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SUPPLEMENTARY ONLINE MATERIAL FOR

Extreme abundance of ammonoids in mass accumulations from the Late Devonian of the Moroccan Anti-Atlas

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Supplementary Online Material

SOM 1a. Density, weight and volume of each sample before preparation.

SOM 1b. Density, weight and volumes of all prepared complete ammonoids.

SOM 2. Ammonoid counts for each sample.

SOM 3a. Ammonoid volume estimated from measured weight and the density of 2.71 g/cm^3 that is found in the sample of Madene El Mrakib.

SOM 3b. Calculated volumes for ammonoids with sizes up to 32.5 mm diameter and calculated volumes for all ammonoids that were destroyed during preparations within each sample.

SOM 4. Body chamber volumes and soft tissue biomass of all counted ammonoids in the different samples (complete + destroyed).

SOM 5. General data on all samples.

SOM 1a. Density, weight and volume of each sample before preparation.

	Density (g/cm ³)	Weight (g)	Volume cm ³	Volume (dm ³)
Madene	2.71	2700	996.31	0.996
Jerane	2.79	1940	695.34	0.695
Taouz	2.62	2150	820.61	0.821
Filon D. 1	2.66	2150	808.27	0.808
Filon D. 2	2.85	1000	350.88	0.351

SOM 1b. Density, weight and volumes of all prepared complete ammonoids. The volume of all destroyed ammonoids and the total volume of all ammonoid within each sample plus the percentages.

	Volume of complete ammonoids				volume of destroyed ammonoids		total volume of all ammonoids (cm ³)	
	Density (g/cm ³)	Weight (g)	Volume (cm ³)	Percentage of the	Volume (cm ³)	Percentage of the	Volume (cm ³)	Percentage of the sample
Madene	2.7	970	357.9	35.9	47.5	4.8	405.4	40.7
	1		3		5		8	
Jerane	2.7	740	265.2	38.1	11.2	1.6	276.4	39.8
	9		3		5		8	
Taouz	2.6	750	286.2	34.9	10.3	1.3	296.6	36.2
	2		6		6		2	
Filon D. 1	2.6	1230	462.4	57.2	4.64	0.6	467.0	57.8
	6		1		5		5	
Filon D. 2	2.8	330	115.7	33.0	7.73	2.2	123.5	35.2
	5		9		2		2	

SOM 2. Ammonoid counts for each sample (summarized in Fig. 5 per 1 mm).

Size(mm)	Madene complete	Madene destroyed	Jerane complete	Jerane destroyed	Taouz complete	Taouz destroyed	Filon D. 1 complete	Filon D. 1 destroyed	Filon D. 2 complete	6. Filon D. 2
0.5										
1.0		17				1		1		
1.5		59						11		5
2.0		95		5		1		22		8
2.5		104				1	1	5		7
3.0		98	1	1	2	4	4	20		9
3.5	1	48					4	3	1	6
4.0	1	106		3	1	7	1	17		12
4.5	1	22		2	2	2	6	3	2	2
5.0		50	5	9		6	6	7		5
5.5		23	1			1	2	1	4	1
6.0		44		1		2	7	8		4
6.5	2	8	1	1	2		5		2	
7.0	7	41	2		4	3	10	3	4	3
7.5	3	5			1		6		2	
8.0	16	30	3		1	6	11	9	3	3
8.5	4	3	1		5		11		5	
9.0	19	25	5	2	3	1	8	2	3	2
9.5	2		4		3		10		1	
10.0	12	15	8		1	3	14	2	4	5
10.5	5				2		8		6	
11.0	19	13	5		7	1	8	1		
11.5	7			1	1		8		1	
12.0	17		1		4	3	13		2	1
12.5	6		1		3		7			
13.0	31	4	3		6	4	14		2	
13.5	15		2		4		12		3	
14.0	21	2	1		8		15		5	
14.5	11		1		2		4		4	
15.0	22		6		7	2	20		6	
15.5	7	1			3		3			
16.0	24		3		5		8		4	
16.5	5		3		2		8		2	
17.0	22		2		8	1	8		2	
17.5	9				5		3		2	
18.0	21	6	2		3	1	16		1	
18.5	8				3		2		1	
19.0	13		2		3		3			
19.5	5		1		1		1		1	
20.0	16		6		3		2		2	
20.5	3		1		1		1			

