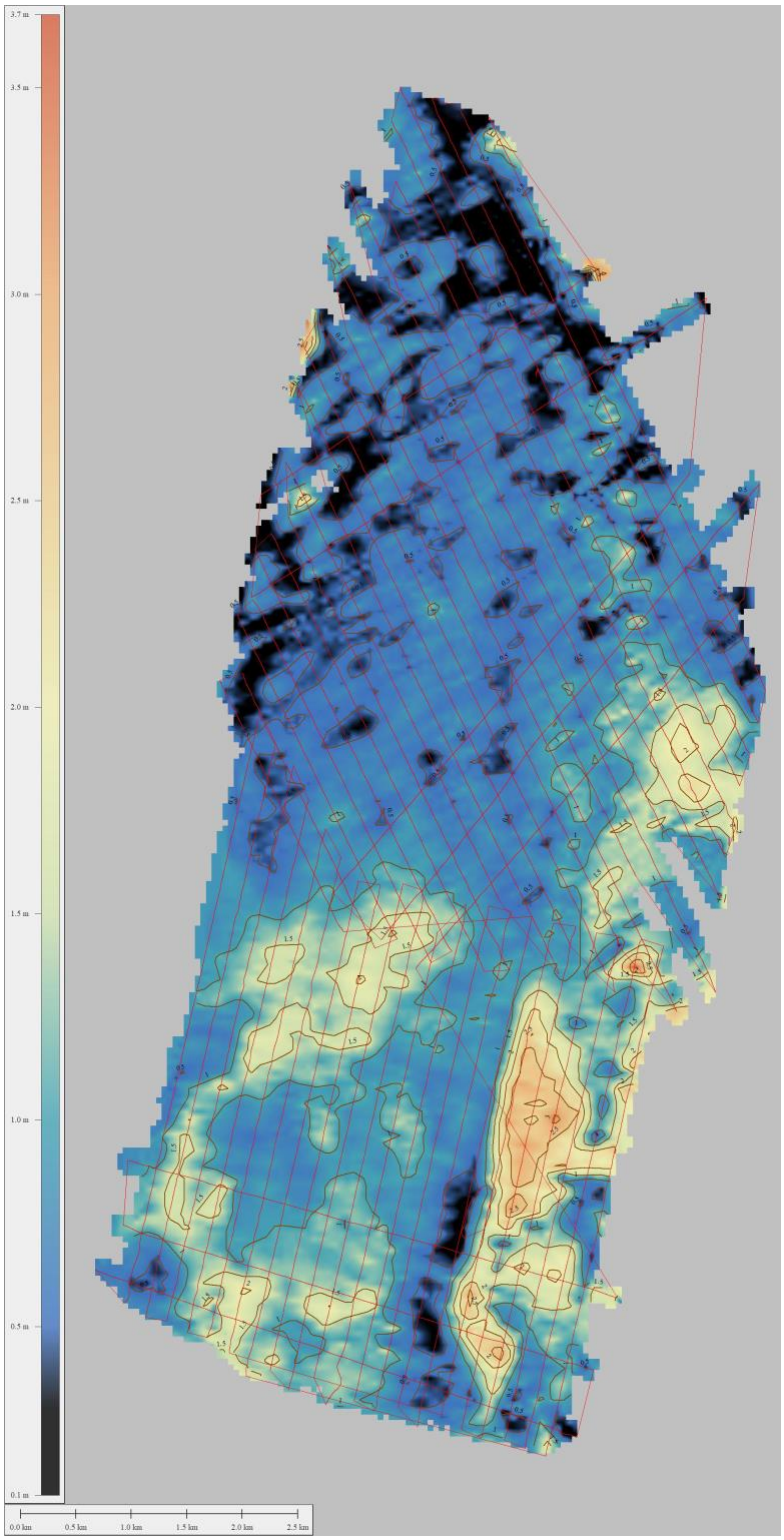
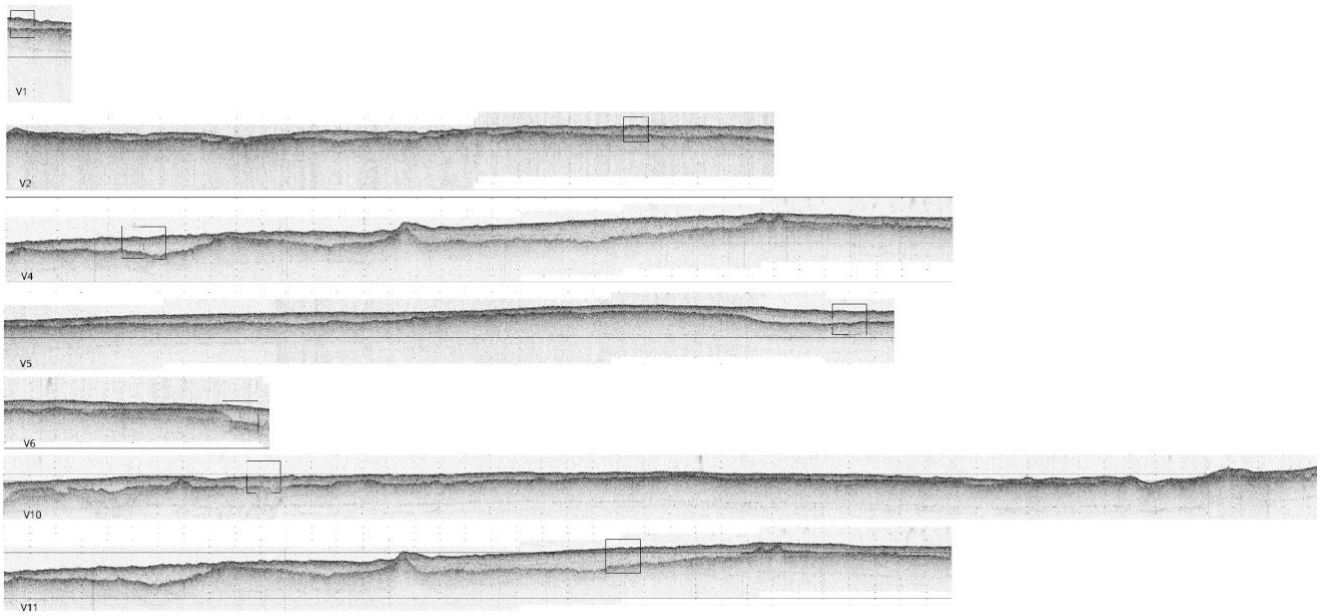
