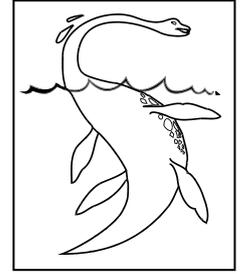
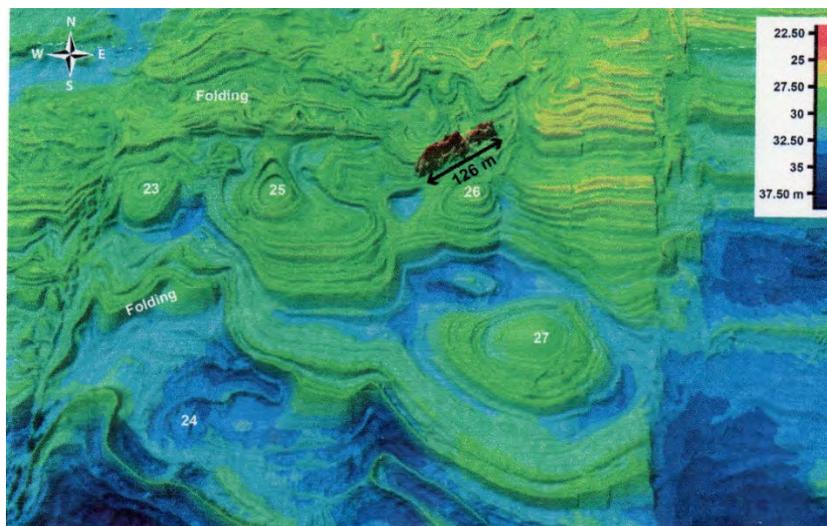


Isle of Purbeck Sub-Aqua Club



Bumps in the Bay 2



The conclusion to a research project on the large, circular seafloor anomalies
along the Jurassic Coast

Sponsored by The BSAC Jubilee Trust

2023

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Introduction

Historic – Prior to the “Bumps in the Bay; final report 2019”

The Jurassic Coastline, an UNESCO world heritage site, stretches 95 miles from Devon to Dorset. It has been cited as a geologist dream; the exposed folded layers of strata have enabled significant land-based studies to be undertaken without particular difficulty. However, underwater geological studies are limited.

A major breakthrough came with the multibeam survey DORIS (DORset Integrated Seabed study) This was a collaborative project between Dorset Wildlife Trust, Maritime and Coastguard Agency, Channel Coastal Observatory and National Oceanographic Centre, Southampton and was funded through a major award from Viridor Credits.

This underwater survey revealed large circular structures in the Purbeck Limestone which have not been seen in any of the coastal cliffs or quarries from Durlston Bay to Portland despite over a hundred years of geological research.

In 2018 Emeritus Professor of Geology, Dan Bosence, Royal Holloway University of London published a research article about them “*Discriminating between the origins of remotely sensed circular structures: carbonate mounds, diapirs or periclinal folds?*” (*Journal of Geological Society London, vol 155, 2018*)

This research was presented as a talk entitled “Bumps in the Bay” at the Etches Museum, Kimmeridge, Dorset. In the audience were a couple of members of the Isle of Purbeck Sub-Aqua club who had been diving on and around these structures for years without actually recognising their potential geological significance. After the talk the members and a couple of other divers in the audience introduced themselves to Dan and discussed the possibility of collaborating on a voluntary basis to undertake further the research. In particular, the collection of seafloor geological samples from these structures.

Completion of the First Stage – a synopsis as of December 2019

From the 8 hypotheses initially tabled for the formation of these seafloor anomalies; 4 were categorically eliminated as a result of the project work undertaken.

The achievement of this important staging post was presented to both the public and the scientific community at the following venues:-

Fine Foundation Gallery Durlston Castle, Dorset

National Oceanography Centre, Southampton

Royal Holloway University, London

During the presentations the support received from The Jubilee Trust was formally acknowledged.

The full details are available at <https://www.bsac.com/document/bumps-in-the-bay/>

Project Background – The Final Stage

It was stated in the 2019 report “.....progress has been made concerning the origin of the “Bumps” the definitive answer is still outstanding.. Because most of the dives have retrieved lithologies that are well-known within the Purbeck limestones it is thought that the rock types and the structure that actually formed the original bump are at a lower level than is exposed in most sites on the present day sea-floor. What we are seeing are the dome-shaped, or draping, cover, to the structure rather than the rocks forming the actual dome.

It is therefore planned to firstly carry out a more detailed view of the DORIS data using 3D imaging software that is revealing more information on bump morphology on the sea floor. This can be used to target sites that we now expect to reveal the older, lower levels of rocks that should provide the evidence we are seeking.

Sample collection is still key to resolving the origin of the bumps and now that the divers have proven themselves competent with single point sampling it has been suggested that “dip and strike” sampling along various transects using a preplaced line would enhance the data collection. Possible use of a clinometer has also been discussed.....”

To ensure that the project continued successfully a number of factors were experienced and addressed:-

Budget: the first few “Bumps” dives were a novelty, challenging the skill of the camera operator and the physical prowess of the person chipping lumps off the bottom. Pragmatically however, expecting divers to pay £50 a time to continue was a non-runner. A second tranche of money from the Jubilee Trust was applied for and awarded.

Covid: this stopped the project for a significant period, even after the lockdowns had finished. The social element of the Branch has always been an important element of its success; there was very little interest in continuing to dive until the requirement of “distancing” and “face-masks” had been lifted. Additionally, the HQ requirement of a 30M limit on all diving put many sites out of reach.

Availability of Hardboat: As a result of Covid and economic climate the local charter company reduced its fleet of 3 to a single boat, this had significant implications as if another more lucrative booking came in, we were “bumped”.

Utilising a RIB 1: We had already explored the feasibility of a member’s RIB during a “Shallow Trial Day” at the start of the initial Project but found that with the limited space, deployment of heavy shots, combined with lengthy ropes, could be a liability.

Utilising a RIB 2: The member replaced the boat mentioned above with a different format RIB; this one proved ideal with a bathing platform suitable for easy and safe deployment/recovery of both shot and divers. Unfortunately, the craft was plagued with a host of teething problems and planned Project dives were either postponed or cancelled. Once the problems were ironed out this craft proved ideal for a small team and was extremely cost effective.

Maximising the information from a dive: many of the Club divers were now adept at the tasks required so were asked to add clinometer evidence to the work package. A training day was scheduled to understand the practicalities of measuring the dip and strike of bedding planes and was well attended.

Standard protocols regarding the preparation of Risk Assessments, Dive-Plans and the completion of SOLAS forms would be undertaken before any divers entered the water.

Clinometer Methodology

A standard piece of equipment in a geologists' tool kit is the clinometer; it measures the incline or slope of the beds and direction. This was an item that 95% of our Club Members had never heard of let alone used.

These items are easily available in a number of formats for normal "surface" geology but nothing within the marketplace appeared suitable for our envisaged ocean bottom use. Not only was a sub-sea clinometer required to provide a geological reading but had to be built to survive the harsh environment and the undoubted poor treatment it would receive in transit. An entrepreneurial member designed and built half-a-dozen of them which have proven themselves and are still in fine working conditions after three seasons.

A dry, hands-on, training course on the Clinometer was given by Dan Bosence on bedded limestones exposed in the cliffs at Peveril Point. This is a location on the Jurassic Coast that replicated many conditions that would be found on the target sites.

The text and photos below indicate the clinometer and compass being used on dive site K2 and how it conforms with the interpreted slope imaged in MBES data on the northeastern shoulder of this bump. Use of the compass clinometer was successful in 10 dives and in each case the measured dip of bedding was consistent with the slope imaged on the MBES data.

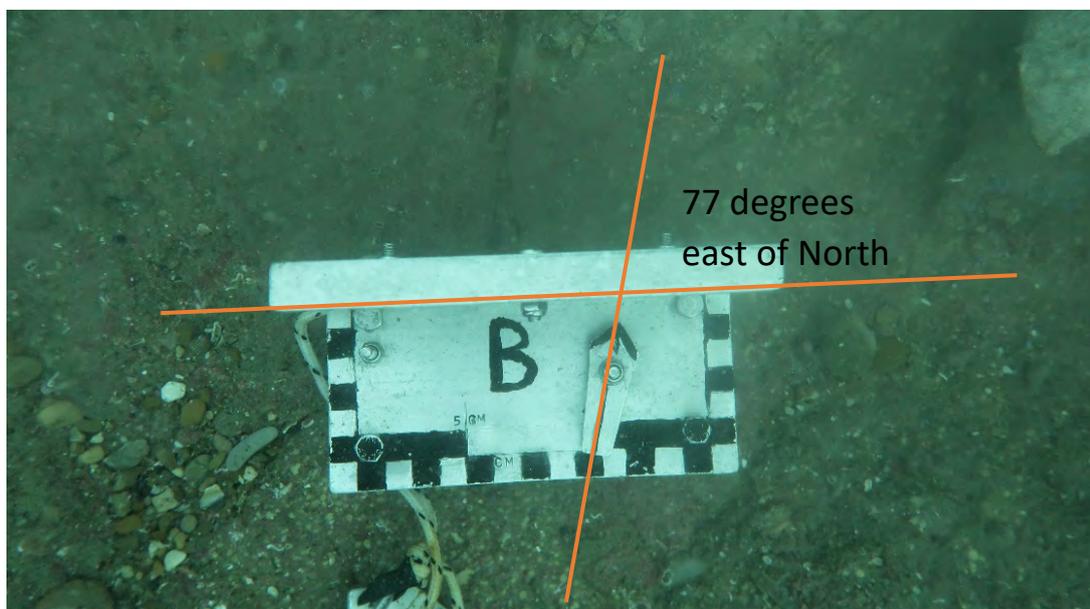
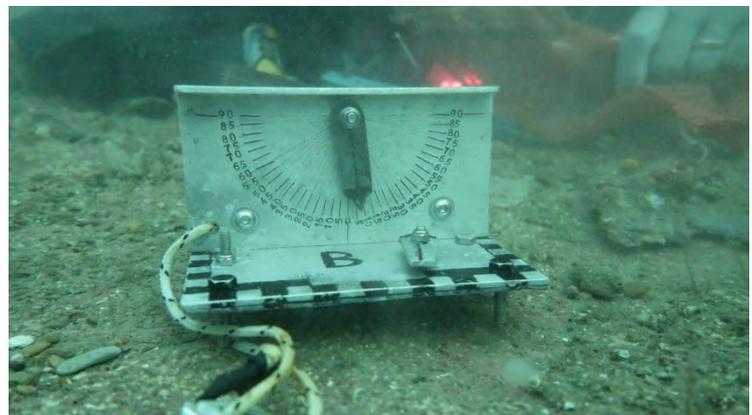
Site K2

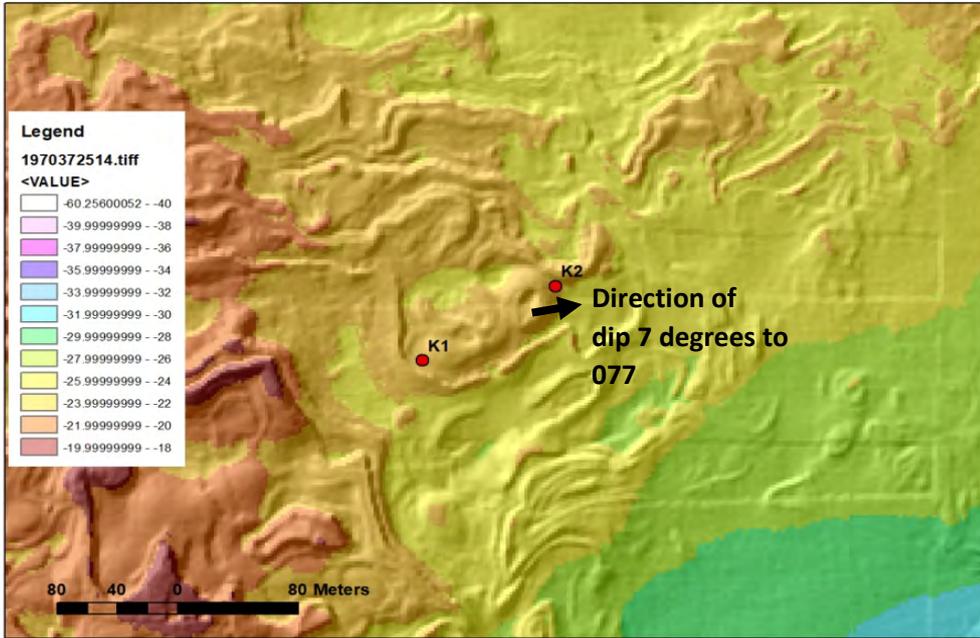
Nice clean bedding plane with Slightly angled view of clinometer showing gentle slope to the right (estimated at 7 degrees).

Below, clear vertical view of compass arrow set by diver to north.

This gives the direction of maximum dip of the beds of 7 degrees to 077

Direction of dip is consistent with that interpreted on from MBES image





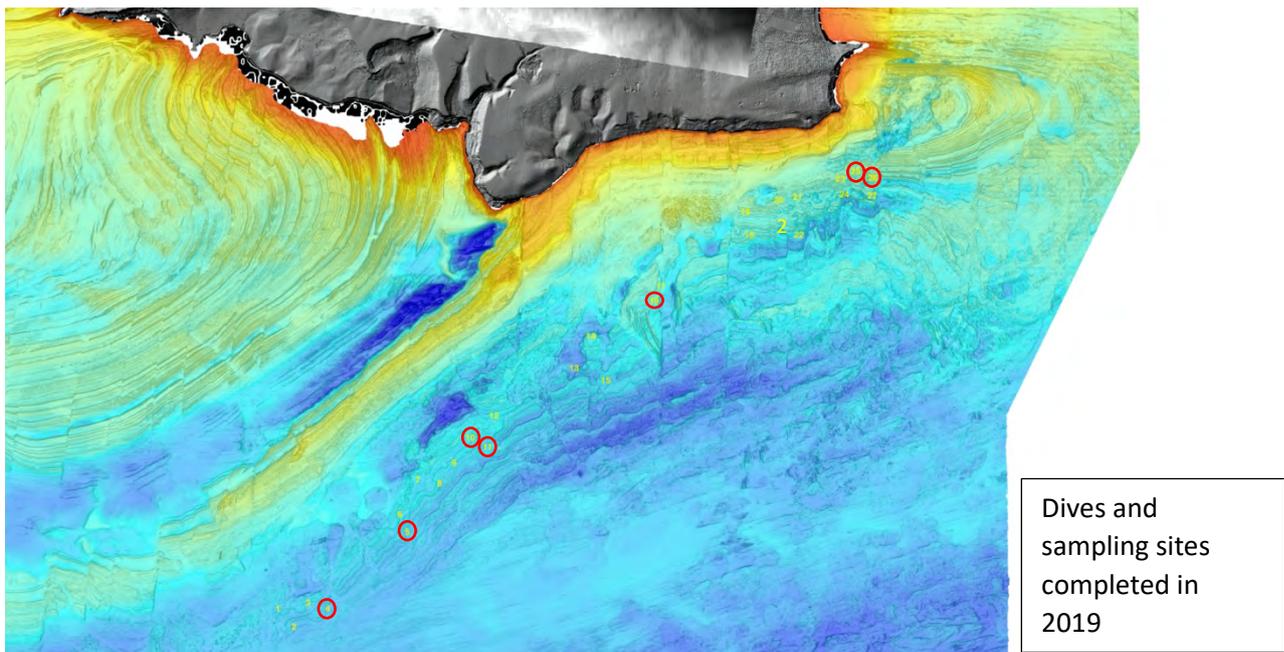
Identified Sites for 2021-2023 dives

The selection of sites for the post-Covid diving was based on completing the coverage of dive sites to include a greater geographic and stratigraphic spread of structures. In addition, desk-top studies using Surfer and Arc GIS software enabled 3-D viewing of structures to improve targeting of dive sites as shown in the image below:

