2018–2019

British Marine Aggregate Producers Association, Historic England and The Crown Estate

Marine Aggregate Industry Protocol for the Reporting of Finds of Archaeological Interest

Annual Report to BMAPA 2018–2019

November 2019

Prepared by
Wessex Archaeology

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Protocol background

The Marine Aggregate Industry Archaeological Protocol (the Protocol) is in place to ensure the protection of submerged cultural heritage during marine aggregate industry dredging works. Prior to a licence being granted to dredge a licence area, an intensive investigation is undertaken to identify potential archaeological material on the seabed. Using geophysical and geotechnical survey, and analysis of available records from various sources, archaeologists identify and protect known and suspected sites of archaeological interest within aggregate extraction regions. Even after this level of investigation, unidentified sites and individual artefacts may still be found within dredged cargoes. In response to this, the Protocol was proposed to define a framework through which archaeological material could be identified, reported, investigated and, crucially, protected. The Protocol ensures that any items of potential heritage importance recovered during aggregate dredging, whether encountered on the seabed, on a dredging vessel or more commonly, at a wharf after a cargo is landed, can be properly reported, assessed, recorded and archived. In some instances, further mitigation or monitoring may be required.

Wessex Archaeology drafted the Protocol in 2005 on behalf of Historic England and the British Marine Aggregate Producers Association (BMAPA).

BMAPA member companies have since adopted the scheme voluntarily since 2006, though adherence to the Protocol is becoming a formal condition of consent for new marine licences and licence renewals. The Crown Estate joined BMAPA in 2009 to co-fund the Protocol Implementation Service.

When a find is encountered, it is reported through a Site Champion on the wharf or the vessel to a Nominated Contact who alerts the Implementation Service, currently operated by Wessex Archaeology.

The Protocol has been overwhelmingly successful, with over 1800 finds reported since its inception.

The Protocol Implementation Service has now completed its 14th year of operation and this annual report covers the period from 1 October 2018 to 30 September 2019.

Access

Planning conditions relating to archaeology are placed on developments and dredging areas, which include a duty to publicise the results of archaeological investigations to the relevant bodies.

Once a find is reported to the Protocol Implementation Service, it is researched, and compiled into a report. Details of the dredged finds are then reported to:

- the Site Champion that reported it;
- the Nominated Contact;
- Historic England;
- BMAPA;
- The Crown Estate;
- The National Record of the Historic Environment (NRHE);
- and the appropriate local Historic Environment Record (HER).

If considered wreck material, finds are also reported to the Receiver of Wreck in compliance with the *Merchant Shipping Act* 1995 and they ascertain a droit number. All aircraft material is reported to the Ministry of Defence as it may relate to the *Protection of Military Remains Act* 1986.

Once the finds have been reported to the NRHE, they are uploaded to a publicly accessible database, PastScape[1].

All finds are also published on the Marine Aggregate Industry Archaeological Protocol Facebook page[2] that was set up in March 2017.

Each annual report also publishes all the reports that were found during that reporting year, and they are all available to download[3].

In addition, the discoveries and achievements of the staff involved with the Protocol are acknowledged through various publications produced by Wessex Archaeology, including the biannual *Dredged Up* newsletter, also available to download via the previous link.

1. https://www.pastscape.org.uk/default.aspx
2. https://www.facebook.com/marineaggregateindustryarchaeologicalprotocol
3. https://www.wessexarch.co.uk/our-work/marine-aggregate-industry-protocol-reporting-finds-archaeological-interest

Reporting process

Archaeological finds identified by wharf and vessel staff are reported through a Site Champion to the designated Nominated Contact of the company owning the wharf or vessel. The Nominated Contact uploads the images and preliminary form to the secure online console (http://net.wessexarch.co.uk/bmapa/login.aspx?ReturnUrl=%2fbmapa%2findex.aspx). In some cases, the Site Champion will report finds directly to the console rather than through the Nominated Contact. The console alerts the Protocol Implementation Service operated by Wessex Archaeology and the find is then recorded in the database before being investigated and a report produced.

Wessex Archaeology then communicates directly with the Nominated Contact and/or Site Champion regarding the archaeological importance of the discovery, and conservation and storage recommendations.

The Nominated Contact for each company is detailed below.

BMAPA Company	Nominated Contacts	Position
Britannia Aggregates Ltd	Richard Fifield	Marine Resources Manager
CEMEX UK Marine Ltd	Joseph Holcroft	GIS and Licence Co-ordinator
DEME Building Materials Ltd	Christophe Matton Tom Janssens	Marine Resources Manager General Manager
Hanson Aggregates Marine Ltd	Chris Popplestone Nigel Griffiths	GIS and Resources Coordinator Principal Resources Manager
Isle of Wight Aggregates	Edward Skinner	Marine Resources Coordinator
Kendall Bros Ltd	Paul Stevens	Managing Director
Tarmac Marine	Edward Skinner	Marine Resources Coordinator
Volker Dredging Ltd	Will Drake	General Manager

Fourteenth Anniversary

In 2018–2019, the Protocol turned 14. During this year, 96 individual finds were reported through the Protocol (from 43 reports) including medieval cannonballs, Victorian munition and aircraft. These have been added to a database of over 1800 finds reported since the launch of the scheme in 2005.

Without the reporting process, finds from dredged aggregate would most likely never have entered the archaeological record as dredgers allow us to access areas of the seabed otherwise physically unexplored. The reporting procedure laid out in the Protocol is designed to allow users to follow a time-effective process of documenting and reporting finds to the Nominated Contact or Implementation Team at Wessex Archaeology. The team aim to identify and conduct research on the find before producing a short report and sharing the information with marine aggregate industry staff and the named authorities. In the instance that the team cannot identify the object, an in-house or external specialist will be contacted to ensure that the utmost is done to provide a background and relative age on the reported find.