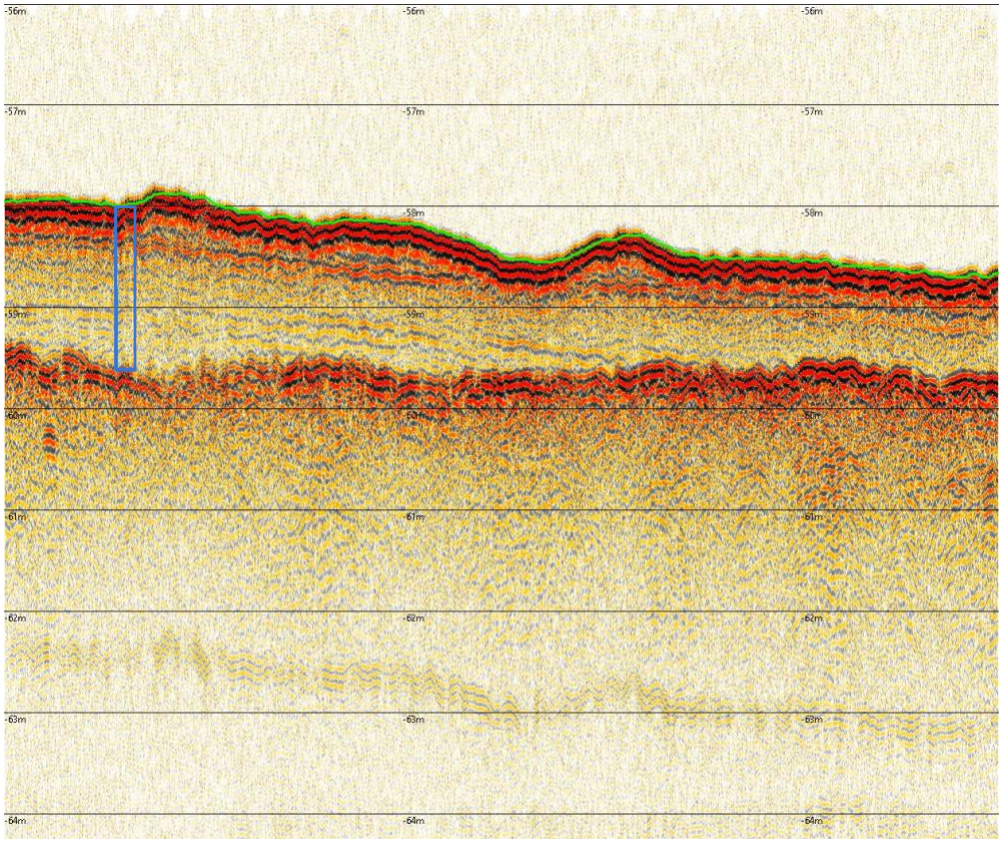
Supplementary Material 1 – Geophysical images