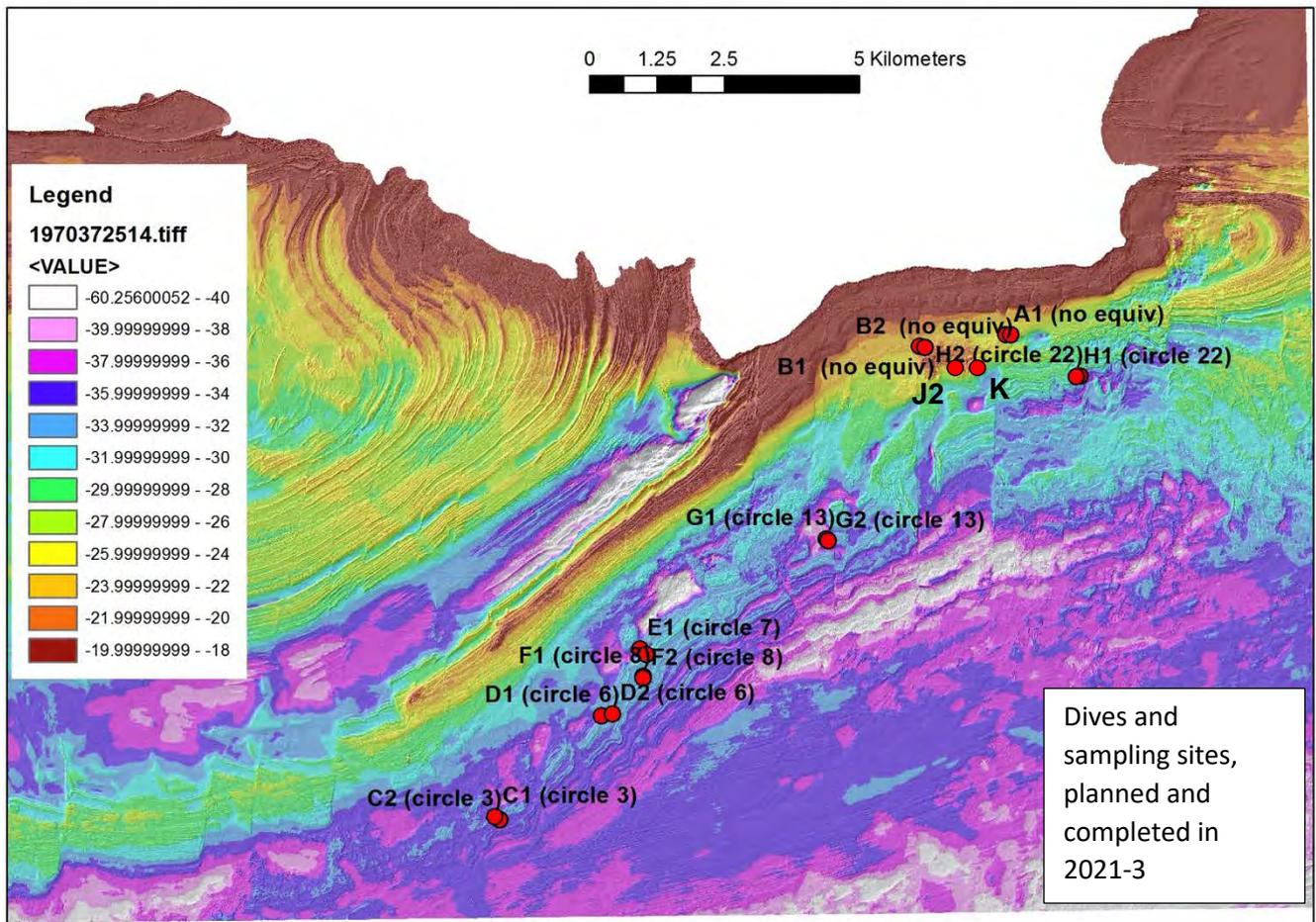
Bump 22 identified as suitable eroded structure with potential to expose core of bump.

Arc GIS image

The map below shows the structures sampled in 2019 (see 2019 Report)



The underlying map shows location of sites planned and sampled during the seasons 2021 to 2023.



Results

It took 3 years to finish the Project and it was judged to be a considerable success. Despite all the postponements, delays and knock-on effects of Covid 16 further sites were sampled; again, covering a geographical spread from northeast to southwest and from shallower to deeper water sites.

The table overleaf summarises the series of 11 successful days. The full details of each dive are available in "Diary format" in **appendix "A"**.

DATE	LOCATION	PARTICIPANTS	WEATHER	VIS	DEPTH	SAMPLES
3 rd June 2021	Site B1 Bump 31 50 34.674 02 0.390 Site B2 Bump 32 50 34.669 02 0.216	Peter Lightower Jeremy Goodall Keith Coombes Chris Dunkerley Jamie Robson Nick Reed	W/SW 3-4	5m	21m	5 samples along a roped transect between the 2 points
2 nd July 2021	Site A1 Bump 28 50 34.786 01 58.935 Mid Transect Bump 29 50 34.786 01 58.899 Site A2 Bump 30 50 34.786 01 58.863	Peter Mensikov Jeremy Goodall Chris Dunkerley Keith Coombe Nick Reed	Wind Variable 2-4	8m	25m	5 samples from 3 spot sites. 2 from A1 1 from mid-point 2 from A2
7 th June 2022	Site J2 Bump 33 50 34.592 01 59.837 Site J3 Bump 34 50 34.613 01 59.791	Peter Mensikov Keith Coombes Chris Dunkerley Iain Westman Stephan Spiriak Jamie Robson	Wind Variable 2-4	4m	22m	5 samples
18 th Sept 2022	Site K2 Bump 36 50 34.591 01 59.299	Peter Mensikov Jeremy Goodall Chris Dunkerley	N/NW 3-4	8m	26	1 sample
21 st Sept 2022	Site G2 Bump 13 50 32.729 02 01.779 Site mid-G Bump 13 50 32.739 02 01.794	Peter Mensikov Chris Dunkerley Jeremy Goodall Nick Reed	Wind variable going South 2-4	3m	37m	2 samples

13 th June 2023	Site J4 Bump 35 50 34.616 01 59.994	Chris Dunkerley Jeremy Goodall Pete Mensikov	Wind Variable 2-4	5m	21m	2 samples
28 th June 2023	Site G3 Bump 13 50 32.751 02 01.796	Chris Dunkerley Jeremy Goodall Pete Mensikov	SW 3-5	4m	39m	1 sample
29 th June 2023	Site G4 Bump 13 50 32.733 02 01.789	Pete Mensikov Chris Dunkerley Jeremy Goodall	NW 3-4	3m	36m	1 sample
24 th Aug 2023	Site E Bump 7 50 31.561 02 04.804	Chris Dunkerley Jeremy Goodall Peter Mensikov	Wind variable 3 or less	1m	34.5m	1 sample
25 th Aug 2023	Site H Bump 22A 50 34.364 01 57.794	Peter Mensikov Keith Coombs Chris Dunkerley	NW 3-5	3m	34.3m	1 sample
6 th Sept 2023	Site D Bump 6 50 30.978 02 05.350	Chris Dunkerley Jeremy Goodall Nick Reed	Wind variable 3 or less	3m	34m	2 samples

The main objective of the diving was completed in that 26 samples were retrieved. These were collected from in-situ outcrops that were photographed before and after sampling and were oriented for way-up. The samples are examined on freshly broken surfaces for their structures, textures and composition. Some are sliced and microscope slides have, or are being made to assess their petrography, their environment of deposition and for comparison with the documented outcropping strata along the coast.

To date 10 different lithologies (rock types) have been found from the entire project (2019-2023) comprising 9 limestones and 1 chert. Most of these are consistent with those that are known to occur within cliff outcrops of the Purbeck Limestone Group but some are previously unknown. Initial examination indicates that the previously unknown lithologies are microbialites where calcium carbonate is precipitated under the influence of lake-floor microbial communities (bacteria and algae). Such deposits form calcareous tufas and travertines in modern day lakes that get lithified into limestone in ancient rocks. The next stage in this research will be completing the analyses of the sampled rocks and assessing their environment of formation. This work will assess how the rock types that have been collect either supports or do not support hypotheses on the origin of the bumps, or circular structures of Weymouth Bay. The current working hypothesis is that the structures are formed from the build-up of tufa mounds in the large lake that existed in this part of Dorset during Late Jurassic times. Subsequent layers of calcareous lake sediments led to their burial and draping of younger limestones over the tufa mounds. Following uplift of the Jurassic sediments during the Alpine orogeny they were eroded and subsequently much later (post-glacial) erosion led to further erosion and exposure of horizontally truncated mounds and their mound-shaped overburden layers which form the bumps on the present-day seafloor.

Public Presentations

There has been considerable interest in the “Bumps in the Bay “project, both from the general public and from specialist scientific societies. Professor Dan Bosence was invited to give the following list of lectures about the Project. At each event specific reference was made to the funding and support given by the Jubilee Trust.

Bumps in the Bay; Enigmatic circular sea-floor structures off the Jurassic Coast.
Mole Valley Geological Society, Dorking.
10th February 2022.

Bumps in the Bay; Enigmatic circular sea-floor structures off the Jurassic Coast.
The Purbeck Society, Mowlem Theatre, Swanage.
8th April 2022.

Bumps in the Bay; Enigmatic circular sea-floor structures off the Jurassic Coast.
Farnham Geological Society, Farnham Maltings.
12th April 2023.

Bumps in the Bay; Enigmatic circular sea-floor structures off the Jurassic Coast.
Horsham Geological Society, Horsham.
13th September 2023.

Bumps in the Bay; Geology of offshore Dorset.
Wealden Geological Assembly, Lewes.
11th November 2023.

Bumps in the Bay – The Results
Isle of Purbeck Sub-Aqua Club, Langton Matravers, Dorset.
29th November 2023

Conclusions

Diving

- The significant dive planning, dry training and shallow practice events were soundly validated when the chipper and photographer successfully achieved all the set tasks in the very limited “no-stop” windows available at each site.
- The transfer of operation from Hard boat to RIB was seamless again due to planning and shallow practice.
- “Diving with a purpose” has enthused the whole team; interestingly some divers with personal commitments that severely limited their normal Club activities were still booking on the “Bumps” dives.
- Club membership has increased; very much an intangible, but general consensus is that the positive publicity generated by the Project has had a considerable influence.

Geological

- Collection of oriented, *in situ* geological samples was successfully completed in a range of sites covering the geographic and stratigraphic spread of the bumps and from shallow to deep water sites.
- The custom-built compass and clinometer proved to work successfully in this relatively challenging diving environment. The readings obtained enabled the dips of the beds imaged and interpreted on the MBES data to be “ground truthed” thus confirming their validity.
- Analysis of the collected samples demonstrates that nearly all of the sampled bumps are formed within the Purbeck Limestone Group and can be compared with outcropping rocks onshore along the Purbeck coast and the Isle of Portland. This confirms the previous mapping of ledges within the Jurassic strata imaged on the MBES bathymetry basemap.
- Samples from the eroded core of one of the bumps revealed a rock type characteristic of tufa mounds that are known to grow in present day and ancient lakes. Such mounds are consistent with the dimensions of the bumps in Weymouth Bay. This discovery supports our working hypothesis that the “Bumps in the Bay” are most likely to be ancient tufa mounds that grew within a large lake that existed in this area in Jurassic times. These mounds were subsequently buried by overlying Cretaceous strata, uplifted during Alpine mountain-building and then eroded to reveal the eroded bumps on the present-day seafloor.

Appendix A – Project Diaries

Bumps in the Bay – Project Diary

Day 1 – Thursday 3rd June 2021

Location (s) (WGS 84)

- Dive Site Transect B1 - 50° 34.674; 2° 0.390
 B2 - 50° 34.669; 2° 0.216

Expenditure from Grant

- £ 38.00 Air & Nitrox fills
- £ 210.00 Hard boat charter from Divers Down

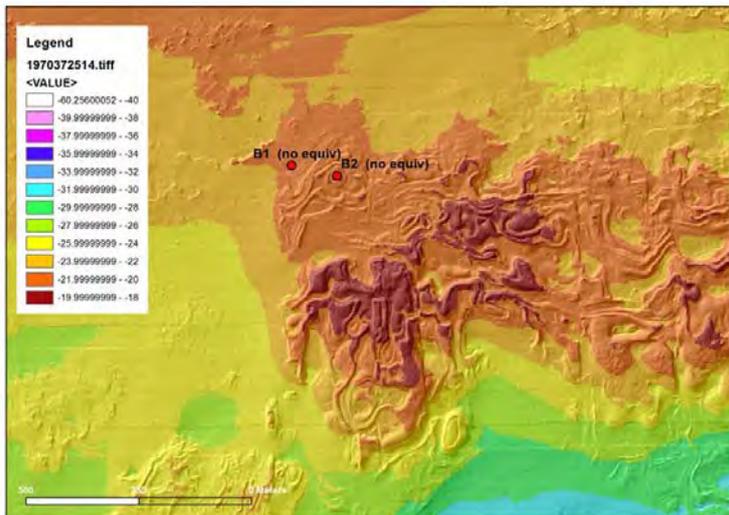
Expenditure to date

£ 248.00

Participants

- Nick Reed - Diver
- Chris Dunkerley – Diver
- Jeremy Goodall – Diver
- Pete Lighttower - Diver
- Keith Coombs – Diver
- Jamie Robson - Diver

Site – Approx 1½ miles directly South Dancing Ledge. Low water slack mid position 21M

