	0.020±97.356	0.188±0.004	22.943±0.272	12.4	20.094±0.227	5.1	96.98±1.07
5.0	3.91	0.0030±0.0002	0.008±148.682	0.202±0.002	20.911±0.108	4.3	20.017±0.100	17.6	96.62±0.47
12.0	2.44	0.0023±0.0004	0.010±97.740	0.200±0.003	20.694±0.207	3.3	20.009±0.214	11.0	96.58±1.01
Aliquot: B									
3.0*	0.37	0.0910±0.0044	0.051±290.386	0.194±0.007	45.315±0.958	59.3	18.436±1.430	1.7	89.17±6.75
3.9	1.38	0.0048±0.0006	0.012±149.688	0.213±0.004	21.643±0.341	6.5	20.237±0.318	6.2	97.66±1.49
5.0	2.93	0.0024±0.0004	0.009±82.141	0.206±0.002	20.599±0.110	3.4	19.891±0.120	13.2	96.03±0.56
12.0	3.31	0.0013±0.0004	0.009±80.749	0.207±0.003	20.395±0.184	1.9	20.015±0.210	14.9	96.61±0.99
Aliquot: C									
3.0*	0.33	0.0676±0.0033	0.112±184.215	0.148±0.006	56.668±1.055	35.2	36.698±1.160	1.5	173.37±5.22
3.9*	1.15	0.0033±0.0010	0.023±101.145	0.225±0.004	22.278±0.211	4.4	21.294±0.266	5.2	102.61±1.24

5.0	1.26	0.0040±0.0006	0.031±182.636	0.192±0.003	21.243±0.303	5.6	20.059±0.265	5.7	96.82±1.25
12.0	1.42	0.0021±0.0005	0.037±89.187	0.200±0.004	20.593±0.182	3.1	19.959±0.132	6.4	96.35±0.62
Aliquot: D									
3.0*	0.12	0.1622±0.0071	0.387±300.607	0.194±0.007	65.344±2.070	73.3	17.416±1.747	0.5	84.35±8.27
3.9	0.30	0.0143±0.0027	0.245±166.084	0.213±0.003	24.142±0.722	17.6	19.903±0.495	1.3	96.08±2.33
5.0	1.03	0.0022±0.0007	0.050±289.024	0.194±0.004	20.441±0.272	3.2	19.777±0.204	4.6	95.49±0.96
12.0	0.72	0.0051±0.0016	0.089±114.144	0.192±0.005	21.413±0.395	7.0	19.920±0.483	3.2	96.17±2.27

a: As measured by laser in % of full nominal power (10W)
b: Fraction 39Ar as percent of total run
c: Errors are analytical only and do not reflect error in irradiation parameter J
d: Nominal J, referenced to FCT-SAN=28.03 Ma (Renne et al., 1994)
*: Not included in regression
All uncertainties quoted at 2σ level

Approximately 50-100 grains were placed in 3mm x 3mm packets along with 3-4 grains of (FCT-SAN) flux monitor (apparent age 28.0 Ma; Renne et al., 1994). The monitor used (Fish Canyon Tuff sanidine) is highly reproducible and can be cross-correlated to effectively with ages determined by the U-Pb method (Villeneuve et al., 2000). Uncertainty is determined from replicate analyses of FCT-SAN and is approximately ±0.3%. The absolute uncertainty on the apparent age of FCT-SAN has no effe on relative age determinations (i.e. rates), but must be included when comparing ages determined by different isotopic systems. Following methodology of Renne et al. (1998) and applying the ±0.15 Ma uncertainty on age of FCT-SAN (Villeneuve et al., 2000), results in a 0.15 Ma increase above the values quoted herein. The larger uncertainty should be used for cross-calibration against an age determined by U-Pb method. Biotite is split into 3-5 aliquots of 4-10 grains for analysis.
Details of analytical procedures are presented in Villeneuve et al. (2000).

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Repository 2: Prokoph, Villeneuve, Agterberg & Rachold:
Geochronology and calibration of global Milankovitch cyclicity
at the Cenomanian-Turonian boundary