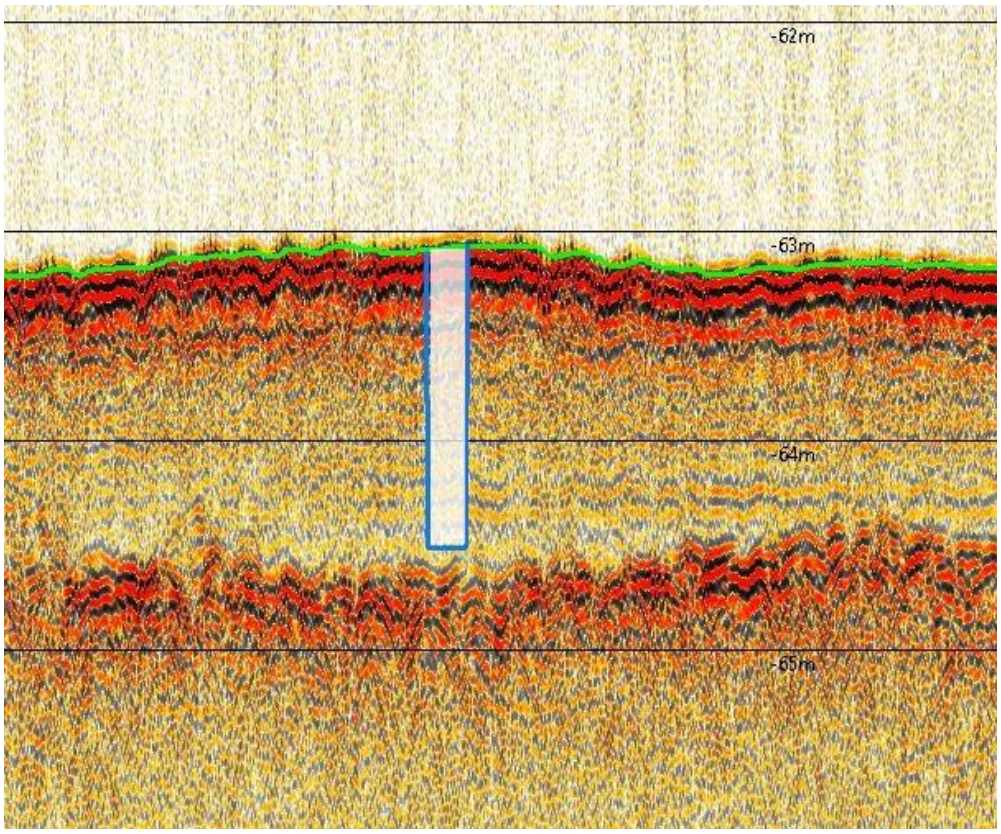


S1a - High-resolution seismo-acoustic profile acquired in May 2022 using an INNOMAR Medium-100 parametric echosounder, illustrating the internal architecture and thickness variability of the bioclastic deposit (left bar).



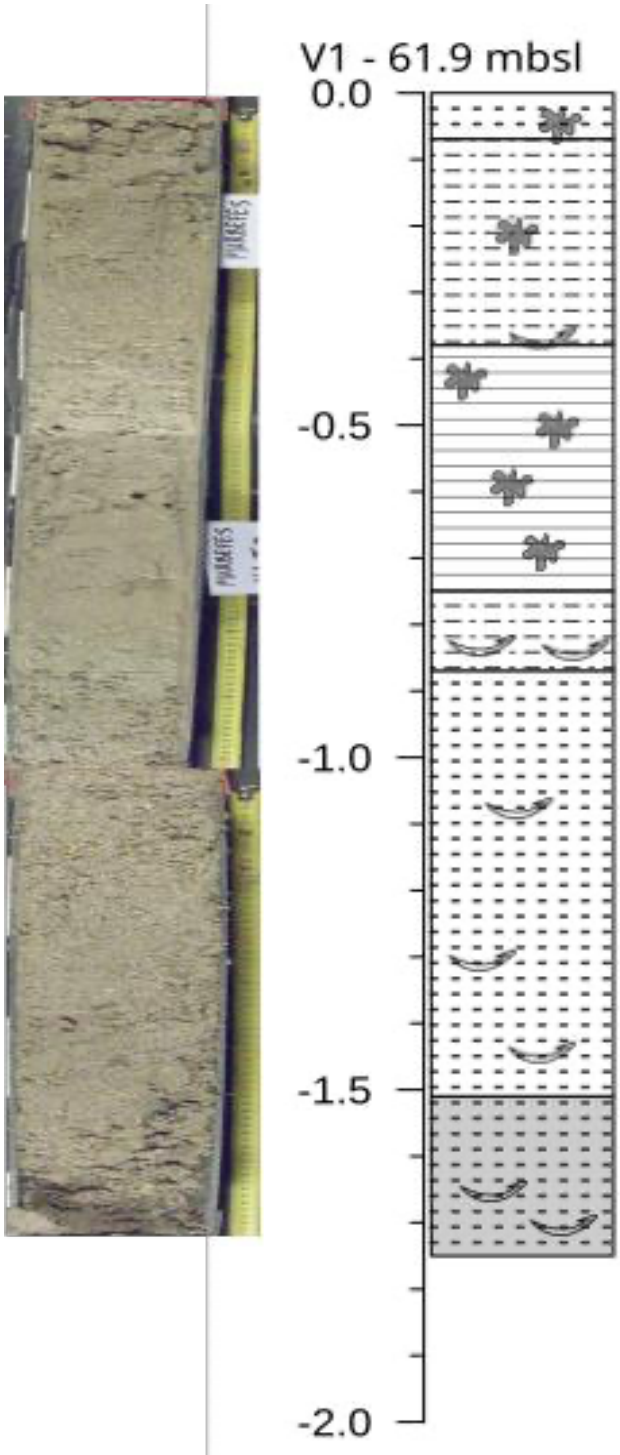
S1b - Geophysical transects showing the location of vibrocore extraction. The boxed region is shown in more detail in Fig. 3 of this supplement.