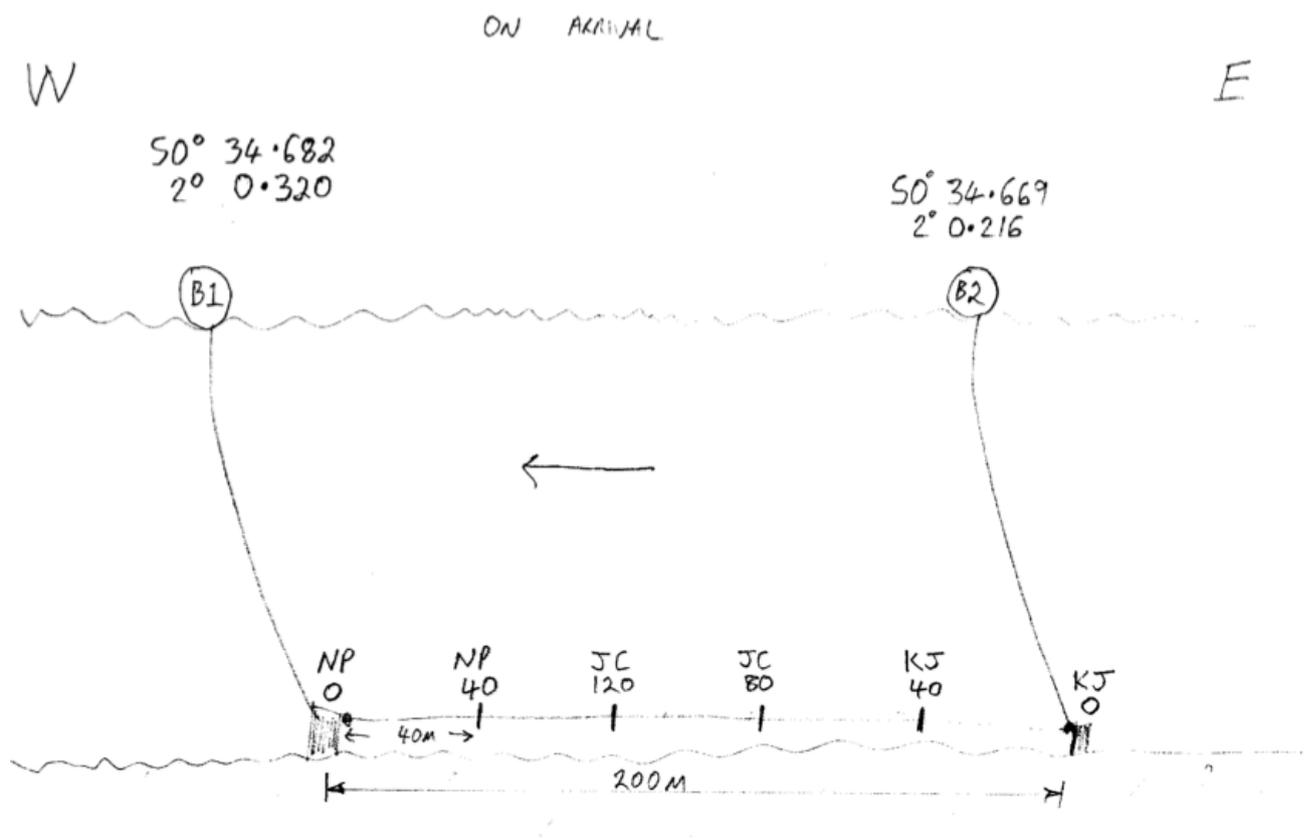


This was the first of two, relatively shallow, trial dives to determine the feasibility of diving along a given transect line as required by Dan and Ian (his co-author). The “worst case” from this years series of transect diving is transect D1 to D2, a distance of 210M. Transect length is 104M between B1 and B2. Samples KJ0; KJ40; JC80 are the ones actually on the required transect; samples NPO and

NP40 will be a bonus (?) to the geologists. The main focus of the day was “can a 200M bottom line be deployed and utilised at 30M plus”?.

Good conditions with sea-state “smooth” and W to SW F3-4

Prior to departure considerable thought had been given to both the dive planning and the methodology of laying the line. The dive boat skipper had prepared an interconnected marked line and twin shots in accordance with the hand-drawn sketch. **NB this was the planning sketch; B1 actually ended up at 50° 34.674; 2° 0.390**



The dive plan was modified prior to departure as the skipper felt that it would not be safe to deploy or recover the chippers kit on this transect set-up as previously done on a single shot and line. Individual chippers were briefed on this and each one confirmed they were happy with this change and would either carry the kit up and down or use a lift-bag or SMB to send it up if they felt unhappy bringing it up on their person.

Once on site the 56 lb shot B2 was deployed and after it had reached bottom the 200M bottom line was fed out by hand as the boat drifted/powerd with the remains of the ebb; during this procedure a tautness was kept on the line, this was a bit of a balancing act though as there was the possibility of pulling the already deployed shot off target. Once the 200M line was fully out the shot B1 was deployed. It was noted that, as expected, it went beyond the actual mark B1 and the skipper ran over both marks and pinged them when the divers were in the water. B2 was confirmed as on target with B1 at 50° 34.674; 2° 0.390

NB 1 This was a “once off” opportunity; the time of deployment was critical and was based as being as early as possible to allow the divers to get the tail end of the ebb but not too early as the shot would be dragged off the target by the tide. This very limited window negated a recovery and redeployment if things had gone wrong – the day would have to be aborted.

NB 2 The skipper insisted that all divers be separated from the area where ropes and shot were present and just prior to the actual deployment a crew member was repeat briefed on handling the shots/rope. Watching a hundredweight of cast iron and 250M of rope plus associated fittings disappear over the back of the boat confirmed absolutely the skippers dictate.

The deployment was professional and textbook but a myriad of potential problems were evident.

The team of 6 divers split into 3 pairs with a planned staggered entry i.a.w the dive plan.

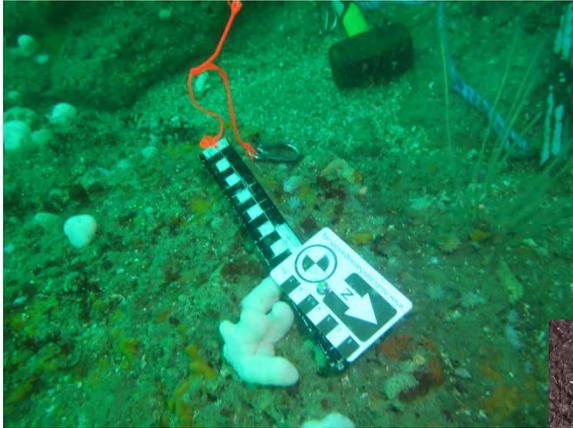
Visibility was around 5M. The “No-stop” air operational window was 30 minutes. 5 samples were obtained.

The first pair swam 80M along the line prior to starting work so they got quite a good overview; the site appeared relatively flat with minimal marine growth; very little loose debris and with ledge edges clearly visible i.e. giving a chance for good and easy samples however all chippers reported frustration as every blow of the hammer/chisel resulted in a cascade of debris rather than a decent lump – the strata was riddled with holes. Exemplified by looking at these two photographs at JC80; “before” is with the chisel, “after” includes the direction indicator



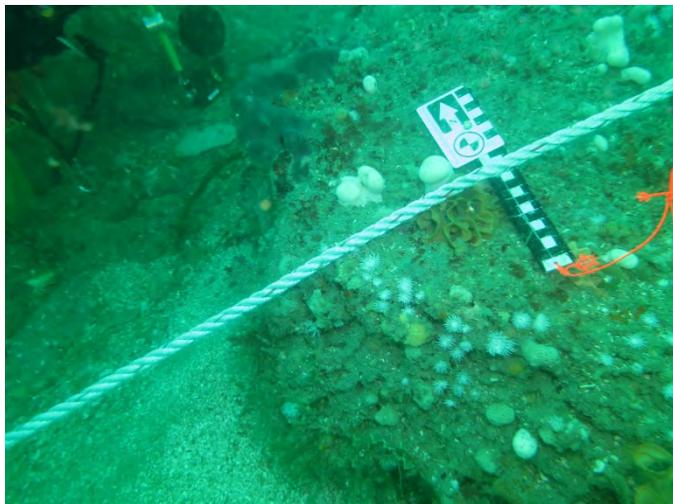
An operational glitch occurred with the first pair (the long-distance swimmers). Their time from surface to first sample JC80 bagged was 8 minutes – this was excellent and the chipper was confident that with only another 40M to swim success was assured... until he looked for the rope; the rope which was next to the pair when they started had either floated off or been dragged off by the effort of tide and other divers now on it. The pair did a North / South search but to no avail they then sent up their DSMB. Lesson learnt.



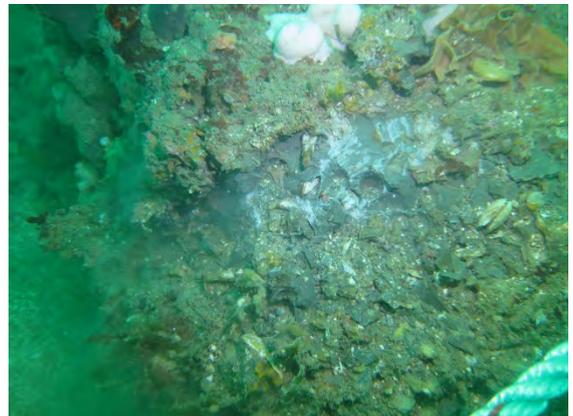


The second pair reported good viz and good slack. Only problems were the short turf on the rock which made it difficult to mark the rock sample, and the hardness of the second rock meant that it was difficult to get a good sample. On reflection it would probably been a good idea to chisel the turf off of the sample area before taking the sample. The floating rope was not

really a problem with this pair as they dumped buoyancy and swam along the rope bringing it down until they got to the mark and then put a large stone on it so that it stayed in place. The photo above shows site KJ0 was fairly flat and the photo to the right showed just how riddled the sample was

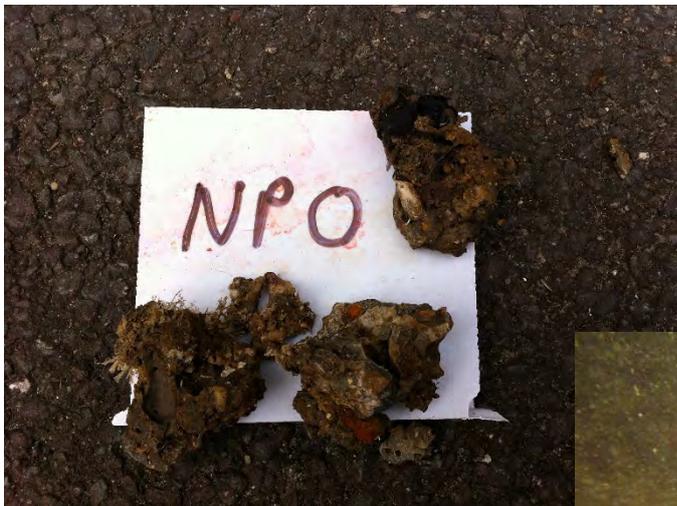


The rock here on the left KJ40 was about 400mm high and looked ideal for a good sample but a study of the photo below taken after the sample was removed shows just why the chippers were struggling.





After sampling the second pair swam back along the line back to the shot over a number of ledges (although the depth only varied from about 22m at KJ40 to about 21m at KJ0 the highest ledge stepped up about 750mm at about halfway (20m) and was running about SSW to NNE as shown here, camera pointing East. No sample taken.



The final pair provided samples of interest from beyond the designated transect. Sample NPO was on the "new" B1. These 4 photos show the site, orientation and the sample in the dry. Although beyond the target area the sample at NPO showed similarities to the other targeted sites.





Even before work commenced there was a lot of sediment in the water which limited the “site overview photograph.

This final pair were very conscious of Dans instruction that “only bedrock was to be recovered” but at NP40 this instruction posed a problem – the sample was levered out rather than chipped, the chipper warned that perhaps it should be viewed as “suspect”; it appeared to have broken off rather than rolled in but even so it cannot be defined absolutely as bedrock



Significant evidence of boring species on the site.



The sample on the surface

Summary

This dive is the first of two “shallow” trials.

More photographs are available some of which are 25Mb resolution if required. Photos of NP0 and NP40 were on a macro lens and are currently being reviewed and processed for inclusion in the final version of this report

A number of observations were made: -

- The two shot and a bottom line system, although successfully proven on this dive are probably not feasible at 30+ M depth or if conditions are any less than perfect. A post-dive debrief considered 3 different shots along the specified line. This will probably be tried during “Trial 2”
- The kit each diver needs should perhaps be prepared in an individual “project bag” rather than each individual rummaging around in the “project tub” just prior to the dive and then hanging the kit off themselves in a, not ideal, “Christmas Tree” fashion.
- There was feedback from the first, draft, issue of this report that the sample IDs needed clarification :-

KJ 0 On the shot B2 50° 34.669; 2° 0.216

KJ 40 40M from B2 Westwards along the line towards B1

JC 80 80M from B2 Westwards along the line towards B1

NP 0 On the shot B1 50° 34.674; 2° 0.390

NP 40 40M from B1 Eastwards along the line towards B2

Bumps in the Bay – Project Diary

Day 2 – Friday 2nd July 2021

Location (s) (WGS 84)

• Dive Site Transect	A1	50° 34.786	01° 58.935
	Mid transect	50° 34.786	01° 58.899
	A2	50° 34.786	01° 58.863

Expenditure from Grant

- £ 42 Air & Nitrox fills
- £ 210.00 Hard boat charter from Divers Down

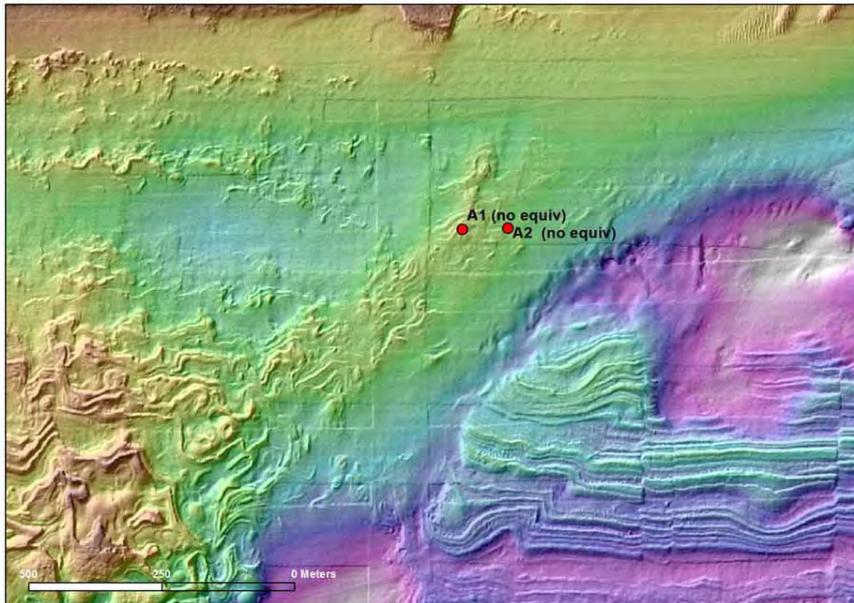
Expenditure to date

£ 500.00

Participants

- Nick Reed - Diver
- Chris Dunkerley – Diver
- Jeremy Goodall – Diver
- Pete Mensikov - Diver
- Keith Coombs – Diver

Site – Approx 1½ miles directly South of the Western Mile Marker. Depth at low water slack, mid transect, was around 25M



This was the second of two, relatively shallow, trial dives to determine the feasibility of diving along a given transect line as required by Dan and Ian (his co-author). The first trial, although very successful, showed that the idea of a bottom line was a fine in theory but could give rise to any number of problems. In the

future therefore a change in approach was needed. Discussion since the last trial focused on the idea of 3 separate shots on the Transect and a pair going down each one. It was decided to use this trial, trial 2 to verify the approach.

Good conditions, 5 days after Springs with sea-state “smooth” and wind V2-4.