21.0	15		5		7		3			
21.5	6		2		2		2		1	
22.0	10		3		2		2		1	
22.5	2		3		2		1			
23.0	10		2		1		1		1	
23.5	5				2		1			
24.0	7		3		2		1			
24.5										
25.0	1		3	2	2					
25.5	1				1					
26.0	4		6				1			
26.5			2		2					
27.0	3		3		2				1	
27.5					2					
28.0	1			1	2					
28.5	1				2					
29.0					2		1			
29.5			1							
30.0			2		2				1	
30.5					1					
31.0									2	
31.5					1					
32.0			1		1				1	
32.5					1					
36.0			1							
37.0			1							
39.0			1							
41.0			1							
48.0			1							
49.0			1							
50.0			1							
total	421	819	114	28	145	50	283	115	83	73

SOM 3a. Ammonoid volume estimated from measured weight and the density of 2.71 g/cm³ that is found in the sample of Madene El Mrakib.

Diameter (mm)	Mass (g)	Volume (cm ³)			
			16	2.63	0.970
			16.4	3.01	1.111
3	0.001	0.000	16.5	2.73	1.007
3.7	0.05	0.018	17.2	3.03	1.118
4.1	0.09	0.033	17.3	3.22	1.188
4.8	0.1	0.037	17.6	3.94	1.454
5.1	0.13	0.048	17.9	3.6	1.328
5.2	0.13	0.048	19.2	4.69	1.731
5.7	0.15	0.055	19.4	4.27	1.576
5.8	0.19	0.070	20	4.42	1.631
6.1	0.2	0.074			
6.6	0.24	0.089			
6.8	0.265	0.098			
7	0.34	0.125			
7.2	0.31	0.114			
7.3	0.37	0.137			
7.5	0.37	0.137			
7.6	0.35	0.129			
8	0.45	0.166			
8.2	0.445	0.164			
8.4	0.46	0.170			
9.2	0.59	0.218			
9.5	0.65	0.240			
10.1	0.82	0.303			
10.2	0.86	0.317			
10.7	0.91	0.336			
11	0.915	0.338			
11.3	1.07	0.395			
11.4	1	0.369			
11.8	1.11	0.410			
11.9	1.205	0.445			
12	1.32	0.487			
12.2	1.26	0.465			
12.8	1.42	0.524			
12.9	1.36	0.502			
13	1.5	0.554			
13.1	1.53	0.565			
13.3	1.42	0.524			
13.5	1.6	0.590			
13.7	1.78	0.657			
13.9	1.72	0.635			
14	1.79	0.661			
15.2	2.08	0.768			
15.4	2.6	0.959			

SOM 3b. Calculated volumes for ammonoids with sizes up to 32.5 mm diameter and calculated volumes for all ammonoids that were destroyed during preparations within each sample. In each row, the number of ammonoids with the given diameter is shown on the left and the sum of the volumes these ammonoids is shown on the right. The total number of destroyed ammonoids within each sample is shown at the bottom.