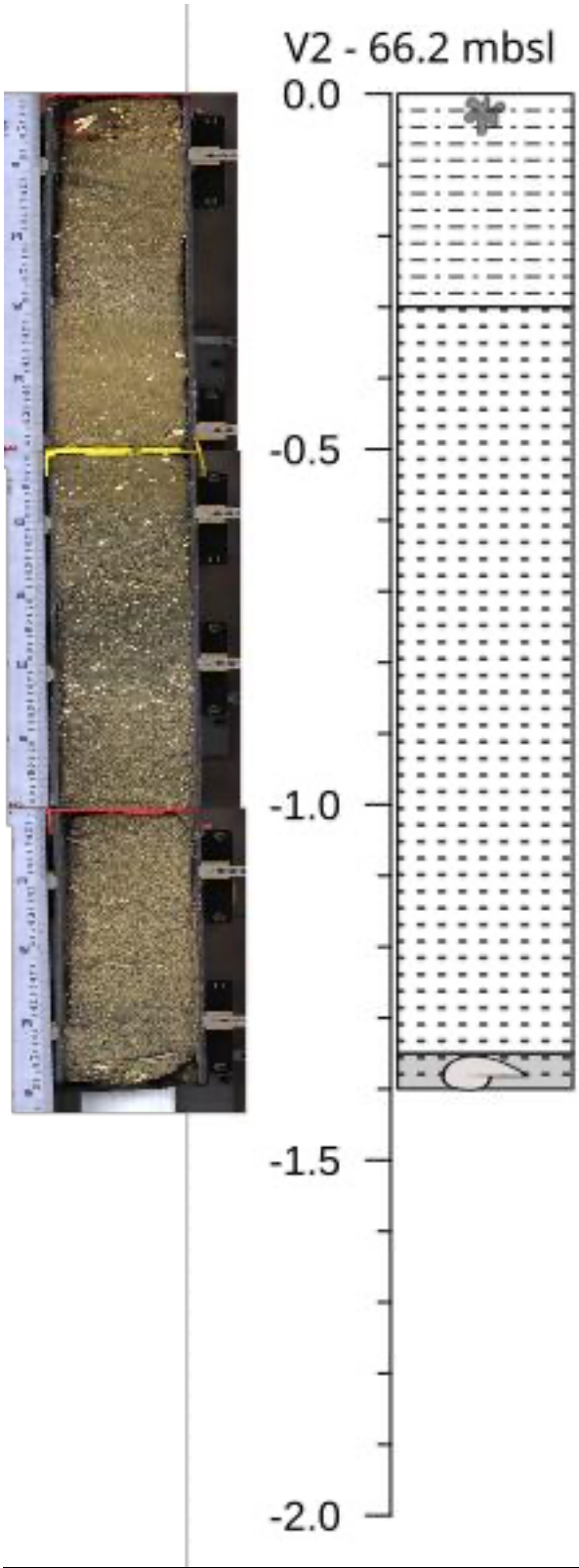


S1c - Representative high-resolution seismo-acoustic profiles acquired in May 2022, illustrating the bioclastic sedimentary deposit overlying the erosional unconformity. Profiles correspond to core locations V1 and V2. At V1, sediment thickness above the unconformity ranges from 1.30 to 1.83 m (mean = 1.50 m) over ~10 m profile length. At V2, thickness ranges from 0.31 to 1.98 m (mean = 0.96 m) over ~140 m profile length.