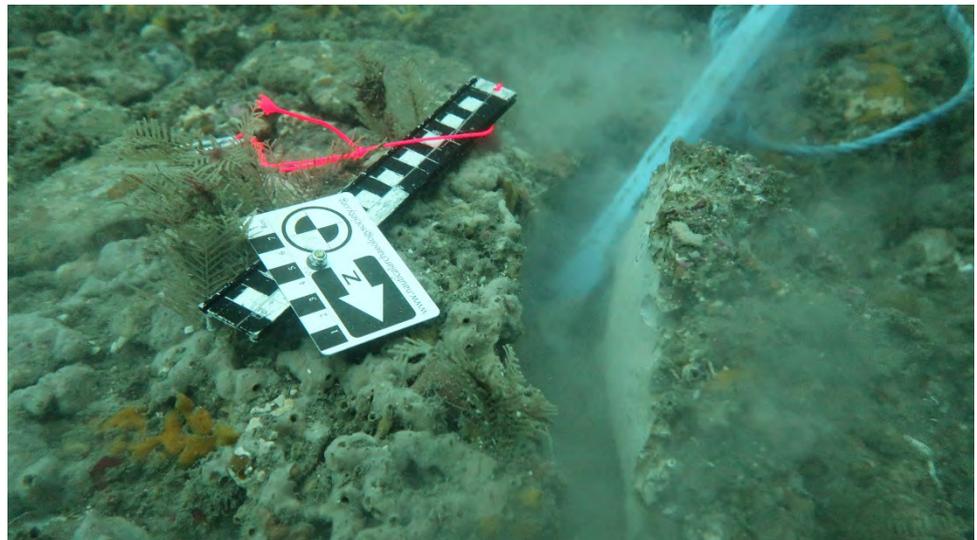
Again the dive plan was modified slightly prior to departure as the skipper stated he was happy for the hammer/chisel sets to go down with each shot he didn’t want to recover them and that the divers would have to bring them up themselves. This request was valid and understood as once the tide turned to get three shots back on board before the buoys were dragged under needed to be undertaken swiftly, bringing the hammer/chisel sets over the front of the vessel rapidly would not be safe and could damage the boat. The method of bringing the items back was left to the discretion of the individuals to either carry the kit up or use a lift-bag/SMB.

Arrival at site was planned to be well prior of slack. Once on site the three shots, around 10Kg each, were individually deployed; it was a good operation and the marks, once checked, were spot on (+/- 5 metres)

The team of 5 divers split into 2 pairs and a solo (equipped as per BSAC guidelines) with a planned staggered entry i.a.w the dive plan.

Visibility was around 8 to 10M. The “No-stop” air operational window was 24 minutes. 5 samples were obtained.

The first pair in were tasked with a sample on A2 and then another 10M west. The site on the shot at A2 was ideal for sampling with a clear ledge. The chipper was extremely surprised by the way the stone cleaved with relatively little work, completely different from all previous samples.



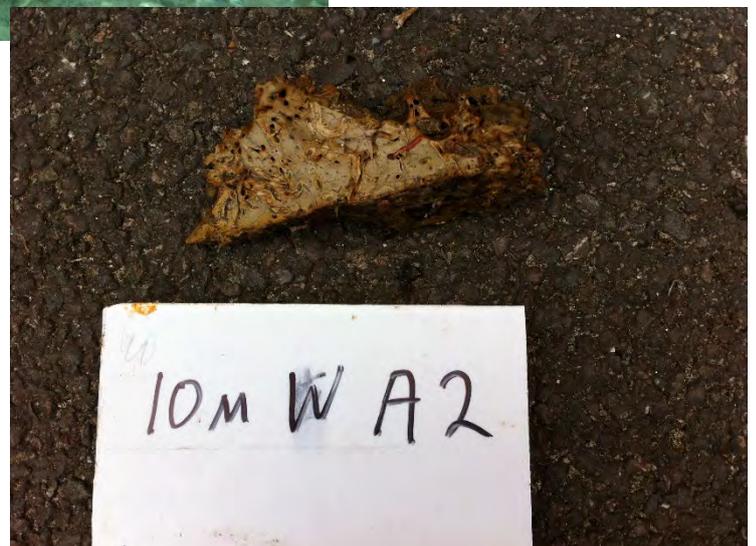


Not only was the vertical cleaving easy but due to the thickness of the ledge a most significant sample was achieved. Because of the roughness of the outcrop surface the clinometer would have provided little information, every site within a metre of the shot would have given different readings



The first pair then moved 10M west of A2; here the bottom appeared similar but sampling was completely different with the frustration of crumbling rather than cleaving. Again, the photographer would struggle to get a clinometer reading of

any value



The second pair were tasked on the Mid-Transect and 10M west



To get a decent sample they had a difficult search and finally located a suitable site 4.6M East of the shot; again, here the chipper was surprised at the behaviour of the rock; this photograph of the Mid-Transect after sample removal demonstrates just how unusual the sampling was. It was relatively simple to extract a sample like a house brick from a wall.

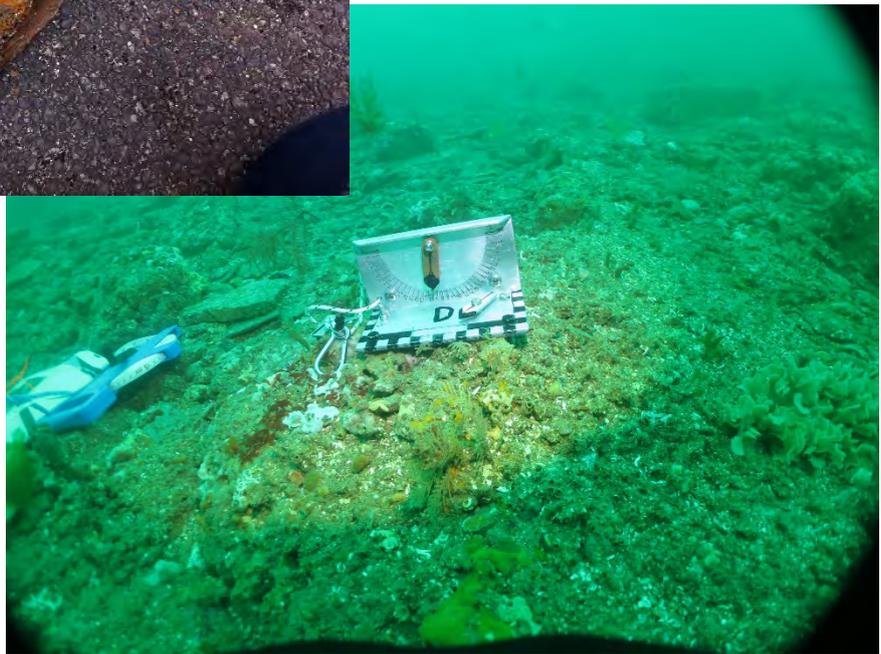
These two views of the sample clearly show the “house brick” analogy.

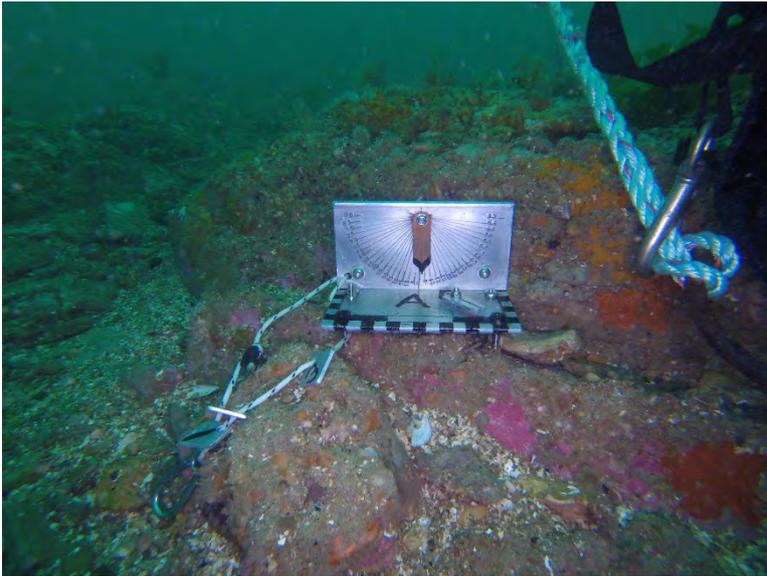




On this mid-transect site the correct positioning of the clinometer was not possible due to the roughness of the surface and could give rise to a myriad of measurements dependant on position as can be seen here.

Unfortunately, the pair were unable to obtain a second sample in the no-deco time available due to the seabed being covered in loose crumbling debris





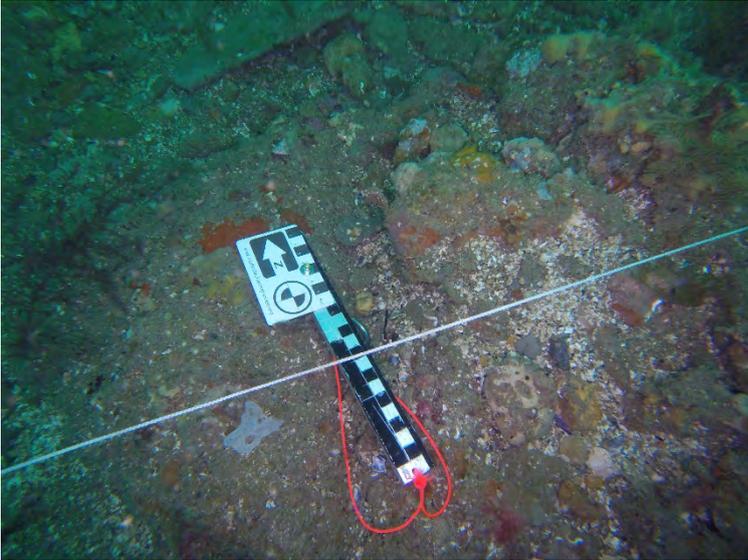
The last diver in was on A1 under BSAC solo conditions but with Nitrox allowing an extended dive giving two samples, photographs and a video from the 10M West site. A significant achievement. Obviously as the depth increases on future sites time will again become a limiting factor.

Here at A1 was the diver's dream; the shot landing on the ledge to be sampled with a reasonable site to place the clinometer and the best viz seen

this season, followed by an easy cleave.

The dream was shattered literally as the superb sample split in two whilst being bagged but the diver felt it was worthwhile to recover both halves.





The solo diver than swam East 10M and cut his second sample from a far crumblier site. Once bagged a video was taken which is available separately from this report.

Summary

This, the second of the two “shallow” trials, confirmed, without a doubt this 3 shot system is the way ahead.

More photographs have been made/are available as is a video of site A2 10M East

A number of observations were made: -

- A purpose bought kit bag was made available and successfully used. Three more are on order.
- The Nitrox diver demonstrated the advantages in time that can be achieved at this sort of depth.
- It is important to note that individual photographers use their own particular nomenclature and when the photos are released individually discretion to be exercised.
- The use of the clinometer is in doubt on these irregularly eroded surfaces with the divers reporting they could achieve any number of different readings dependant on placement.

Bumps in the Bay – Project Diary 2022

Day 1 – Tuesday 7th June 2022

Location (s) (WGS 84)

• Dive Site Transect	J1	50° 34.613	01° 59.911
	J2	50° 34.592	01° 59.837
	J3 Error site	50° 34.613	01° 59.791

Expenditure from Grant

- £ 30 Air & Nitrox fills
- £ 60 Contribution to boat owner

Expenditure to date

£ 590

Participants

- Iain Westman - Diver
- Chris Dunkerley – Skipper
- Stephan Spiriak– Diver
- Pete Mensikov - Diver
- Keith Coombs – Diver
- Jamie Robson - Diver

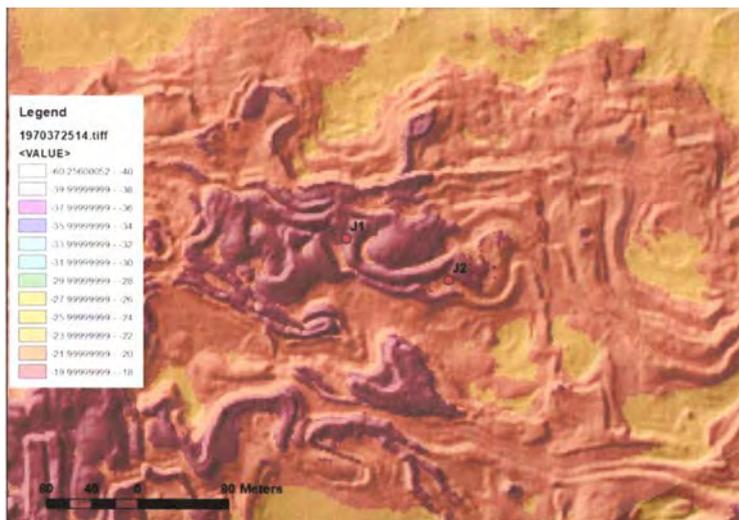
Site – Approx 1 mile South of Dancing Ledge. Depth at low water slack, mid transect, was around 22M

This was the first of two, relatively shallow, trial dives to determine the feasibility of using a small

boat to undertake “Bumps” diving.

The boat has been newly acquired by a club member and should give the project a lot more flexibility; however handling the boat, deploying shots/lines/divers/tools needed to be evaluated.

Additionally, this shallow one permitted the photographers to practice working with the clinometer and to provide data in accordance with instruction given by Dan at the previous evenings training course.



Good conditions, 5 days after Springs with sea-state “smooth/slight” and wind V2-4.

Arrival at site was planned to be well prior of slack but due to little familiarisation with the chartplotters “Refresh” time significant delay was experienced before J2 was successfully shotted. Shotting of J1 was far quicker but the skipper then lost confidence on the marks as J1 ended up East of J2! Slack was approaching so the decision was taken to dive the shots as they were and to resolve the position issue back on the beach. It turned out to be a misread digit in the third decimal place of Latitude.

The divers labelled samples and photos in accordance with where they thought they were diving – but to clarify for the report:-

J2 was actually dived by Stephan and Pete

J3 (the error site) was dived by Iain, Keith and Jamie

J1 was not shotted and not dived

Kitting up was an issue and further delayed the entry

The team of 5 divers split into 1 pair and a three photographer and 2 chippers with a planned staggered entry i.a.w the dive plan.

Visibility was around 4 to 5M. The “No-stop” air operational window was 30 minutes. 5 samples were obtained.

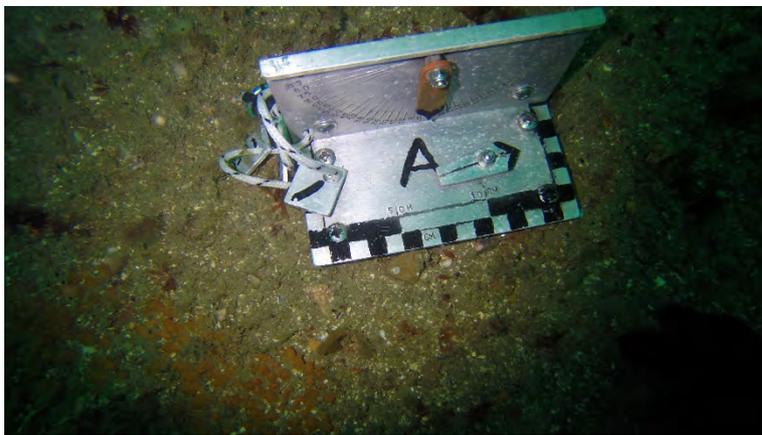
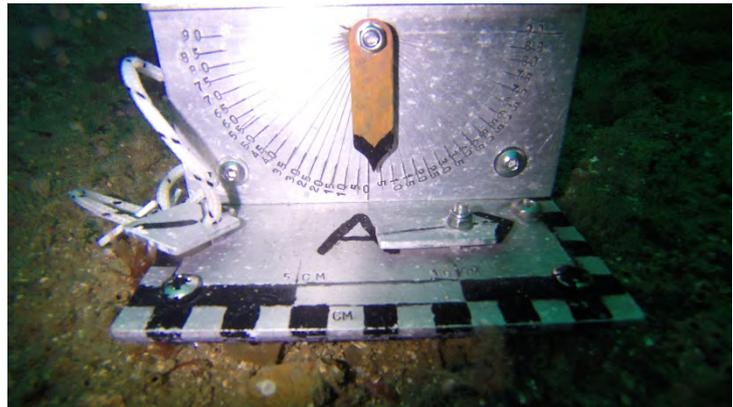
The first pair dived J2 and achieved a small but decent sample 1/2 m North of the shot, as can be seen by these two images



A Go-Pro video supported the stills taken on this site.

