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Benthic foraminifera and brachiopods from a marine cave in Spain: environmental significance

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Integrated environmental study in the CT12 marine cave (Eastern Spanish coast) through benthic fauna and sediment texture

Luisa BERGAMIN, Emma TADDEI RUGGIERO, Giancarlo PIERFRANCESCHI, Belen ANDRES, Ricardo CONSTANTINO, Cinzia CROVATO, Andrea D'AMBROSI, Andrea MARASSICH, and Elena ROMANO

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Fig. S1: Grainsize distribution curve; gravel (orange), sand (yellow), silt (green), clay (blue).

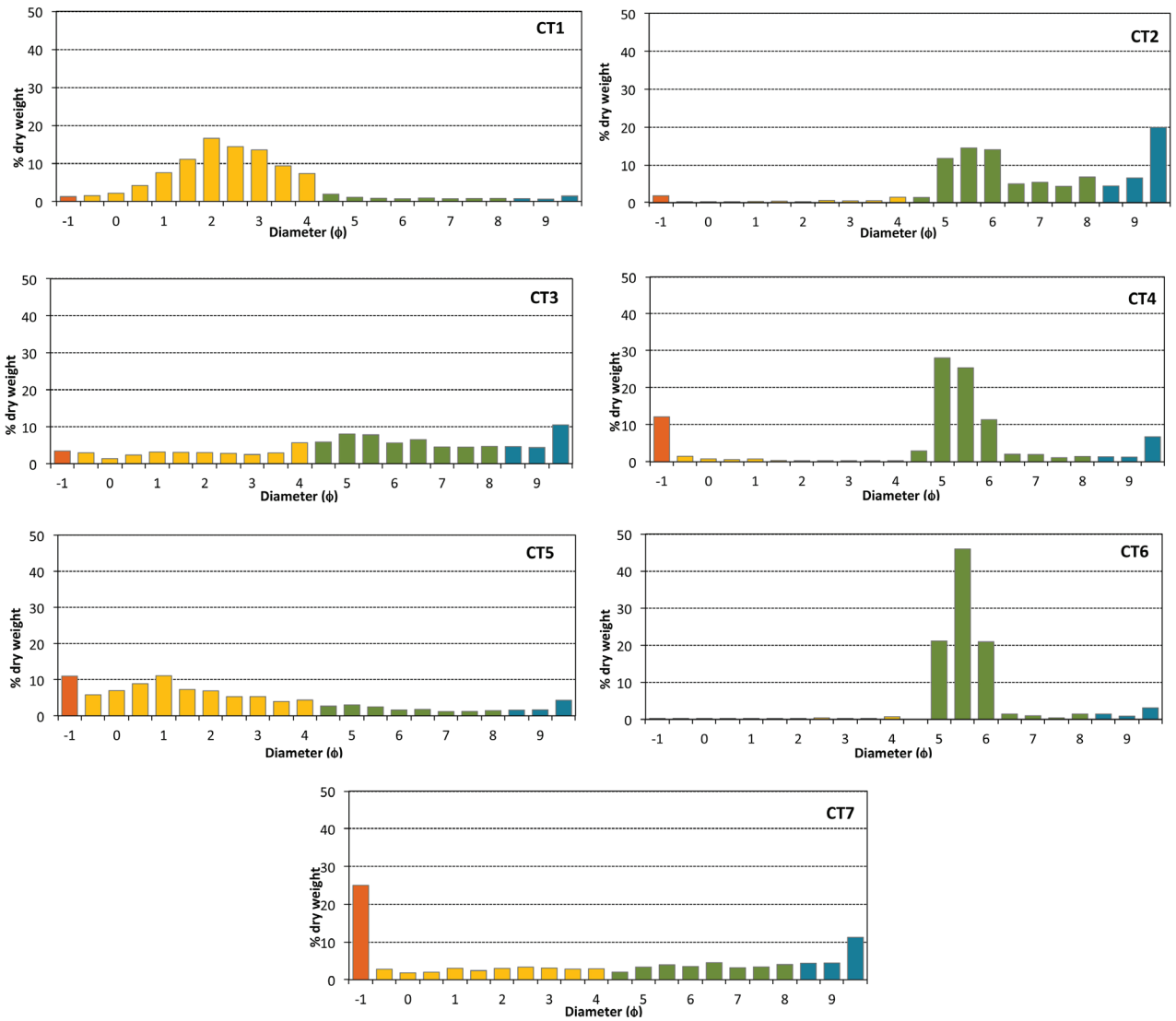


Table S1. Results of grain size analysis with sediment fractions at 0.5 φ interval.