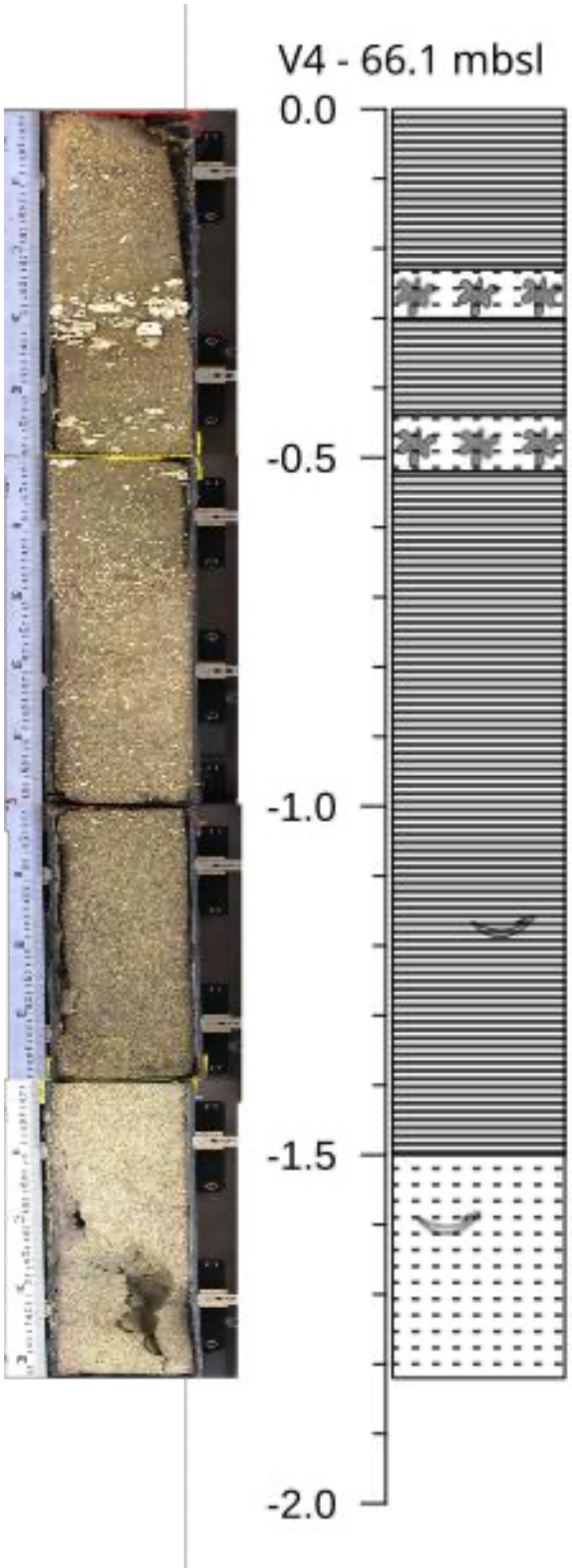
Supplementary Material 2 – Longitudinally sliced vibrocore photos with interpretation.



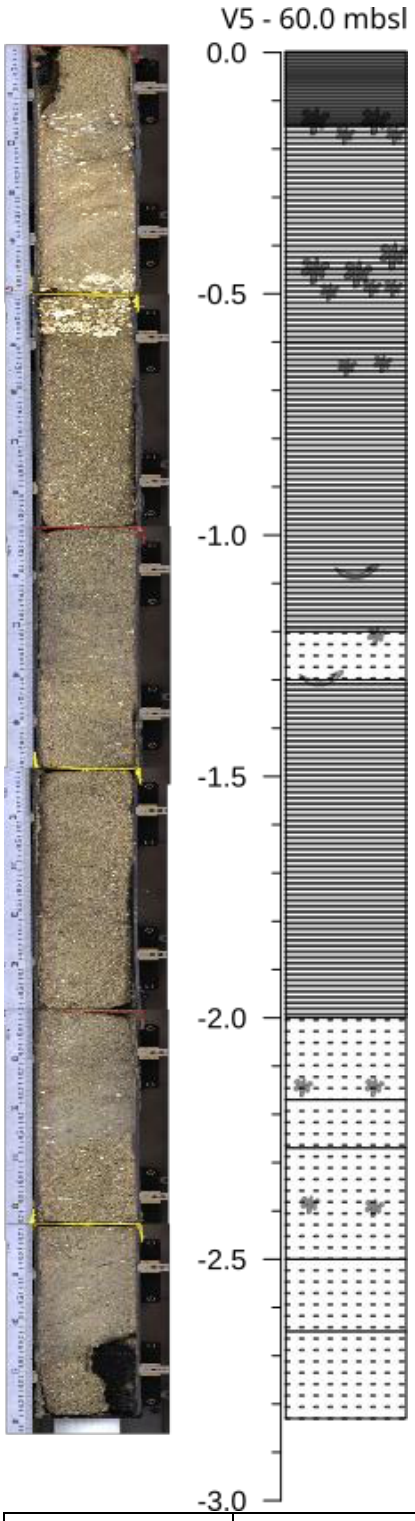
V1 (175 cm)	Lower 25 cm of core with hard, cemented, fine sand and large bioclasts (bivalves) between 175 and 165 cm (bottom of core). Scarce coralline algae. Mid section of core with fine to medium sand including large bioclasts (bivalves) and fragments of branched corallines. Upper section of core (87 to 7 cm) progressing from muddy sand to fine-medium sand, with abundant and dispersed fragments of branched and non-branched rhodoliths (especially from 65 to 36 cm). Surface layer (0 to 7 cm) with medium sand, containing branched and and non-branched rhodoliths.