The Clinometer is now recognised as an important tool and is being used with increasing confidence. The required angle of slope is clear and unambiguous.

Slope on J2



Here the measurement of the North angle on J2 will possibly prove a little problematic; the photographers are now being encouraged to take the shot as close to perpendicular as possible to enable easy measurement.

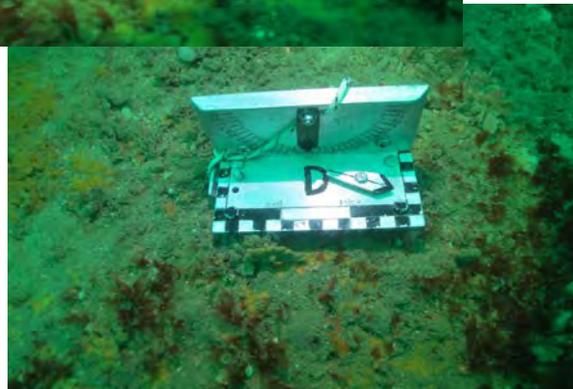
The second wave worked on the "error site" J3 with one photographer covering two chippers, not an ideal solution. These images support the sample taken 10M west of J3 by Iain.



Jamies 3 samples come from within a 3M radius of the shot J3



A mistake was made after the dive with the “dry” photos being taken without the support of the target slate this, unfortunately has given an error with two samples having the same label, without the clarification provided by the “target” slate.





Although this ledge within 3M of the shot J3 appears to be at angle that is not the case as proven by clinometer shots above; the photographer did annotate this anomaly on submission.

Summary

A number of significant observations were made: -

- The previous night's Clinometer practical training was very useful.
- A number of "new boat" issues were noted
 - The depth gauge reading was wrong – possibly seawater/freshwater in "settings"
 - Boarding can be achieved with kit-on/fins off
 - Kitting up was problematic, not enough space
 - The shot deployment worked well and was intrinsically safe.
 - The "refresh" time on the Chartplotter requires a slower, final, approach to target.
- The new kit bags worked well.
- It is important to note that individual photographers use their own particular nomenclature and when the photos are released individually discretion to be exercised.
- 4 divers plus a non-diving skipper are the maximum the new boat can handle on a Bumps dive.
- To achieve conciseness of the report only representative photos have been included; additional photos and a video are also available.
- As we get older glasses are needed if Latitude numbers are to be read off documents correctly!!

Bumps in the Bay – Project Diary 2022

Day 2 – Sunday 18th September 2022

Location (s) (WGS 84)

- Dive Site Transect K2 50° 34.591 01° 59.299

Expenditure from Grant

- £ 13 Air & Nitrox fills
- £ 60 Contribution to boat owner

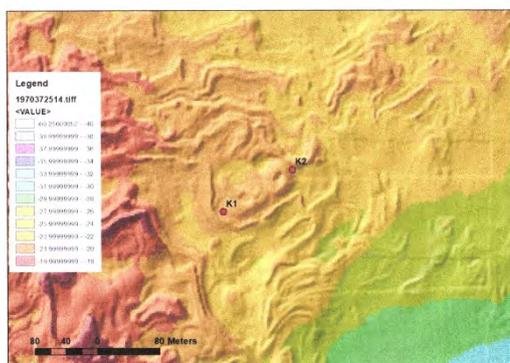
Expenditure to date

£663

Participants

- Chris Dunkerley – Skipper
- Pete Mensikov - Diver
- Jeremy Goodall – Diver

Site – Approx 1 mile South and ½ mile East of Dancing Ledge. Depth at low water slack was 26M



This was the second of two, relatively shallow, trial dives to determine the feasibility of using a small boat to undertake “Bumps” diving; additionally, it was practice for the next dive in two days to 37M

As the State Funeral took place when the dive had initially been scheduled the reconvened date was short notice and only one team signed up; due to the series of problems this year’s Bumps dives have experienced it was decided to

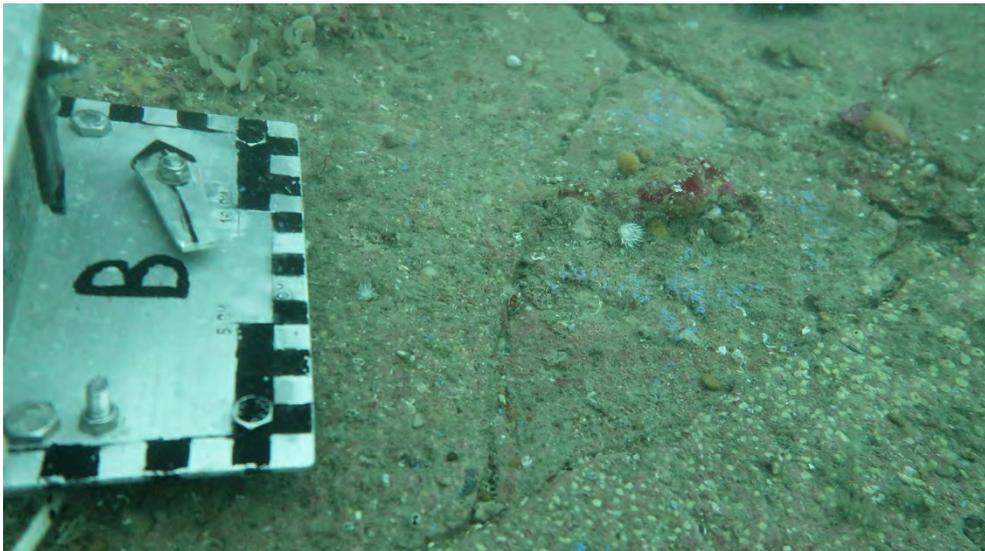
go ahead anyway and just target K2.

Very good conditions, 5 days after Springs with sea-state “smooth/slight” and wind N/NW 3/4.

Although a little last minute in planning and our third attempt at this site this one was a “textbook” dive.

Ideal conditions meant the shot was deployed on the first run and on checking was better than +/- 3M from the mark.

Underwater visibility was excellent for the task, divers reported seeing the bottom once they reached 15M. The “No-stop” air operational window was 24 minutes. 1 sample was obtained.

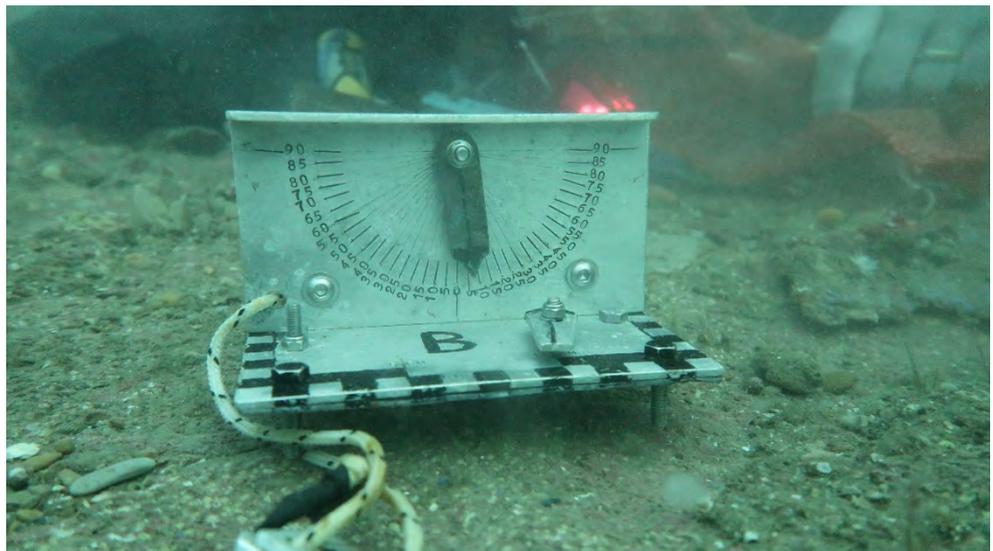


The pair dived K2 and achieved an excellent sample on the shot; seen here with the blue wax ID.

It required significant hammer and chisel work to remove it but was clearly worth the

effort. Ignore the clinometer in this shot it was merely here prior to set up.

A combination of fine visibility and the experience gained on the "J" site meant that the photographer was able to confidently produce some fine shots. This clinometer reading gives a clear indication of the slope of the bed.....





.....and paired with this one gives the direction of maximum slope.

Showing the site once the sample had been removed. Additionally, the site shot-weight can be seen top, centre in the photograph.





Summary

A number of significant observations were made: -

- Previous “lessons learnt” were acted on and gave a “textbook” dive
- The team now feel very confident to tackle the 37M challenge
- 2 divers plus a non-diving skipper gave plenty of boat space but with the penalty of only 1 sample; 2 teams of 2 and a skipper are confirmed as the optimum working off the 23’ craft.
- To achieve conciseness of the report only representative photos have been included; additional photos are available.

Bumps in the Bay – Project Diary 2022

Day 3 – Wednesday 21st September 2022

Location (s) (WGS 84)

- Dive Site Transect
 - G2 50° 32.729 02° 01.779
 - Mid-G 50° 32.739 02° 01.794

Expenditure from Grant

- £215 Air & Nitrox fills / Hardboat Charter

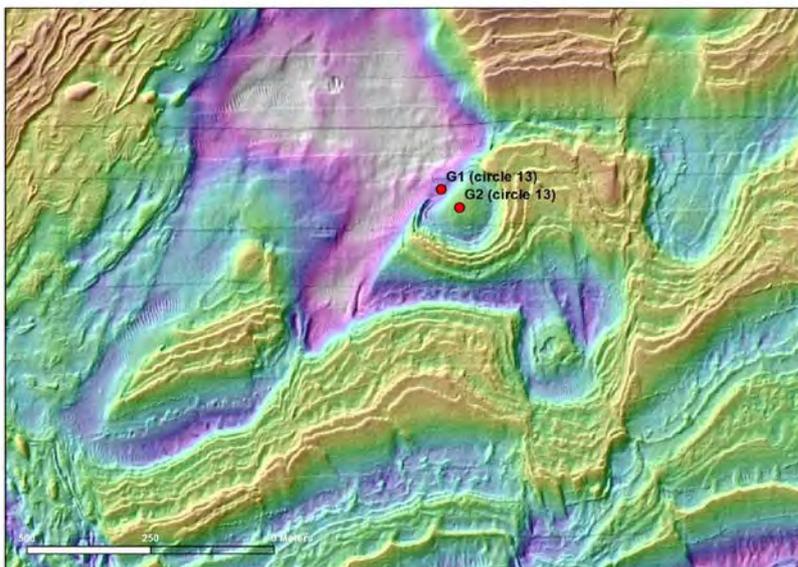
Expenditure to date

£ 898

Participants

- Chris Dunkerley – Diver
- Pete Mensikov - Diver
- Jeremy Goodall – Diver
- Nick Reed - Diver

Site – Approx 3 mile South of Winspit. Depth at low water slack was 36 to 38M



This site was deemed of particular interest and the two preceding dives were undertaken as training/familiarisation for this one; it is at the cusp for sampling when the no-deco limit is applied.

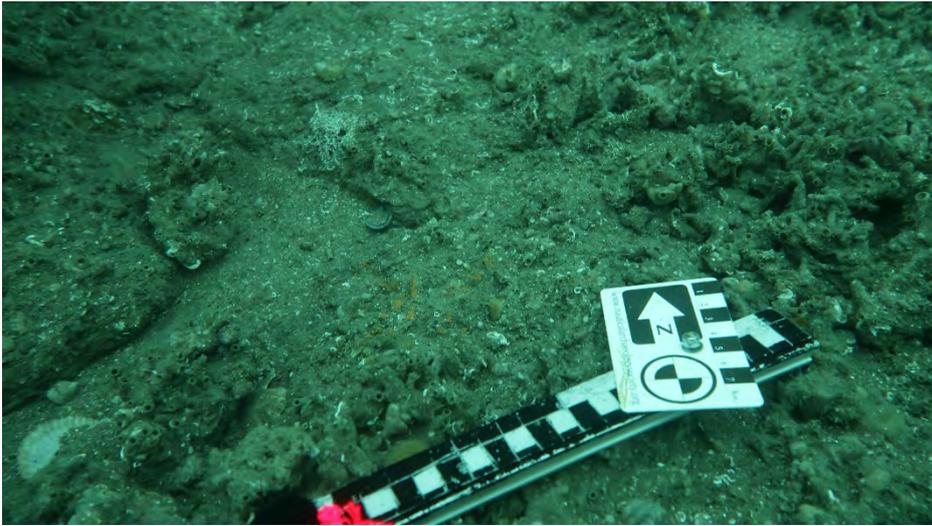
Three specific targets were highlighted – in order of importance G2, Mid G and G1; but as only two teams had signed up only the first two were achieved.

Ideal conditions; 6 days prior to Springs; with sea-state “smooth” and wind Variable to South 2/4.

Both shots were deployed with admirable accuracy just prior to slack.

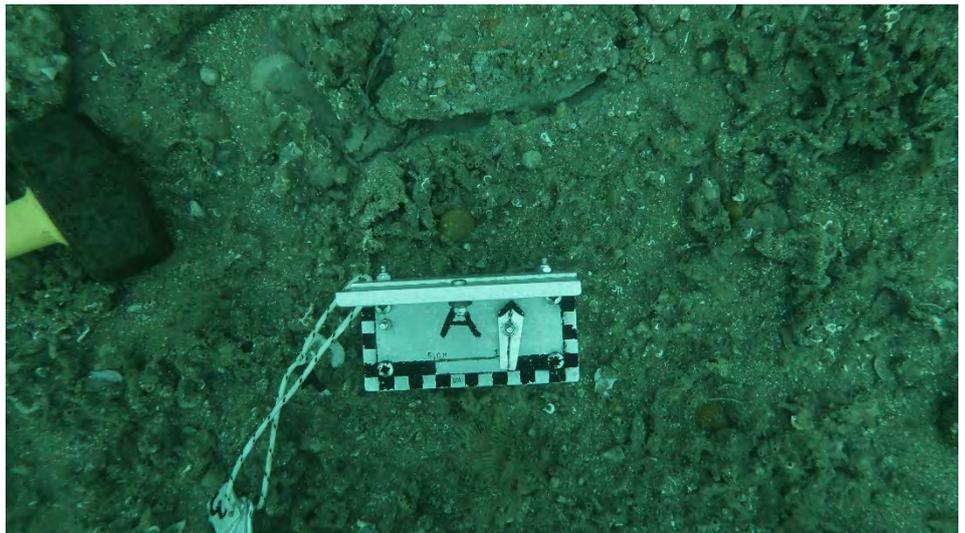
Divers were a little surprised by the “gloom” experienced beyond 25M but the actual visibility was still 3M on the bottom, more than enough for the task. The “No-stop” air operational window was 13 minutes. 2 samples were obtained.