Diameter (mm)	Volumen (cm ³)	Madene	Volume (cm ³)	Jerane	Volume (cm ³)	Taouz	Volume (cm ³)	Filon Douze 1	Volume (cm ³)	Filon Douze 2	Volume (cm ³)
1.0	0.0006	17	0.01		0.00	1	0.00	1	0.00		0.00
1.5	0.0017	59	0.10		0.00		0.00	11	0.02	5	0.01
2.0	0.0037	95	0.35	5	0.02	1	0.00	22	0.08	8	0.03
2.5	0.0067	104	0.70		0.00	1	0.01	5	0.03	7	0.05
3.0	0.0109	98	1.07	1	0.01	4	0.04	20	0.22	9	0.10
3.5	0.0163	48	0.78		0.00		0.00	3	0.05	6	0.10
4.0	0.0232	106	2.46	3	0.07	7	0.16	17	0.40	12	0.28
4.5	0.0317	22	0.70	2	0.06	2	0.06	3	0.10	2	0.06
5.0	0.0419	50	2.09	9	0.38	6	0.25	7	0.29	5	0.21
5.5	0.0539	23	1.24		0.00	1	0.05	1	0.05	1	0.05
6.0	0.0678	44	2.98	1	0.07	2	0.14	8	0.54	4	0.27
6.5	0.0837	8	0.67	1	0.08		0.00		0.00		0.00
7.0	0.1017	41	4.17		0.00	3	0.31	3	0.31	3	0.31
7.5	0.1221	5	0.61		0.00		0.00		0.00		0.00
8.0	0.1447	30	4.34		0.00	6	0.87	9	1.30	3	0.43
8.5	0.1698	3	0.51		0.00		0.00		0.00		0.00
9.0	0.1974	25	4.94	2	0.39	1	0.20	2	0.39	2	0.39
9.5	0.2277		0.00		0.00		0.00		0.00		0.00
10.0	0.2607	15	3.91		0.00	3	0.78	2	0.52	5	1.30
10.5	0.2965		0.00		0.00		0.00		0.00		0.00
11.0	0.3352	13	4.36		0.00	1	0.34	1	0.34		0.00
11.5	0.3769		0.00	1	0.38		0.00				0.00
12.0	0.4217		0.00		0.00	3	1.27			1	0.42
12.5	0.4697		0.00		0.00		0.00				
13.0	0.5209	4	2.08		0.00	4	2.08				
13.5	0.5754		0.00		0.00		0.00				
14.0	0.6333	2	1.27		0.00		0.00				
14.5	0.6948		0.00		0.00		0.00				
15.0	0.7598		0.00		0.00	2	1.52				
15.5	0.8284	1	0.83		0.00		0.00				
16.0	0.9008		0.00		0.00		0.00				
16.5	0.9770		0.00		0.00		0.00				
17.0	1.0570		0.00		0.00	1	1.06				
17.5	1.1410		0.00		0.00		0.00				
18.0	1.2290	6	7.37		0.00	1	1.23				

19.0	1.4174	0.00		0.00	0.00		
23.0	2.3463	0.00		0.00	0.00		
24.8	2.8623	0.00		0.00	0.00		
25.0	2.9236	0.00	2	5.85	0.00		
28.0	3.9423	0.00	1	3.94	0.00		
32.5	5.8412	0.00		0	0.00		
Total volume (cm ³) for destroyed ammonoids		47.55		11.25	10.36	4.64	4.02

SOM 4. Body chamber volumes and soft tissue biomass of all counted ammonoids in the different samples (complete + destroyed). The volumes were calculated in SOM 3b. The percentage of 33.5 % for the body chamber volume is explained in the text (Results part: Total number of early and late Famennian ammonoids and their biomass, Fig. 8).