f	CT1	CT2	CT3	CT4	CT5	CT6	CT7
-1.0	1.3	1.8	3.4	12.2	11.0	0.0	25.0
-0.5	1.5	0.2	2.9	1.5	5.9	0.1	2.8
0.0	2.2	0.1	1.4	0.7	7.0	0.1	1.8
0.5	4.2	0.2	2.4	0.5	8.9	0.1	2.0
1.0	7.6	0.3	3.2	0.7	11.1	0.1	3.0
1.5	11.1	0.4	3.1	0.3	7.3	0.2	2.4
2.0	16.6	0.3	3.0	0.1	6.9	0.2	3.0
2.5	14.4	0.6	2.8	0.1	5.3	0.4	3.3
3.0	13.5	0.5	2.5	0.1	5.3	0.2	3.1
3.5	9.4	0.5	2.9	0.1	4.0	0.3	2.8
4.0	7.4	1.5	5.7	0.1	4.4	0.7	2.9
4.5	1.9	1.4	5.9	2.9	2.7	0.0	2.0
5.0	1.1	11.7	8.0	28.1	3.0	21.1	3.4
5.5	0.9	14.4	7.8	25.4	2.5	45.9	3.9
6.0	0.7	14.0	5.6	11.4	1.6	20.9	3.5
6.5	0.9	5.0	6.5	2.0	1.8	1.5	4.5
7.0	0.7	5.3	4.5	1.9	1.2	1.0	3.2
7.5	0.8	4.3	4.5	1.1	1.2	0.4	3.4
8.0	0.8	6.8	4.7	1.4	1.4	1.5	4.0
8.5	0.8	4.4	4.6	1.3	1.6	1.5	4.4
9.0	0.6	6.6	4.4	1.3	1.7	0.9	4.4
11.0	1.4	19.9	10.5	6.8	4.3	3.1	11.2

Table S2. Foraminifera absolute abundance standardized at 1 g dry sediment. Faunal parameters are also given at the table bottom.

	CT1	CT2	CT3	CT4	CT5	CT6	CT7
Adelosina cliariensis (Heron-Allen & Earland, 1930)	0	0	0	0	0	0	25
Adelosina mediterranensis (Le Calvez & Le Calvez, 1958)	4	0	0	0	0	0	0
Affinetrina planciana (d'Orbigny, 1839)	0	33	0	0	0	0	0
Articulina carinata Wiesner, 1923	0	0	0	0	0	20	0
Asterigerinata mamilla (Williamson, 1858)	32	33	25	25	0	0	0
Astrononion stelligerum (d'Orbigny, 1839)	4	67	50	13	67	0	0
Aubignyna perlucida (Heron-Allen & Earland, 1913)	0	67	25	75	0	40	0
Bolivina alata (Seguenza, 1862)	0	0	0	0	0	20	0
Bolivina catanensis Seguenza, 1862	0	33	0	25	0	0	0
Bolivina earlandi Parr, 1950	0	33	0	13	17	20	50
Bolivina pseudoplicata Heron-Allen & Earland, 1930	0	67	0	13	0	0	0
Bolivina striatula Cushman, 1922	0	0	0	38	0	0	0
Bolivina variabilis (Williamson, 1858)	0	700	50	375	0	80	50
Bulimina aculeata d'Orbigny, 1826	0	0	0	0	0	0	25
Bulimina elongata d'Orbigny, 1846	4	0	0	13	0	0	0
Bulimina marginata d'Orbigny, 1826	0	33	0	0	0	0	75
Buliminella elegantissima (d'Orbigny, 1839)	0	33	0	0	0	0	0
Carterina spiculotesta (Carter, 1877)	0	33	0	0	0	0	0
Cibicides refulgens Montfort, 1808	68	33	125	88	100	20	25
Cibicidoides lobatulus (Walker & Jacob, 1798)	112	433	125	125	100	60	50
Cibicidoides variabilis (d'Orbigny, 1826)	64	0	0	0	0	0	0
Conorbella erecta (Sidebottom, 1908)	16	0	0	0	0	0	0
Cornuspira involvens (Reuss, 1850)	0	33	0	0	0	0	0
Cribrostomoides jeffreysii (Williamson, 1858)	0	0	25	0	0	20	0
Cycloforina sp.	4	0	0	0	0	0	0
Cymbaloporetta sp.	4	0	0	0	0	0	0
Discammina compressa (Goess, 1882)	0	0	0	0	0	0	25
Discorbis torrei (Bermudez, 1935)	0	0	0	0	0	40	0
Elphidium aculeatum (d'Orbigny, 1846)	48	0	0	0	0	0	0
Elphidium advenum (Cushman, 1922)	4	0	25	0	0	0	0
Elphidium crispum (Linnaeus, 1758)	4	0	0	0	0	0	0
Elphidium fichtelianum (d'Orbigny, 1846)	8	0	0	0	0	0	0
Elphidium pulvereum Todd, 1958	4	0	0	0	0	0	0
Eponides repandus (Fichtel & Moll, 1798)	0	267	50	13	0	20	0
Fissurina orbignyana Seguenza, 1862	0	33	0	38	0	20	0
Fissurina sp.	0	33	0	13	0	0	0
Fursenkoina subacuta (d'Orbigny, 1852)	0	0	0	0	0	20	0
Gavelinopsis praegeri (Heron-Allen & Earland, 1930)	168	233	25	75	17	80	25
Globocassidulina crassa (d'Orbigny, 1839)	0	33	0	63	0	40	0
Globocassidulina subglobosa (Brady, 1881)	0	233	0	175	0	80	0
Gyroidina umbonata (Silvestri, 1898)	0	0	0	13	0	40	0
Haynesina depressula (Walker & Jacob, 1798)	0	33	0	63	0	0	25
Haynesina germanica (Ehrenberg, 1840)	0	0	0	0	0	40	0
Laevidentalina communis (d'Orbigny, 1826)	0	33	0	0	0	0	0
Lagena sp.	0	0	0	13	0	0	0