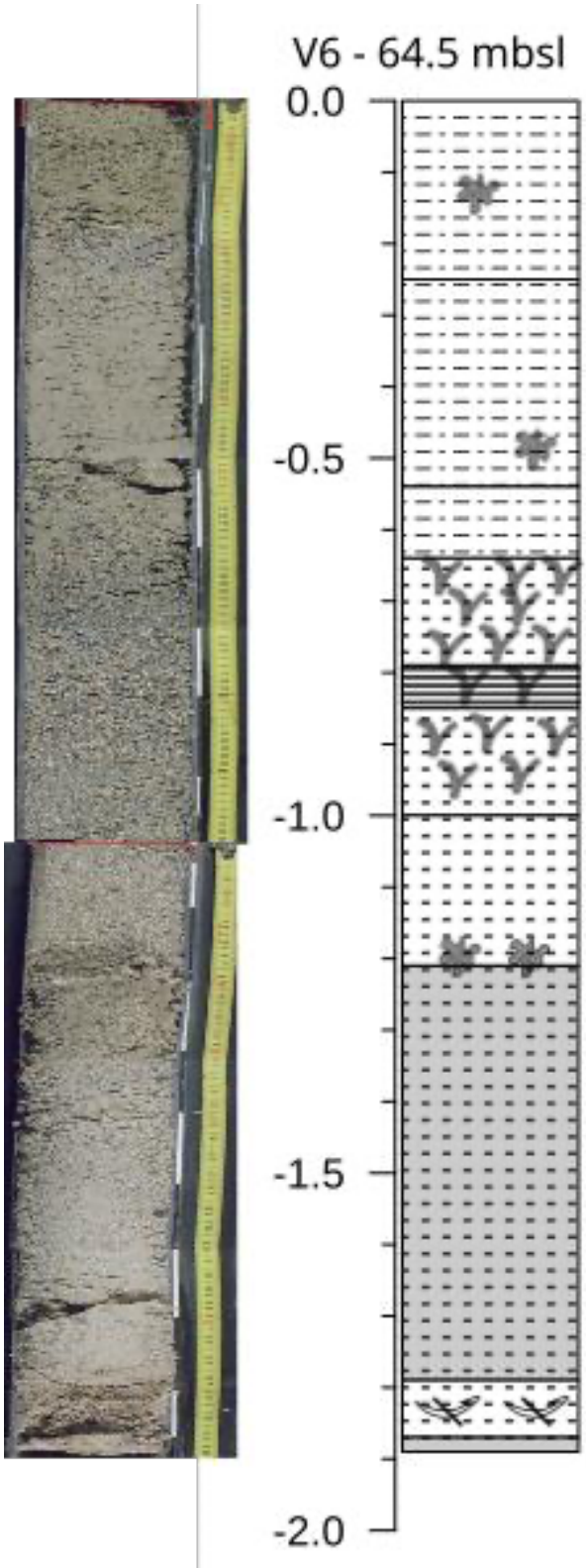
V2 (140 cm)	Lower 5 cm of core with hard, cemented, fine sand and large calcareous rock between 135 and 140 cm (bottom of core). From 135 to 80 cm fine sand with dispersed bioclasts (bivalve shells, scarce branched and non-branched rhodoliths). Mid section of core with medium sands and grey grains (siliciclasts), with lower bioclast component. Upper section (45 to 0 cm) with fine sand and dispersed rhodoliths (branched and non-branched), among other bioclasts. Large non-branched rhodolith at the core surface.