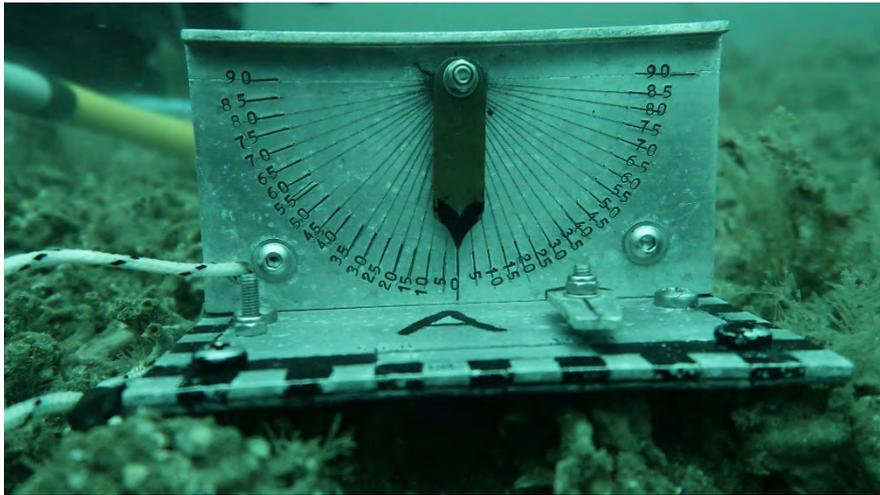
Site G2



This was the area selected, however there were a fair, few other places that would have been equally suitable within a metre radius of the shot

Here the sample is loose but still in situ, with North clearly indicated. It had to be “cut” out it didn’t just breakaway.





There is no discernible slope of the bedrock

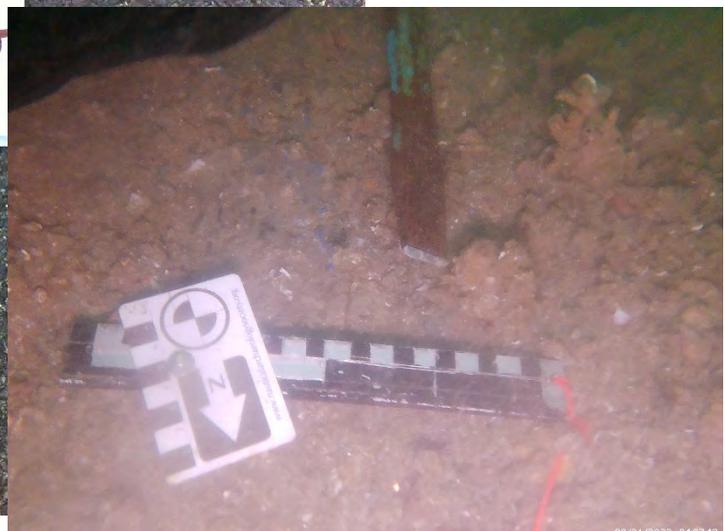
Overview of site G2 with sample removed.



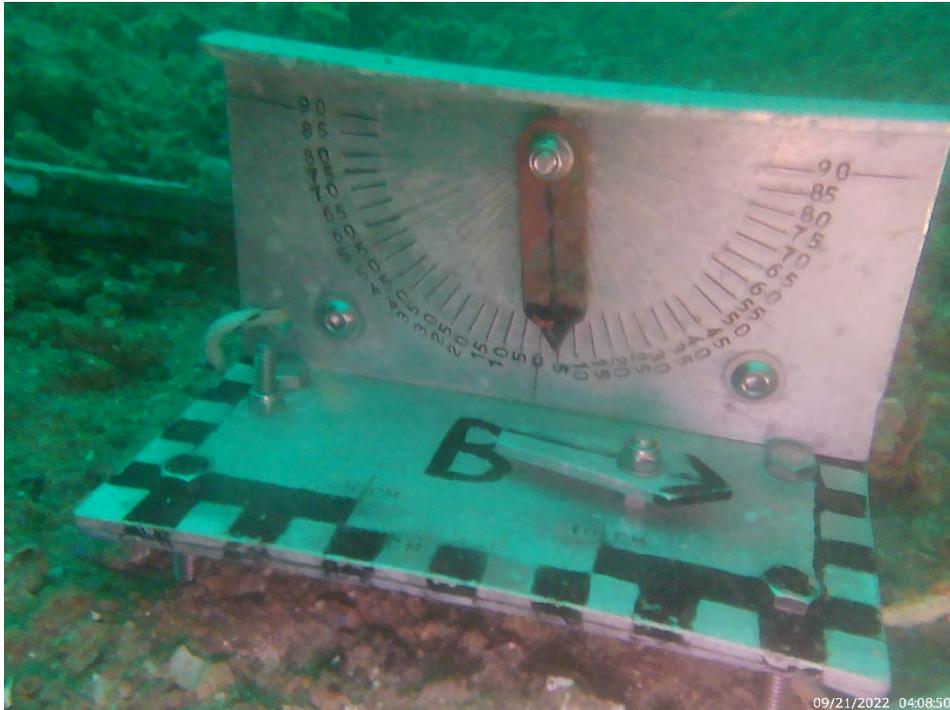
Mid G



The divers struggled in their descent due to too much slack being present in the shot line;



therefore, the remaining time available, once the bottom had been reached, severely impacted on the normal practice of wandering around looking for the best spot. The decision was taken to work where they were; but the spot turned out to be problematic yielding only crumbling pieces after a single chisel blow.



Mid-G, Sample site
– the two
clinometer shots





Whilst the chipper was labelling and bagging the photographer took the opportunity to drift 4 M North of the shot and undertook another clinometer reading.

Summary

A number of significant observations were made: -

- The tough (financial) decision to use a hard-boat after the recent success on the 23' RIB was dictated by a breakdown. It was a last-minute decision and didn't give additional club members any time to book therefore only two teams departed when three would have been ideal.
- The practise of having a little extra line on the shot to avoid it "bouncing" learned on earlier dives has to be offset against giving the divers descent difficulties where a "bight" occurs due to too much line on completely slack conditions. (Divers are instructed to swim down the line – they do not pull themselves down for fear of moving the shot). A careful compromise has to be considered.
- Although the divers on mid-G were disappointed with the sample achieved, there was enough there for analysis to be conducted.
- To achieve conciseness of the report only representative photos have been included; additional photos and a video are available.

Bumps in the Bay – Project Diary 2023

Day 1 – Tuesday 13th June 2023

Location (s) (WGS 84)

- Dive Site J4 50° 34.616 01° 59.994

Expenditure from Grant

- £60 Air & fills / Rib Charter

Expenditure to date

£ 958

Participants

- Chris Dunkerley – Skipper
- Pete Mensikov - Diver
- Jeremy Goodall – Diver

Site – Approx 1 mile South of Dancing Ledge. Depth at low water slack was 21M

J4 on DORIS showing start of photo transect A 28 1 (starts at eastern end)



This site was chosen as the first “Bumps” dive of the year i.e. a training dive for refamiliarization with boat, kit and methodology. The main criteria was its depth; additionally, nearby sites J2 and J3 dived previously has provided interesting samples containing molluscan rudstones with intraclasts and have been deemed worthy of further

investigation.

Bang on Neap and absolutely perfect conditions to restart the Project; wind variable 2/4 with seastate smooth.

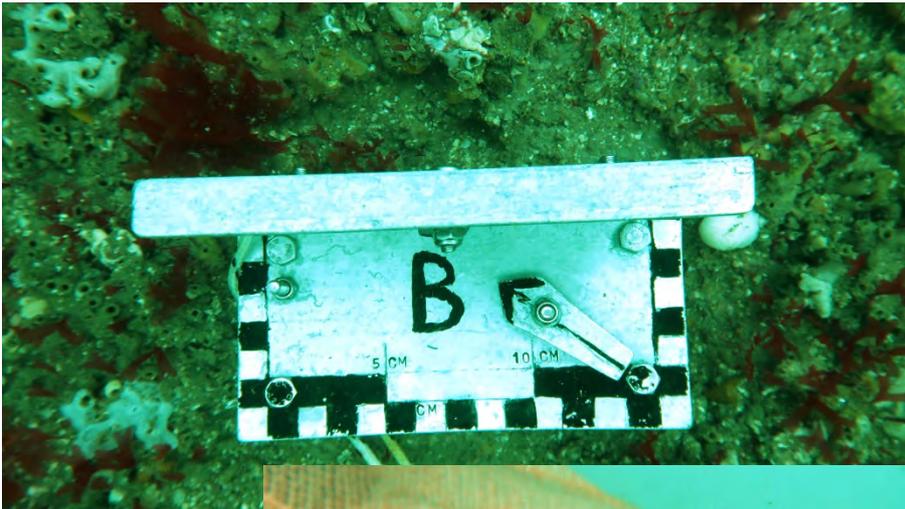
Very easy deployment of shot with a pre-dive site check giving an accuracy of about +/- 5M if not better.

Visibility was reported at 5 to 6M at the bottom, again an ideal start to this years’ Project diving. The “No-stop” air operational window was 37 minutes. Two samples were obtained.

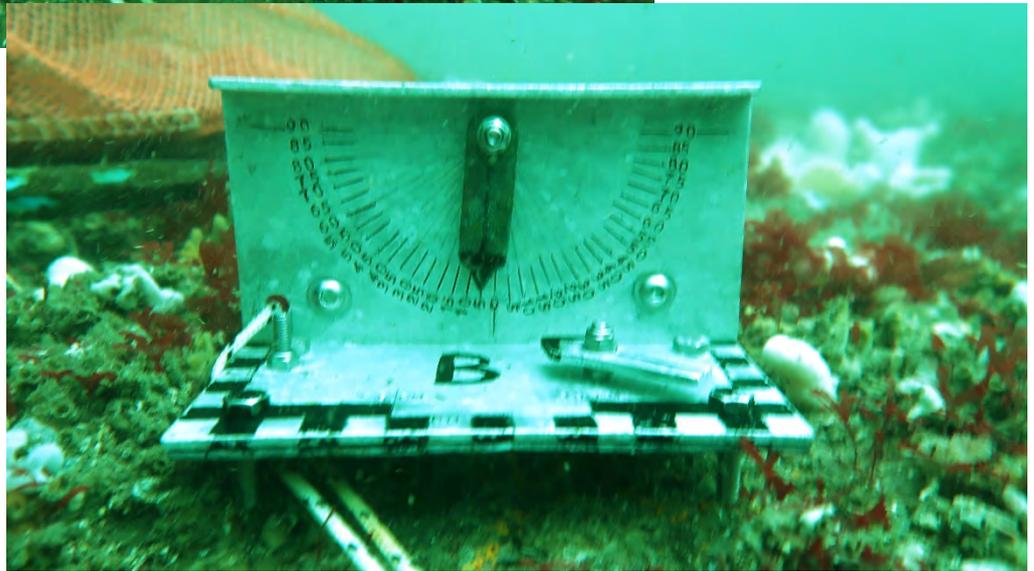
Site J4 at Shot

The chipper was spoilt for choice when the bottom of the shot was reached, the sample was confidently marked and proved to be a reasonably easy extraction. The photo below shows the advantage of a very slight current – light debris is born away.

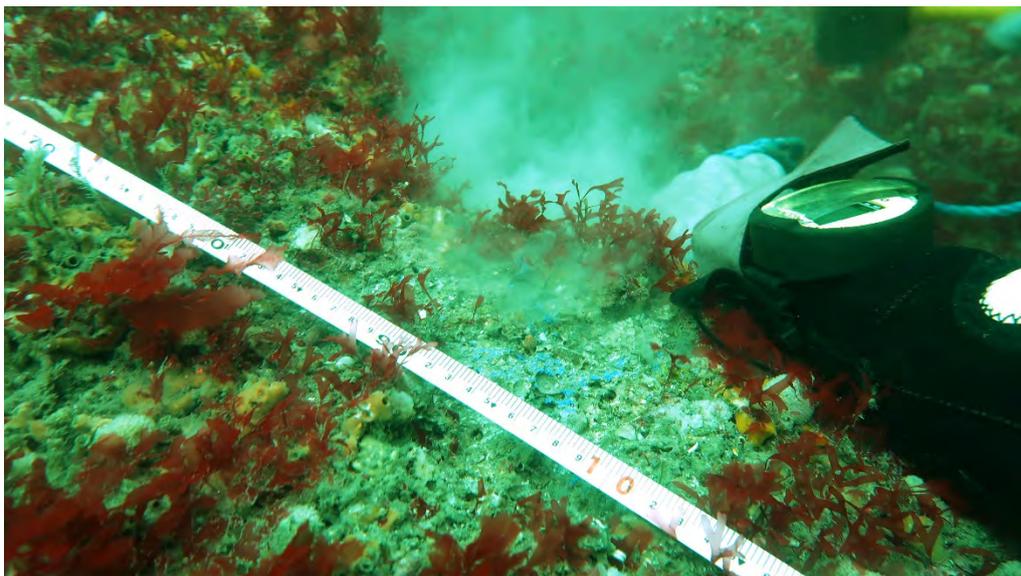




The fine visibility gave some top-quality photographs of the clinometer but the stepped and jagged nature of the bedrock didn't really permit a location to give an accurate overview of the slope.



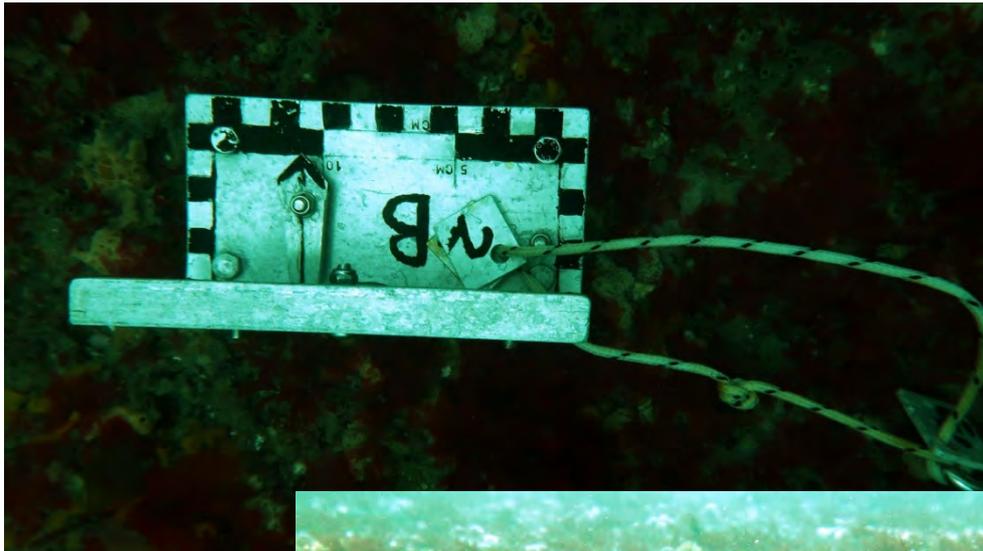
Site J4 10M East of Shot



The divers had plenty of bottom time at this depth so moved Eastwards from the shot a distance of 10M with the view to obtaining a second sample.