continued

Table S2 continued

	CT1	CT2	CT3	CT4	CT5	CT6	CT7
Lagenammina fusiformis (Williamson, 1858)	0	33	0	13	17	0	0
Lamarckina scabra (Brady, 1884)	8	33	0	0	0	0	0
Lenticulina gibba (d'Orbigny, 1839)	0	67	0	0	0	0	25
Lepidodeuterammina ochracea (Williamson, 1858)	0	0	0	0	0	20	0
Leptohalysis scottii (Chaster, 1892)	0	0	0	13	0	0	0
Melonis barleeanus (Williamson, 1858)	0	0	0	13	0	0	0
Miliolinella semicostata (Wiesner, 1923)	0	0	0	25	0	0	0
Miliolinella subrotunda (Montagu, 1803)	120	500	375	200	183	120	125
Neoconorbina terquemi (Rzehak, 1888)	4	0	0	0	0	0	0
Patellina corrugata Williamson, 1858	4	2,867	1,300	1,488	1,250	2,040	2,900
Peneroplis pertusus (Forsskal in Niebuhr, 1775)	16	0	0	0	0	0	0
Peneroplis planatus (Fichtel & Moll, 1798)	8	0	0	0	0	0	0
Pileolina patelliformis (Brady, 1884)	0	33	0	25	0	0	0
Planorbulina mediterranensis d'Orbigny, 1826	36	0	25	0	0	0	50
Pseudotriloculina cuneata (Karrer, 1867)	0	0	0	0	0	100	0
Pseudotriloculina lecalvezae (Kaasschieter, 1961)	0	0	0	0	0	40	0
Pseudotriloculina sp.	8	0	150	0	0	0	0
Pyrgo inornata (d'Orbigny, 1846)	0	0	0	13	0	0	0
Quinqueloculina auberiana d'Orbigny, 1839	20	67	50	50	0	0	0
Quinqueloculina berthelotiana d'Orbigny, 1839	12	33	25	0	33	20	0
Quinqueloculina bosciana d'Orbigny, 1839	0	167	0	13	0	40	0
Quinqueloculina irregularis d'Orbigny in Terquem, 1878	16	0	0	0	0	0	0
Quinqueloculina laevigata d'Orbigny, 1839	0	0	0	0	0	20	0
Quinqueloculina lata Terquem, 1876	8	0	50	25	17	20	0
Quinqueloculina milletti Wiesner, 1923	0	0	0	0	0	60	0
Quinqueloculina parvula Schlumberger, 1894	8	200	75	138	100	20	25
Quinqueloculina pygmaea Reuss, 1850	0	33	0	13	0	40	0
Quinqueloculina seminulum (Linnaeus, 1758)	0	0	175	125	183	20	25
Quinqueloculina stelligera (Terquem, 1882)	12	67	250	13	83	40	25
Quinqueloculina ungeriana d'Orbigny, 1846	44	0	0	0	0	0	0
Quinqueloculina cf *venusta* Karrer, 1868	0	0	225	0	17	0	25
Rosalina bradyi (Cushman, 1915)	56	100	225	88	133	40	75
Rosalina floridana (Cushman, 1922)	16	133	0	50	0	20	0
Rosalina obtusa d'Orbigny, 1846	0	33	0	0	17	0	0
Rosalina posidonicola (Colom, 1942)	0	0	0	25	0	0	0
Sahulia conica (d'Orbigny, 1839)	44	0	25	0	0	0	25
Sejunctella sp.	0	967	400	125	233	120	250
Sigmoilina costata Schlumberger, 1893	0	67	0	38	33	0	0
Sigmoilina grata (Terquem, 1878)	4	133	0	13	17	0	0
Sigmoilopsis schlumbergeri (Silvestri, 1904)	0	67	450	150	550	40	75
Siphonina reticulata (Čžjžek, 1848)	0	133	25	38	150	20	100
Spirillina vivipara Ehrenberg, 1843	4	1,967	1,875	1,000	767	1,540	1,875
Spiroloculina ornata d'Orbigny, 1839	8	267	225	175	467	20	75
Spirophthalmidium emaciatum (Haynes, 1973)	0	1,133	250	225	17	420	400