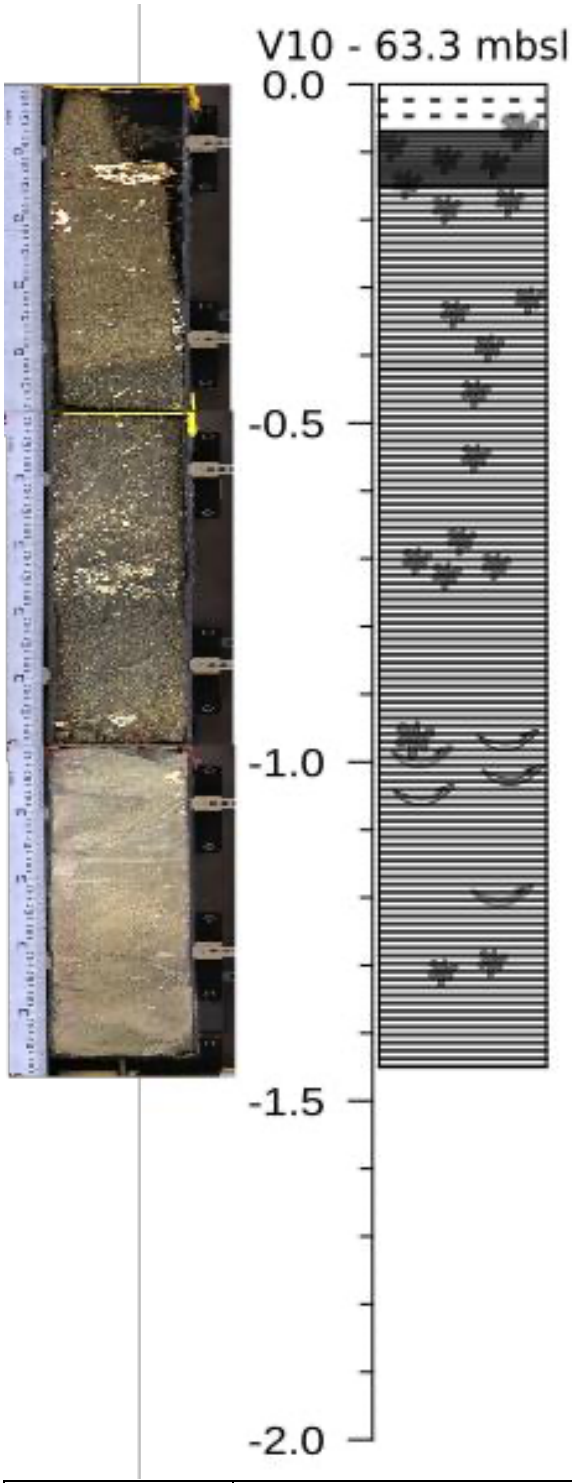
V4 (180 cm)	Lower horizon (150 to 180 cm) with fine sand and scarce bioclasts, including scarce fragments of branched rhodoliths. Mid section (50 to 150 cm) with coarse sand with loosely packed, relatively small bioclasts (bivalves and branched rhodolith fragments). Large non-branched rhodolith horizons at 45-55 cm and 25-35 cm in medium sand, followed by coarse sand to gravel sized grains, mostly of bioclastic origin, with branched and non-branched rhodolith fragments.



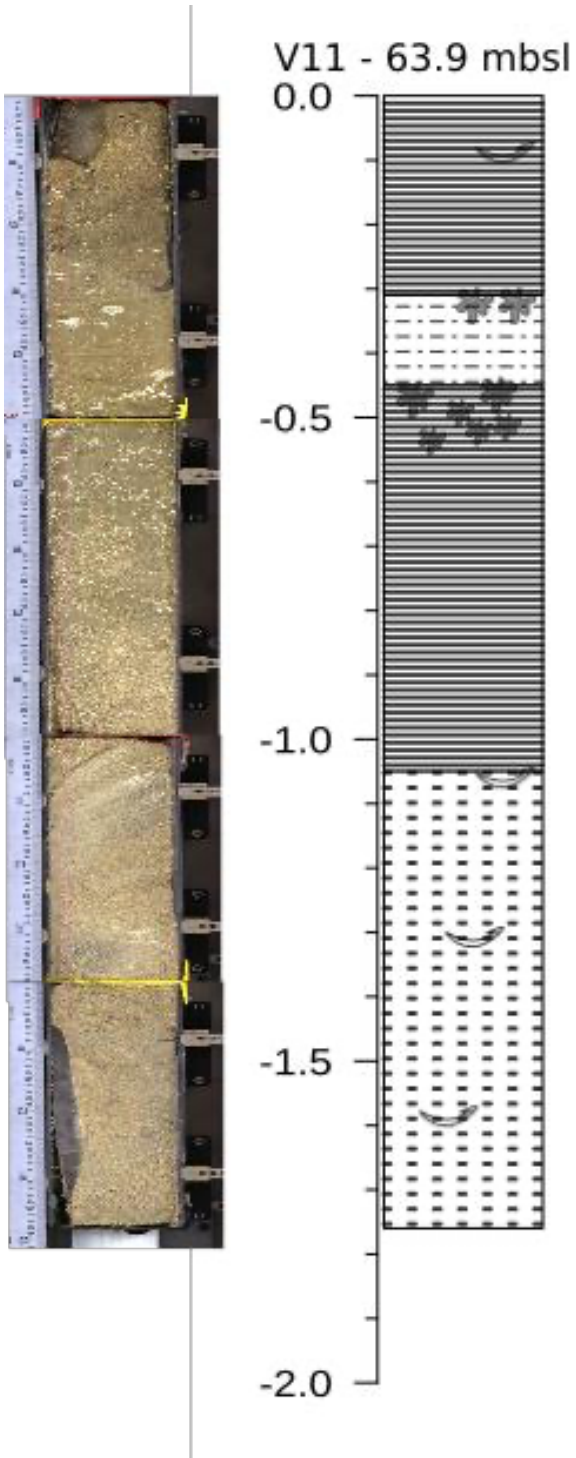
V5 (285 cm)	Bottom horizon with alternating layers of 20 cm approximately consisting of fine sands with gray grains and few bioclasts and fine sands with loosely packed bioclasts (small branched rhodoliths and bivalves, with occasional non-branched rhodolith remains). Mid section from 200 to 60 cm with medium to coarse bioclastic sands, with disperse fragments of rhodoliths (both branched and non-branched), interrupted from 130 to 120 cm by a band of medium sand with large bioclasts. Horizon from 60 to 45 cm with densely packed large non-branched rhodoliths. Upper horizon with coarse sand to gravel, with loosely packed rhodolith fragments.