Youngstown Core; geochemical and foraminifera analysis

sample/ No. †	depth	TOC§	CaCO3§	δ13C * carb	δ13C * org
	m	%	%	per mil	per mil
Core 6-34-30-8W4					
1	679.9	3.7	0.01		-27.38
2	680.6				
3	682	2.76	0.01		-27.09
4	687				
5	687.8				
6	691	3.26	0.01		-27.125
7	692.2	4	0.01		-27.23
8	693.3	4.12	1.58	2.05	-26.975
9	694	3.97	0.92		-26.89
10	694.7	4.93	4.33	0.26	-26.995
11	695.8	4.6	4.08	0.27	-26.96
12	696.8	3.97	1.92		-27.13
13	697.5	4.68	1.92		-27.28
14	698	4.03	0.83		-27.215
15	699.5	4.77	4.17	-1.65	-27.395
16	701	4.04	10.75	-2.13	-27.23
17	702	4.97	4.08	-1.78	-27.375
18	703.3	6.26	3.58	0.1	-27.255
19	704.2	9.5	35.00	0.06	-26.29
20	705	5.24	36.67	0.98	-26.73
21	705.5	5.4	34.58	1.48	-26.39
23	706.3	5.98	29.83	0.92	-25.685
24	707	6.76	47.00	-0.22	-25.41
25	709	6.05	32.25	1.58	-25.575
26	710	5.28	12.25	1.63	-24.935
28	710.8	6.29	22.67		-24.905
29	711.7	6.41	25.33	2.16	-24.33
30	712.3	5.05	9.66	3.72	-25.36
31	712.9	4.21	9.79	-0.01	-25.19
32	713.6	5.96	9.98	1.46	-25.55
33	717	3.88	0.67		-26.73
34	717.5	3.60	1.13		-26.76
35	718	4.90	3.17	0.51	-26.9
36	720.4	2.89	0.12	1.3	-26.95
37	720.8			-2.1	
38	723	4.52	7.49	1.4	-26.86
39	723.8	5.29	6.42	0.92	-27.23
40	725.5	5.01	7.97	0.87	-27.24
41	728	6.82	25.20	-0.12	-27.59
42	729.5	7.36	41.83	0.36	-27.55
43	732.2	6.45	16.08	1.06	-27.16
44	733.3	5.85	13.07	-1.02	-27.17
45	734.2	5.82	9.93	1.42	-27.15
46	736	6.18	15.84	1.41	-27.39
47	739.5	7.48	13.13	-0.19	-27.25
48	741.3	6.62	33.07	-0.19	-26.99
49	742.8	8.23	26.75	0.58	-26.97
50	743.3	8.44	0.10		-27.12
51	743.7	6.4	0.28		-27.3
52	745.2	6.01	2.86		-26.67
53	746	2.1	0.10		-26.74
54	748	1.15	0.10		-26.57
55	751.3	1.57	0.10		-26.84
56	752.4	2.37	0.10		-27.77
57	753.5	1.69	0.10		-26.98

sample /No. †	foraminiferal specimen counts > 63 µm from ~ 20g rock sample spiral Plankton (e.g., hedbergellids)	biserial Plankton (e.g., heterohelicidae)	Benthics

	no.	no.	no.
1	11	0	159
2	0	0	98
3	2	0	92
4	0	0	68
5	0	0	88
6	0	0	162
7	0	0	35
8	0	0	163
9	0	0	32
10	0	0	7
11	0	0	7
12	0	0	4
13	0	0	10
14	0	0	14
15	0	0	3
16	0	0	1
17	0	0	10
18	0	1	8
19	60	20	3
20	23	30	4
21	11	58	10
23	10	12	0
24	49	2	4
25	47	19	0
26	160	9	0
28	13	46	1
29	2	0	2
30	41	10	2
31	5	51	0
32	0	3	7
33	0	1	44
34	0	0	55
35	6	0	0
36	0	0	42
37	0	0	0
38	6	27	5
39	9	500	0
40	30	430	0
41	0	7	17
42	4	50	12
43	8	33	39
44	4	2	29
45	0	0	34
46	0	0	18
47	0	0	26
48	0	0	16
49	0	0	18
50	0	0	27
51	0	0	30
52	0	0	0
53	0	0	65
54	0	0	5
55	0	0	38
56	0	1	11
57	0	0	122

* 13C/12C isotope ratios were measured using a FINNIGAN DELTA S mass spectrometer after removal of carbonate with 1 N HCl in Ag-cups and
combustion to CO2 in a Heraeus elemental analyzer. Sample volumes were chosen to contain about 0.2 mg C. Accuracy of the analytical methods
was checked by parallel analysis of international standard reference material (IAEA-CH-7).
Results are expressed vs. V-PDB (Belemnite from the Peedee Formation)
in the form: δ13C (‰) = [(13C/12Csample-13C/12Cstandard)/(13C/12Cstandard)] x 1000.

† Samples and residues are stored at the Dept. of Earth Science, Univ. of Ottawa, P.O.box 450,Stn. A, Ottawa, ON, K1N 6N5, Canada.

§ Total carbon (TC) concentrations were measured on pulverized samples using a LECO elemental analyzer. Total organic carbon (TOC) was analyzed with a Metalyt-CS-1000-S (Eltra Corp.) after removal of carbonate (10% HCl) at a temperature of 80°C. Carbonate carbon expressed as $CaCO_3$ was calculated based on the difference between TC and TOC.