The bottom was clearly stepped with an apparent myriad of suitable sites for a decent sample to be extracted but this proved to be inaccurate; the bedrock was extremely frangible and frustrating for the chipper who was unable to get a single decent sample but instead had to be satisfied with a bag of small bits.





The clinometer is now an accepted part of the Project and the photographers are gaining experience in choosing the optimum site to maximise data obtained.



Summary

A couple of observations were made: -

- Additional photos are available.
- The team are now confident to sample at 35+ M later this month (other non-Project dives being undertaken to build up depth experience)

Bumps in the Bay – Project Diary 2023

Day 2 – Wednesday 28th June 2023

Location (s) (WGS 84)

- Dive Site G3 50° 32.751 02° 01.796

Expenditure from Grant

- £62 Air & fills / Rib Charter

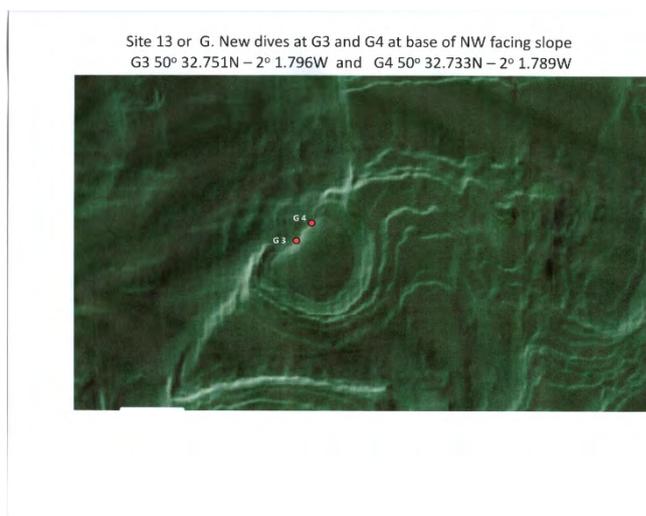
Expenditure to date in 2023

£1020

Participants

- Chris Dunkerley – Skipper
- Pete Mensikov - Diver
- Jeremy Goodall – Diver

Site – Approx 3 mile South of Winspit. Depth at low water slack was 39M



This “Bump G” has been deemed of particular interest because of its apparently truncated morphology to the NW. This year further validation with “spot” dives is required, G3 is the first of the two “spots” specified. It is at the very cusp for sampling when the no-deco limit is applied.

Bang on Neap but poor conditions for the Project with sea-state “slight” and wind SW 3/5.

With the swell and tide prior to slack the first deployment of the shot was very poor indeed and way off the mark; conditions were not unsafe but certainly gave the crew a challenge.

The second deployment was acceptable, but only just, with a positional check after deployment giving an accuracy of only +/- 10M. The 47M shot line coupled with confusing current bottom to top, and the swell didn't permit the skipper to view the line on the screen as would normally be possible.

Visibility was 4M on the bottom, more than enough for the task. The “No-stop” air operational window was 14 minutes. One sample was obtained.

Site G3

This overview of the site is one of the very few photographs taken. The site was the most unusual so far tackled; the entire area around the shot was loose gravel and stone to a depth of approximately 200mm. Initially the vis was 4M



but as soon as the chipper burrowed to the bedrock this reduced the visibility to nearly zero making the photographers task almost impossible.

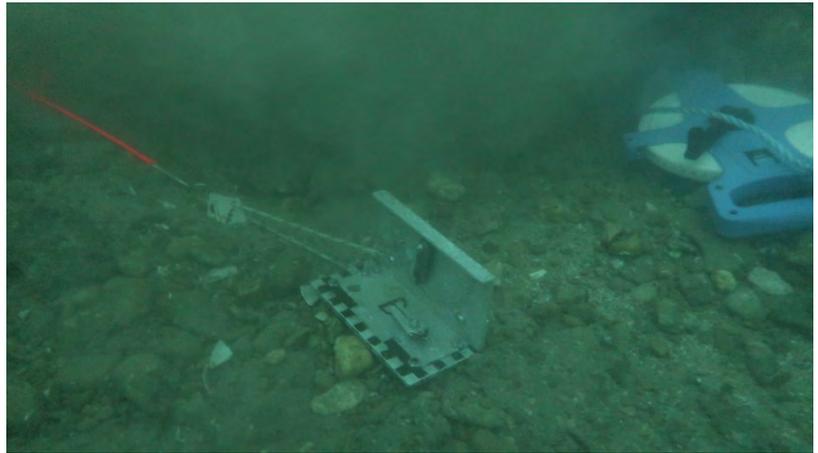


To the chippers credit a fine sample was actually obtained by burrowing down and then hammering the chisel in at an angle and levering a quite significant piece of bedrock off – as can be seen from this surface photograph the sample was absolutely

riddled (boring sponges?) and probably aided the chippers effort. This sample is the biggest yet retrieved on the project and was in excess of 300mm across – a significant achievement with the conditions encountered.

This shot is an attempt to provide the required overview; certainly not ideal but any further away and the visibility became a real issue.

Despite the Clinometer being in the photograph it was not utilised on this site. The nature of the surface was such that it was just not possible to excavate to bed rock without the sides of the excavation falling in and covering the tool.



Summary

A couple of observations were made: -

- The fact a fine sample was brought to the surface is a credit to the team – everything in their favour was against them!
- Too much line gave a problematic decent/ascent – the divers were in control but it was deemed a nuisance.

Bumps in the Bay – Project Diary 2023

Day 3 – Thursday 29th June 2023

Location (s) (WGS 84)

- Dive Site G4 50° 32.733 02° 01.789

Expenditure from Grant

- £62 Air & fills / Rib Charter

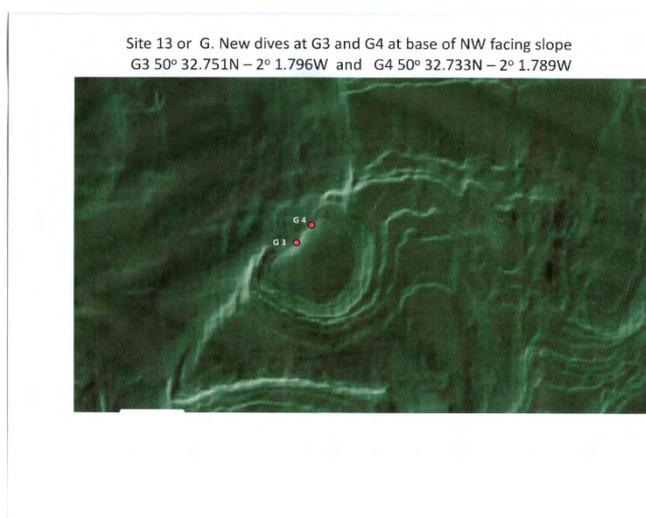
Expenditure to date

£1082

Participants

- Chris Dunkerley – Diver
- Pete Mensikov - Skipper
- Jeremy Goodall – Diver

Site – Approx 3 mile South of Winspit. Depth at low water slack was 36M



This “Bump G” has been deemed of particular interest as a result of sample analysis over the last couple of years. This year further validation with “spot” dives is required, G4 is the second of the two “spots” specified. It is at the cusp for sampling when the no-deco limit is applied.

SEE NOTE IN “SUMMARY” WHEN VIEWING THIS SCREEN SHOT.

Good conditions; 6 days prior to Springs; with sea-state “smooth/slight” and wind NW 3/5.

The shot was deployed just prior to slack and on doing a positional check after deployment an accuracy of +/- 5M can be assumed.

It was an easy descent with little current on a steeply sloping line – this slope was deliberate after problems during a previous dive where too much “slack” was present.

Visibility was 3 to 4M on the bottom, more than enough for the task. The “No-stop” air operational window was 14 minutes. One sample were obtained.

Site G4

This is a close up of the area selected; it was within a metre of the shot and appeared ideal. Unfortunately, this was not immediately the case as the bedrock was impervious to a significant number of blows and vital time was wasted.



In the last 2 minutes the chipper moved 300mm and easily obtained a sample from what looked like the same ledge.



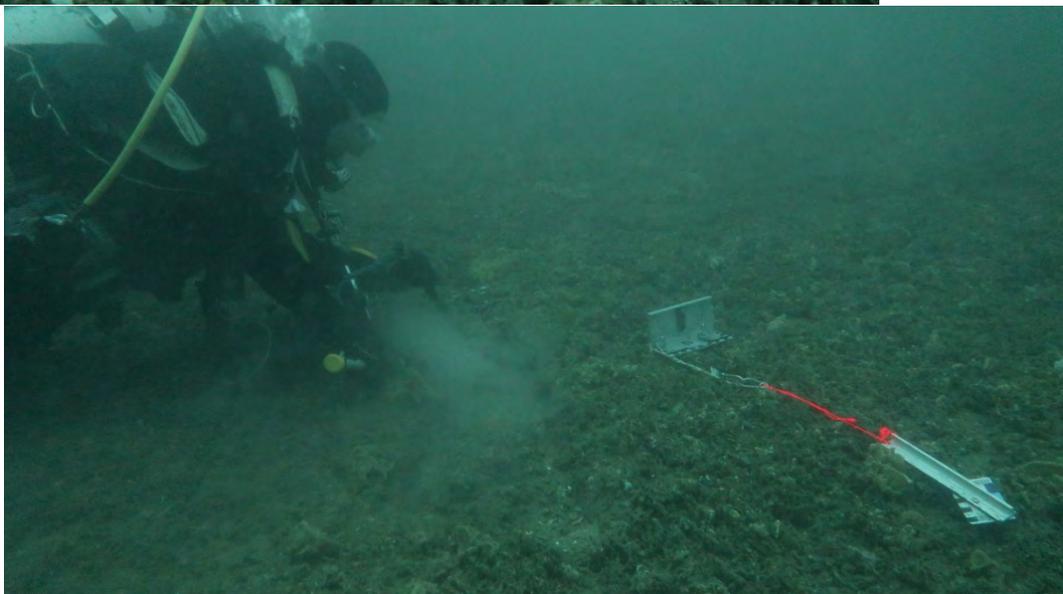
The photographer is now spending far more time on preparing and recording clinometer data to supplement the evidence portfolio, but even with this greater effort the site selection has always got to balance bottom time and mustn't distract from the overriding "buddy" requirement.



Where the slope is slight, here it was a mere 5° , the photographer has to take even more care as such a small reading can easily be overlooked by rushed positioning, furthermore trying to determine the maximum slope can easily consume valuable bottom time.

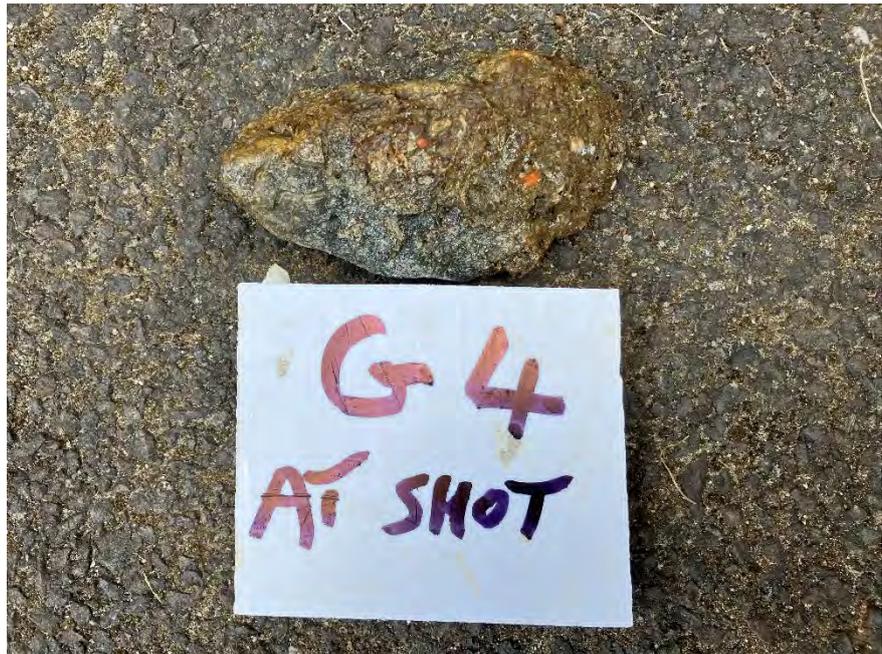


Showing the relationship of the sample site to the positioning of the clinometer before the released sample is removed



And moving out for the overview.

The recovered sample on the surface.



Summary

A couple of observations were made: -

- To achieve conciseness of the report only representative photos have been included; additional photos are available.
- These deeper sites with very limited “no stop” times tend towards “smash and grab” in order to achieve a sample; the chipper does not have the luxury of a wander around prior to selection.
- With “spot” sampling using one dive pair and dedicated skipper there is a far calmer approach on the boat – the team are not fighting the slack window.
- When the boat arrived on site and was manoeuvring in order to deploy the shot it was noticed that the mark G4 on the screen showed itself to be South of yesterday’s mark G3 whereas on the pre-dive paperwork the converse was true. Something was obviously wrong but as slack was approaching an immediate decision was required – the decision was taken to dive on the given marks and to ignore the pictorial representation.

Bumps in the Bay – Project Diary 2023

Day 4– Thursday 24th August 2023

Location (s) (WGS 84)

- Dive Site Bump 7 50° 31.561 02° 04.804

Expenditure from Grant

- £65 Air & fills / Rib Charter

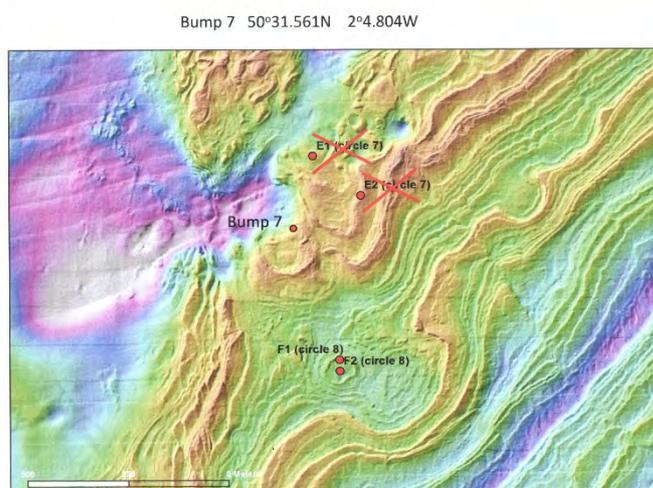
Expenditure to date

£1147

Participants

- Chris Dunkerley – Skipper
- Pete Mensikov - Diver
- Jeremy Goodall – Diver

Site – Approx 4 miles South of Houns Tout. Depth at low water slack was 34.5M



“Bump 7” lays approximately between the “E” and “F” transects that were sampled earlier in the project and is being used to verify earlier findings by a single “spot” dive,

Ideal conditions; 2 days off Neaps with sea-state “smooth/slight” and very light winds, variable 3 or less.

Despite the distance from the mooring, it was a very quick passage on a very flat sea; the shot was deployed just prior to slack and on doing a positional check after deployment an accuracy of +/- 5M can be assumed.