continued

Table S2 continued

	CT1	CT2	CT3	CT4	CT5	CT6	CT7
Spiroplectinella earlandi (Parker, 1952)	0	100	75	0	67	0	50
Spiroplectinella wrighti (Silvestri, 1903)	16	0	0	0	17	0	0
Spirosigmoilina tenuis (Čžjžek, 1848)	0	0	0	50	0	0	25
Textularia agglutinans d'Orbigny, 1839	16	0	0	0	0	0	0
Textularia bocki Höglund, 1947	100	0	0	13	33	0	0
Tretomphaloides concinnus (Brady, 1884)	4	0	0	0	0	0	0
Triloculina plicata Terquem, 1878	4	33	0	0	0	0	25
Triloculina schreiberiana d'Orbigny, 1839	24	0	0	0	0	0	0
Tubinella inornata (Brady, 1884)	0	2,533	1,225	350	433	620	975
Vertebralina striata d'Orbigny, 1826	12	0	0	0	0	0	0
Unknown specimen	0	0	0	0	0	20	0
Taxa_S	**44**	**48**	**31**	**49**	**28**	**41**	**30**
Dominance_D	**0.06**	**0.11**	**0.12**	**0.11**	**0.12**	**0.19**	**0.23**
Shannon_H	**3.14**	**2.75**	**2.59**	**2.85**	**2.55**	**2.31**	**1.99**
FN	**1,180**	**14,300**	**8,000**	**5,763**	**5,117**	**6,120**	**7,525**

Table S3. Relative abundance of commonly occurring foraminiferal species.

	CT1	CT2	CT3	CT4	CT5	CT6	CT7
Bolivina variabilis	0.0	4.9	0.6	6.5	0.0	1.3	0.7
Cibicides refulgens *	5.8	0.2	1.6	1.5	2.0	0.3	0.3
Cibicidoides lobatulus *	9.5	3.0	1.6	2.2	2.0	1.0	0.7
Gavelinopsis praegeri *	14.2	1.6	0.3	1.3	0.3	1.3	0.3
Miliolinella subrotunda *	10.2	3.5	4.7	3.5	3.6	2.0	1.7
Patellina corrugata *	0.3	20.0	16.3	25.8	24.4	33.3	38.5
Rosalina spp. *	6.1	1.9	2.8	2.4	2.9	1.0	1.0
Sejunctella sp. *	0.0	6.8	5.0	2.2	4.6	2.0	3.3
Sigmoilopsis schlumbergeri	0.0	0.5	5.6	2.6	10.7	0.7	1.0
Spirillina vivipara *	0.3	13.8	23.4	17.4	15.0	25.2	24.9
Spirophthalmidium emaciatum	0.0	7.9	3.1	3.9	0.3	6.9	5.3
Textularia bocki	8.5	0.0	0.0	0.2	0.7	0.0	0.0
Tubinella inornata *	0.0	17.7	15.3	6.1	8.5	10.1	13.0

* epifaunal clinging-attached taxa according to Murray (2006).

Table S4. Absolute abundance of Brachiopoda.

	CT1	CT2	CT3	CT4	CT5	CT6	CT7
Argyrotheca cistellula (Searles-Wood, 1841)	14	15	51	20	19	32	22
Argyrotheca cuneata (Risso, 1826)	45	7	22	21	41	9	5
Gwynia capsula (Jeffreys, 1859)	0	0	0	0	0	7	0
Joania cordata (Risso, 1826)	29	0	0	0	0	0	0
Megathiris detruncata (Gmelin, 1791)	1	0	0	1	11	0	0
Novocrania anomala (Mueller, 1776)	22	5	10	4	78	0	0
Tethyrynchia mediterranea (Logan, 1994)	2	12	42	5	32	16	29
Total # individuals	**113**	**39**	**125**	**51**	**181**	**64**	**56**
Number of species	**6**	**4**	**4**	**5**	**5**	**4**	**3**