dm (mm)	Volume per specimen vol. (cm ³)	Body chamber volume (33.5%)	Size(mm)	Madene, spec. nr.	Madene body chamber volume	Jerane, spec. nr.	Jerane body chamber volume	Taouz, spec. nr.	Taouz, body chamber volume	Filon D. 1, spec. nr.	Filon D. 1 body chamber volume	Filon D. 2, spec. nr.	Filon D. 2 body chamber volume
1.0	0.0006	0.0003	1.0	17	0.005		0.000	1	0.000	1	0.000		0.000
1.5	0.0017	0.0009	1.5	59	0.053		0.000		0.000	11	0.010	5	0.004
2.0	0.0037	0.0019	2.0	95	0.181	5	0.010	1	0.002	22	0.042	8	0.015
2.5	0.0067	0.0034	2.5	104	0.357		0.000	1	0.003	6	0.021	7	0.024
3.0	0.0109	0.0056	3.0	98	0.544	2	0.011	6	0.033	24	0.133	9	0.050
3.5	0.0163	0.0083	3.5	49	0.408		0.000		0.000	7	0.058	7	0.058
4.0	0.0232	0.0119	4.0	107	1.269	3	0.036	8	0.095	18	0.213	12	0.142
4.5	0.0317	0.0162	4.5	23	0.372	2	0.032	4	0.065	9	0.146	4	0.065
5.0	0.0419	0.0214	5.0	50	1.068	14	0.299	6	0.128	13	0.278	5	0.107
5.5	0.0539	0.0275	5.5	23	0.632	1	0.027	1	0.027	3	0.082	5	0.137
6.0	0.0678	0.0346	6.0	44	1.520	1	0.035	2	0.069	15	0.518	4	0.138
6.5	0.0837	0.0427	6.5	10	0.427	2	0.085	2	0.085	5	0.213	2	0.085
7.0	0.1017	0.0519	7.0	48	2.491	2	0.104	7	0.363	13	0.675	7	0.363
7.5	0.1221	0.0622	7.5	8	0.498		0.000	1	0.062	6	0.373	2	0.124
8.0	0.1447	0.0738	8.0	46	3.395	3	0.221	7	0.517	20	1.476	6	0.443
8.5	0.1698	0.0866	8.5	7	0.606	1	0.087	5	0.433	11	0.953	5	0.433
9.0	0.1974	0.1007	9.0	44	4.431	7	0.705	4	0.403	10	1.007	5	0.503
9.5	0.2277	0.1161	9.5	2	0.232	4	0.465	3	0.348	10	1.161	1	0.116
10.0	0.2607	0.1330	10.0	27	3.590	8	1.064	4	0.532	16	2.127	9	1.197
10.5	0.2965	0.1512	10.5	5	0.756		0.000	2	0.302	8	1.210	6	0.907
11.0	0.3352	0.1710	11.0	32	5.471	5	0.855	8	1.368	9	1.539		0.000
11.5	0.3769	0.1922	11.5	7	1.346	1	0.192	1	0.192	8	1.538	1	0.192
12.0	0.4217	0.2151	12.0	17	3.656	1	0.215	7	1.506	13	2.796	3	0.645
12.5	0.4697	0.2395	12.5	6	1.437	1	0.240	3	0.719	7	1.677		0.000
13.0	0.5209	0.2656	13.0	35	9.298	3	0.797	1	2.656	14	3.719	2	0.531
								0					