V6 (190 cm)	Lower 50 cm of core with hard, cemented, fine sand, containing recognizable branched rhodolith fragments, among other bioclasts. Horizon with large non-branched rhodoliths at 120 cm. Mid section of core (120 to 65 cm approx.) with centimeter-size, loosely packed branched rhodoliths in medium and coarse sand. Upper section (65 to 0 cm) with muddy sand to silty sand, with dispersed branched and non-branched rhodoliths.



V10 (145 cm)	Coarse sand to gravel size bioclasts (disperse rhodolith and bivalve fragments) throughout, with abundant large non-branched rhodolith fragments at certain horizons (e.g. 130 cm; 95; 70 cm; 20 to 15 cm). Medium sands in the top 5 cm of sediment.



V11 (176 cm)	Lower 66 cm with fine to medium sand containing disperse bioclasts (bivalve shells of 5 cm and more), with scarce remains of branched rhodoliths. Middle section with coarse sand and abundant branched rhodolith fragments from 110 to 45 cm, capped by a 10 cm thick horizon with large, densely packed non-branched rhodolith fragments. This is followed by a 15 cm section of fine to muddy sand containing non-branched rhodoliths as well as branched rhodolith remains. Top horizon (30 to 0 cm) composed of coarse sand with disperse clasts (bivalve shells and abundant fragments of rhodolith branches).

Supplementary table 1 – summary data for carbon content (as %) in the first 50cm of the sediment column, including radiocarbon datation, sediment type and observed presence or absence of rhodoliths..

Sample	Corer Depth	Sediment type	Presence of rhodolith	Age cal BP (yr)	%TOC
V1	10	medium-fine sand	P		0.98
	20	sandy-silt	A		0.61
	30	sandy-silt	P		0.56
	40	sandy-silt	A		0.15
	50	silt	P		0.28
V2	10	sandy-silt	P		0.77
	20	sandy-silt	A		0.79
	30	sandy-silt	A		0.44
	40	medium-fine sand	A		0.35
	50	medium-fine sand	A	6470	0.65
V4	10	coarse sand-gravel	A		0.38
	20	coarse sand-gravel	A		0.70
	30	medium-fine sand	P		0.30
	40	coarse sand-gravel	A		0.88
	50	medium-fine sand	P	6672	0.88
V5	10	gravel	A		0.74
	20	gravel	P		0.98
	30	coarse sand-gravel	A		0.63
	40	coarse sand-gravel	A		0.38
	50	coarse sand-gravel	P		0.49
V6	10	sandy-silt	A		0.60
	20	sandy-silt	P		0.84
	30	sandy-silt	A		0.50
	40	sandy-silt	A		0.60
	50	sandy-silt	P	7058	0.31
V10	10	medium-fine sand	P		0.65
	20	gravel	P		0.79
	30	coarse sand-gravel	A		0.55
	40	coarse sand-gravel	P		0.46
	50	coarse sand-gravel	P		0.28
V11	10	coarse sand-gravel	A	113	0.29
	20	coarse sand-gravel	A		0.49
	30	coarse sand-gravel	A		0.42
	40	sandy-silt	P		0.30
	50	sandy-silt	P		0.85

Supplementary table 2a – Model selection (AICc; ML fits) for Carbon Density

Model ID	Fixed effects (logCarDens)	AR(1)	df	logLik	AICc	Delta AICc	Weight
m2b	depth_sc + d50_sc + carb_sc + bio_sc	No	7	-0.667	19.5	0.00	0.368
m2	depth_sc + d50_sc + carb_sc	No	6	-2.548	20.1	0.61	0.271
m3	depth_sc + d50_sc + carb_sc + sediment	No	7	-1.794	21.7	2.25	0.119
m3b	depth_sc + d50_sc + carb_sc + sediment + bio_sc	No	8	-0.462	22.5	2.98	0.083
m2b_ar	depth_sc + d50_sc + carb_sc + bio_sc	Yes	8	-0.667	22.9	3.39	0.068
m2_ar	depth_sc + d50_sc + carb_sc	Yes	7	-2.548	23.2	3.76	0.056

***Supplementary table 2b, c** – Final mixed-effects model (REML) for Carbon Density*

(B)

Term	Estimate (beta)	Std. Error	DF	t value	p value
(Intercept)	-0.536	0.083	24	-6.487	<0.001
depth_sc	-0.033	0.059	24	-0.565	0.577
d50_sc	0.177	0.057	24	3.123	0.005
carb_sc	-0.306	0.052	24	-5.898	<0.001
bio_sc	0.099	0.052	24	1.905	0.069

(C)

Component	Variance	Std. Dev.
Core (random intercept)	0.037	0.193
Residual	0.052	0.229
ICC (among-core variance proportion)	0.416	
N observations	35	
N cores	7	