It was an easy descent with little current on a steeply sloping line – this slope was deliberate after problems during a previous dive where too much “slack” was present.

With ideal top-side conditions the divers were very surprised, and disappointed, to find it dark on the bottom with visibility limited to 1M even with a torch. The bottom was a gravel mix that when disturbed reduced visibility to nil. The “No-stop” air operational window was 14 minutes. The

photographer, now a very experienced one on this project, expressed his deep concern at the quality of his images due to these very poor conditions

Bump 7

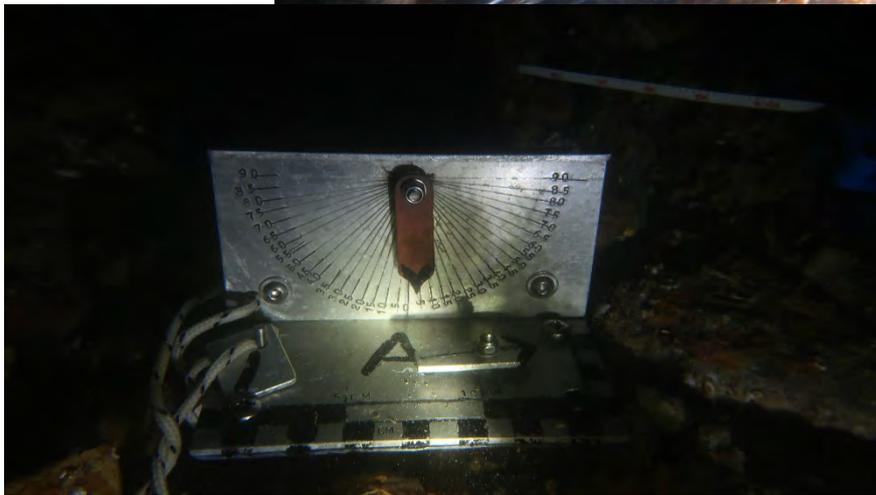
Burrowing under this type of gravel, reducing the visibility to nil and waiting for the muck to drop out was not an option as bottom time would be sorely compromised. Looking around within his limited vision the diver spotted an unusual spur of rock sticking out at approximately 40 degrees about 1 Metre away from the shot he

experimentally tried to “waggle” it to check whether it was bed rock or not. It appeared to be firmly attached.



Here we can see the spurious outcrop before work commences. A more complete overview of the site was not possible due to the limit of site conditions

These Clinometer readings are taken on the seabed where the sample is; but not on the sample



Unusually this sample was removed by inserting the chisel below the sample, a couple of hammer blows and then then applying leverage rather than chipping from above. This was the only sample obtained.





The recovered sample on the surface.

Summary

A couple of observations were made: -

- Topside conditions do not necessarily reflect those on the dive site.
- As stated earlier in this report the quality of the photographs provided reflect conditions on the day and not the quality of camera or operator. There are additional images available but are very limited and are thought not worthy of further examination
- This small team on a small boat again proving ideal for spot sampling.

Bumps in the Bay – Project Diary 2023

Day 5– Friday 25th August 2023

Location (s) (WGS 84)

- Dive Site Bump 22a 50° 34.364 01° 57.794

Expenditure from Grant

- £65 Air & fills / Rib Charter

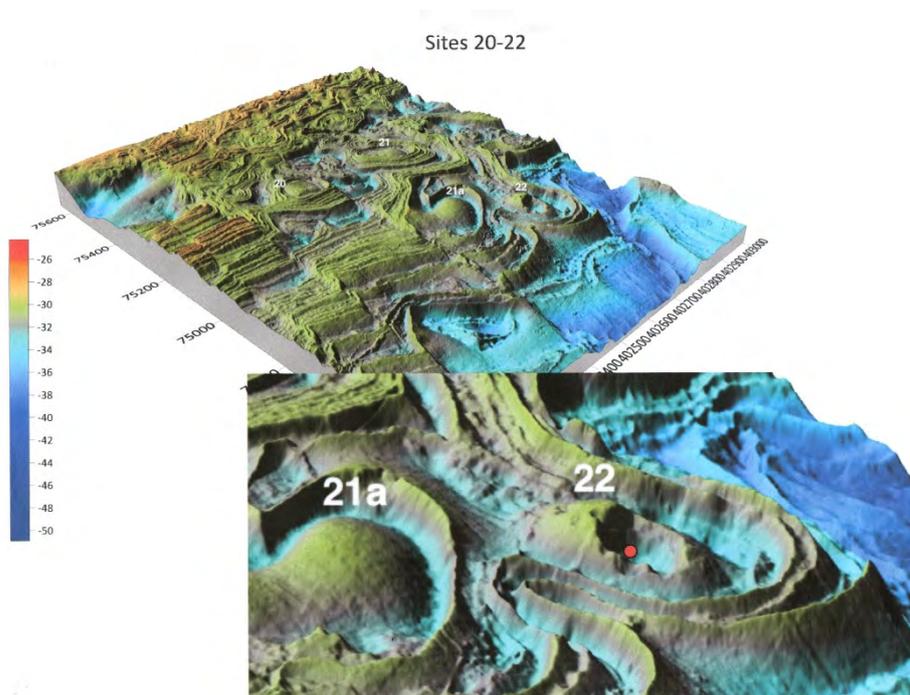
Expenditure to date in 2023

£1212

Participants

- Chris Dunkerley – Diver
- Pete Mensikov - Skipper
- Keith Coombs – Diver

Site – Approx 1 mile South of Anvil Point. Depth at low water slack was 34.3M



“Bump 22” lays on the old “H1-H2” transects that was proposed earlier in the project and is being used to verify earlier findings by a very specific “spot” dive at the base of a 4 to 5M, SE facing wall.

This is a 3D view in Arc GIS from the DORIS data.

Good topside conditions; 1 day off Neaps with sea-state “smooth/slight” and a NW wind F3/5.

The shot was deployed but on checking was an unacceptable distance from this very specific site; it was retrieved and redeployed, this time successfully and on doing a positional check after deployment an accuracy of a very acceptable +/- 2M can be assumed.

It was an easy descent with little current on a steeply sloping line.

Bump 22a

After yesterday's dive at a similar depth the divers were not surprised to find total blackness on the bottom; in fact, they passed through a thick layer, probably a bloom, at around 20M this removed all the light beneath. The water was clear on the bottom but all work had to be done by torch light and caused a small amount of conflict between the chipper and the photographer who obviously had totally different lighting requirements. The "No-stop" air operational window was 14 minutes.



Right on the shot, facing the wall, the chipper found an ideal layer of bedrock approximately 40mm thick from which an ideal sample could be taken; unfortunately despite violent and numerous hammer blows the rock refused to yield.

Aware that bottom time was getting short, the chipper moved only an arms length away to where the layer was thinner – here a couple of light blows released some small, crumbly samples.





It was interesting to note a lot of loose shale in the immediate vicinity.

With the very limited visibility, selection of a position for the clinometer was difficult



Summary

- Again, repeating yesterday's observation--topside conditions did not reflect those on the dive site.

Bumps in the Bay – Project Diary 2023

Day 6– Saturday 9th September 2023

Location (s) (WGS 84)

- Dive Site Bump 6 50° 30.978 02° 05.350

Expenditure from Grant

- £64 Air & fills / Rib Charter

Expenditure to date

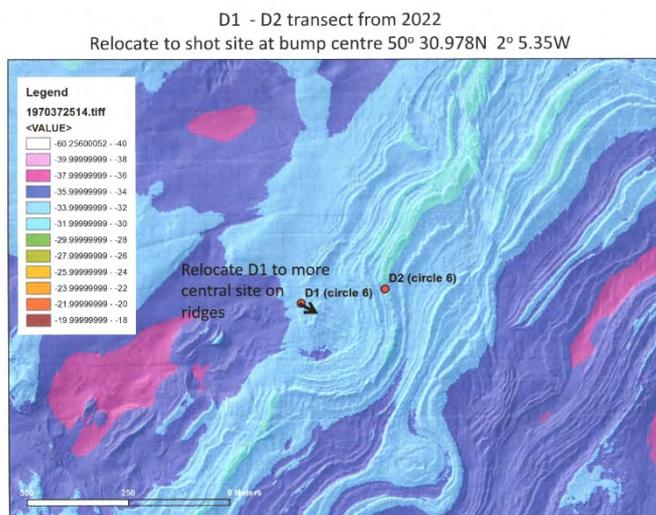
£1276

Participants

- Chris Dunkerley – Skipper
- Nick Reed - Diver
- Jeremy Goodall – Diver

Site – Approx 5 miles South of Chapmans Pool. Depth at low water slack was 34M

Bump 6



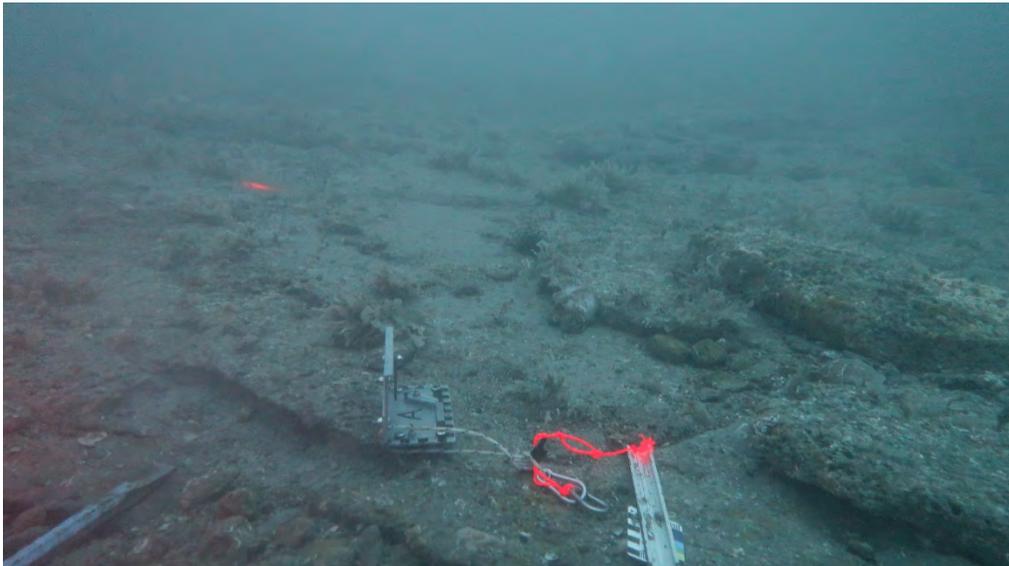
“Bump 6” lays close to the old “D1-D2” transects that was proposed earlier in the project; a spot dive on Bump 6 is being used to verify earlier findings.

Ideal topside conditions; bang on Neaps with sea-state “smooth/slight” and a light wind – variable 3 or less.

The shot was deployed successfully and on doing a positional check after deployment an accuracy of a very acceptable +/- 4M can be assumed.

It was an easy descent with little current on a steeply sloping line.

The “No-stop” air operational window was 14 minutes.



Visibility was 3- 4 M giving the chipper a chance to review a wide range of possible sample areas within easy visual distance of the shot and the photographer was able to

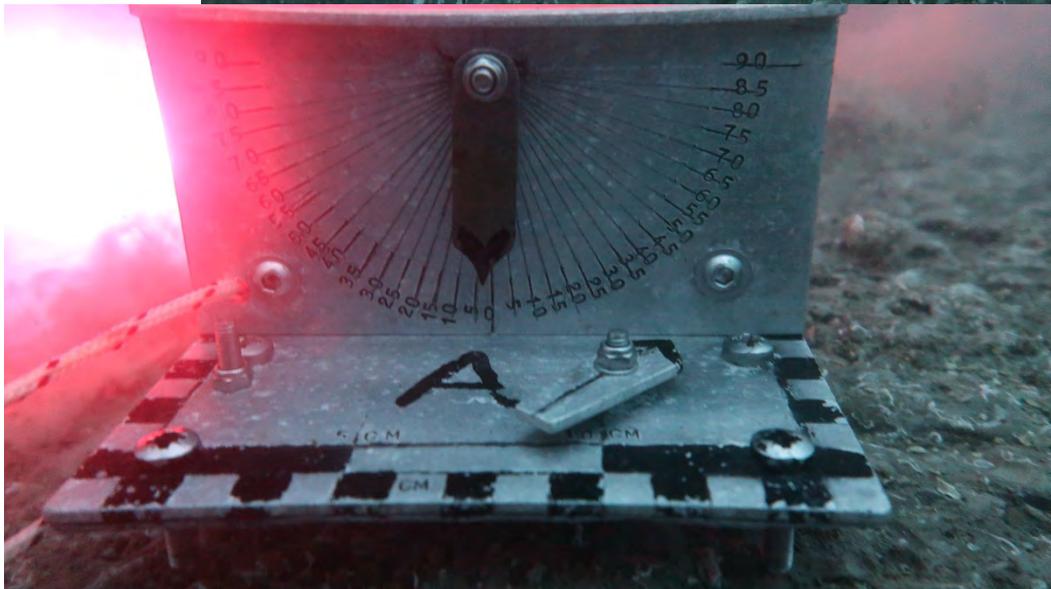
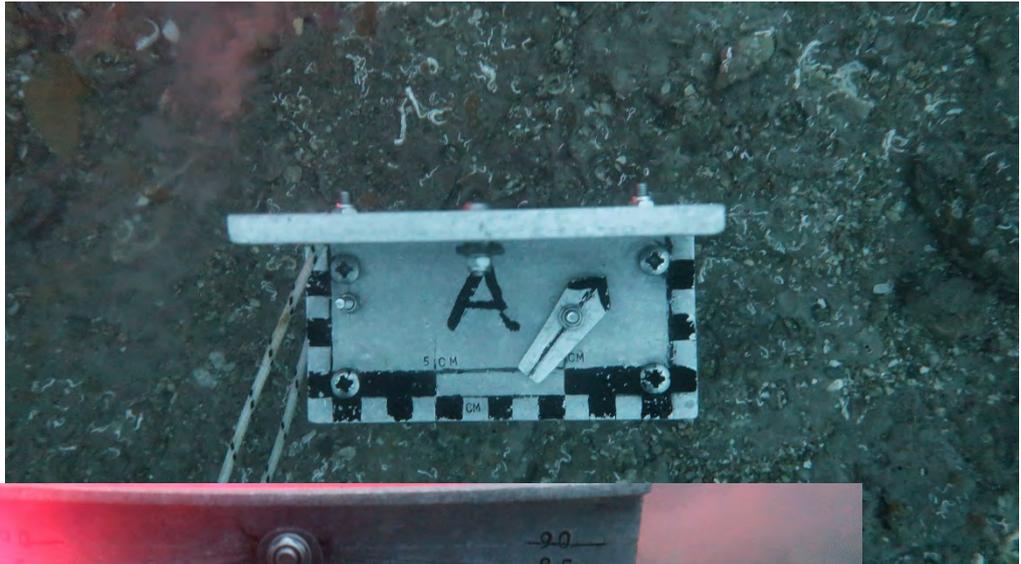
obtain a good overview of the site that can be seen here.

The sample site chosen was impervious to numerous hammer/chisel blows but succumbed eventually after being subject to significant leverage. 2 samples were obtained



Site after sample removal

Clinometer images show the bed-rock being almost flat.



The two samples on the surface



Summary

- A textbook dive.