13.5	0.5754	0.2935	13.5	15	4.402	2	0.587	4	1.174	12	3.521	3	0.880
14.0	0.6333	0.3230	14.0	23	7.429	1	0.323	8	2.584	15	4.845	5	1.615
14.5	0.6948	0.3543	14.5	11	3.898	1	0.354	2	0.709	4	1.417	4	1.417
15.0	0.7598	0.3875	15.0	22	8.525	6	2.325	9	3.487	20	7.750	6	2.325
15.5	0.8284	0.4225	15.5	8	3.380		0.000	3	1.267	3	1.267		0.000
16.0	0.9008	0.4594	16.0	24	11.026	3	1.378	5	2.297	8	3.675	4	1.838
16.5	0.9770	0.4982	16.5	5	2.491	3	1.495	2	0.996	8	3.986	2	0.996
17.0	1.0570	0.5391	17.0	22	11.860	2	1.078	9	4.852	8	4.313	2	1.078
17.5	1.1410	0.5819	17.5	9	5.237		0.000	5	2.910	3	1.746	2	1.164
18.0	1.2290	0.6268	18.0	27	16.924	2	1.254	4	2.507	16	10.029	1	0.627
18.5	1.3211	0.6738	18.5	8	5.390		0.000	3	2.021	2	1.348	1	0.674
19.0	1.4174	0.7229	19.0	13	9.398	2	1.446	3	2.169	3	2.169		0.000
19.5	1.5180	0.7742	19.5	5	3.871	1	0.774	1	0.774	1	0.774	1	0.774
20.0	1.6228	0.8276	20.0	16	13.242	6	4.966	3	2.483	2	1.655	2	1.655
20.5	1.7320	0.8833	20.5	3	2.650	1	0.883	1	0.883	1	0.883		0.000
21.0	1.8457	0.9413	21.0	15	14.120	5	4.707	7	6.589	3	2.824		0.000
21.5	1.9639	1.0016	21.5	6	6.010	2	2.003	2	2.003	2	2.003	1	1.002
22.0	2.0867	1.0642	22.0	10	10.642	3	3.193	2	2.128	2	2.128	1	1.064
22.5	2.2142	1.1292	22.5	2	2.258	3	3.388	2	2.258	1	1.129		0.000
23.0	2.3463	1.1966	23.0	10	11.966	2	2.393	1	1.197	1	1.197	1	1.197
23.5	2.4833	1.2665	23.5	5	6.332		0.000	2	2.533	1	1.266		0.000
24.0	2.6251	1.3388	24.0	7	9.372	3	4.016	2	2.678	1	1.339		0.000
24.5	2.7719	1.4136	24.5		0.000		0.000		0.000		0.000		0.000
25.0	2.9236	1.4910	25.0	1	1.491	5	7.455	2	2.982		0.000		0.000
25.5	3.0804	1.5710	25.5	1	1.571		0.000	1	1.571		0.000		0.000
26.0	3.2423	1.6536	26.0	4	6.614	6	9.921		0.000	1	1.654		0.000
26.5	3.4094	1.7388	26.5		0.000	2	3.478	2	3.478		0.000		0.000
27	3.5817	1.8267	27.0	3	5.480	3	5.480	2	3.653		0.000	1	1.827
27.5	3.7593	1.9173	27.5		0.000		0.000	2	3.835		0.000		0.000
28	3.9423	2.0106	28.0	1	2.011	1	2.011	2	4.021		0.000		0.000
28.5	4.1308	2.1067	28.5	1	2.107		0.000	2	4.213		0.000		0.000
29	4.3247	2.2056	29.0		0.000		0.000	2	4.411	1	2.206		0.000
29.5	4.5242	2.3073	29.5		0.000	1	2.307		0.000		0.000		0.000
30	4.7293	2.4119	30.0		0.000	2	4.824	2	4.824		0.000	1	2.412
30.5	4.9401	2.5194	30.5		0.000		0.000	1	2.519		0.000		0.000
31	5.1566	2.6299	31.0		0.000		0.000		0.000		0.000	2	5.260
31.5	5.3789	2.7432	31.5		0.000		0.000	1	2.743		0.000		0.000
32	5.6071	2.8596	32.0		0.000	1	2.860	1	2.860		0.000	1	2.860
32.5	5.8412	2.9790	32.5		0.000		0.000	1	2.979		0.000		0.000
36	7.6503	3.9016	36.0		0.000	1	3.902		0.000		0.000		0.000
37	8.2237	4.1941	37.0		0.000	1	4.194		0.000		0.000		0.000
39	9.4489	4.8189	39.0		0.000	1	4.819		0.000		0.000		0.000
41	10.7814	5.4985	41.0		0.000	1	5.499		0.000		0.000		0.000
48	16.3405	8.3337	48.0		0.000	1	8.334		0.000		0.000		0.000
49	17.2539	8.7995	49.0		0.000	1	8.800		0.000		0.000		0.000
50	18.1984	9.2812	50.0		0.000	1	9.281		0.000		0.000		0.000
Total volume (cm ³)					233.74		125.20		104.5		87.09		36.95
Biomass (total volume * 1.025 g/cm ³)					239.58		128.33		107.11		89.27		37.87

SOM 5. General data on all samples.

<i>Sample</i>	<i>Madene</i>	<i>Jerane</i>	<i>Taouz</i>	<i>Filon Douze 1</i>	<i>Filon Douze 2</i>	<i>total number/</i>
total number ammonoids	1240	142	195	398	156	2131
smashed ammonoids	819	28	50	115	73	1085
complete ammonoids	421	114	145	283	83	1393
weight before preparation (kg)	2.7	1.94	2.15	2.15	1	
weight after preparations (complete ammonoids) (kg)	0.97	0.74	0.75	1.23	0.33	
weight percentage of prepared ammonoids	35.93%	38.14%	34.88%	57.21%	33.00%	
mean size prepped ammonoids	15.33	18.11	16.54	12.2	13.44	14.83
mean size smashed ammonoids	4.33	7.11	7.48	3.97	4.62	5.50
mean size (mm):				10.59		