Nine wharf visits were conducted this year, allowing us to keep in contact with the staff who report the objects through the Protocol and to meet some of the new staff members who had not previous had archaeological awareness training. The training this year aimed to specifically target wharves who had not been visited in the last two years in order to keep the Protocol and reporting process fresh. As the training occurs predominantly on the south coast, it was decided to visit two wharves in the north of England this year to encourage participation from those further afield.

The number of reports each year and the ongoing success of the Protocol confirms that it is as relevant now as it was in 2005. The support of the marine aggregate industry has once again been substantial, with the continued reporting of significant archaeological finds maintained at a high standard through the Protocol and the welcome received during wharf visits.

Through the implementation of the Protocol, the marine aggregate industry has demonstrated that this is a cost-effective mitigation option for protecting cultural heritage that is both fragile and finite. The Protocol Awareness Programme trains staff to recognise and report finds of archaeological interest discovered within cargoes without the need of an archaeologist being present. Because of the success of the Protocol, the model has been adapted and implemented for use in several other industries. The Offshore Renewables Protocol for Archaeological Discoveries (ORPAD), having commenced in 2010 is now equally well-established. In addition, 2016 saw a reinterpretation of the Protocol principles for non-industry audiences, with the launch of the Marine Antiquities Scheme (MAS) aimed at encouraging coastal users to report any finds they encounter. Wessex Archaeology also continues to run scheme-specific protocols for other development projects based on the marine aggregate industry model.

Further information about the Protocol and the Protocol Implementation Service is available online
https://www.wessexarch.co.uk/our-work/marine-aggregate-industry-protocol-reporting-finds-archaeological-interest

To contact the Protocol Implementation Service email protocol@wessexarch.co.uk or phone **01722 326 867**

Raising awareness

The Protocol Awareness Programme is funded by BMAPA and The Crown Estate and implemented by Wessex Archaeology. Members of the Protocol Implementation Team promote awareness of the Protocol and keep content up to date as well as visiting several wharves a year to maintain a close relationship with the staff. To have consistency, it is often the same member of the team visiting the wharves where possible. Emails between the Implementation Team and the wharf managers and Site Champions are encouraged to keep a consistent flow of communication. Through e-mails, phone calls and during the visits, any questions can be answered, and feedback is gathered so that we can further improve the delivery and content of the Protocol. Awareness is also promoted to the wharves and vessels through the biannual *Dredged Up* newsletter.

The awareness programme:

- delivers in-person training by an archaeologist during awareness visits to wharves, aiding industry staff to identify several different types of archaeological finds through interactive slides as well as the process of reporting finds of archaeological interest discovered on the wharf;
- demonstrates the different types of finds from a range of various ages that can be encountered by allowing wharf staff to handle a collection of finds that has previously been reported through the Protocol;
- produces the biannual *Dredged Up* newsletter which aims to publicise the Protocol and highlight recent finds and news. The newsletter is sent out to each Nominated Contact, wharf and vessel that implements the Protocol. The most recent issue, Issue 25 printed in Autumn 2019, and all previous Dredged Up newsletters, can be found online http://www.wessexarch.co.uk/projects/marine/bmapa/dredged-up;
- raises Protocol awareness amongst third parties, such as geotechnical and environmental survey companies working on behalf of the marine aggregate industry;
- is available to support and train individual Site Champions to ensure that new and existing staff are familiar with the Protocol, either in person, over the telephone or via email;
- as of 2019, produces promotional material in the form of branded photo scale cards and mugs delivered to each wharf and vessel enrolled in the scheme; and
- as of 2019, distributes biosecurity awareness material and delivers the training as an add on to the archaeological awareness training.

New promotional material

This year, we successfully launched new promotional material for the Marine Aggregate Industry Archaeological Protocol in the form of photo scale cards and mugs.

The photo scale cards are the perfect size to be kept in a pocket, wallet or purse and were designed to be used when taking photographs of archaeological finds found on site or on deck. Both sides of the card are a variation of each other and either side can be used. Just one day after releasing the photo scale cards, we received the first report in which the card was used as a scale which signified their success! A request for photographs of everyone using the mugs to be put in the *Dredged Up* newsletter did not disappoint either.

Visits to wharves

Since the 2017–2018 annual report was published, nine Protocol Awareness Visits have been made to wharves around the country. The Protocol Awareness Implementation Team ran training sessions to wharves in Kent, London, Sussex, Isle of Wight, Middlesbrough and South Tyneside.

The training sessions usually last around 30 minutes each to minimise disruption to the work of the wharf and are often split in to two or three sessions so that the wharf can continue working with a rotation of staff. Each session is designed to be informal and involve an interactive presentation to explain how archaeology reaches the seabed and what to do if it is found in the cargo delivered to the wharf. A member of the Protocol Awareness Implementation Team brings an array of archaeological finds previously reported through the Protocol that wharf staff can handle and discuss, as well as awareness handouts, laminated scale sheets and the new branded photo scale cards. Questions can be asked at any time during the training and a discussion is usually had at the end of the presentation. The handouts are designed to be left at the wharf to enable the Site Champions to induct any future employees or so that current employees can refresh their memories. The Protocol Implementation Team firmly believe that these visits are key to the success of the scheme. As well as delivering the training, the visits allow Wessex Archaeology to maintain contact with wharves and vessels, keep the content fresh, boost interest in the Protocol and promote it to both new and existing staff.

All archaeological awareness materials can be accessed through the Protocol pages on Wessex Archaeology's website (http://www.wessexarch.co.uk/projects/marine/bmapa/docs.html) and are available in English, Dutch and French.

Training certificates are sent out to the Site Champions to give to all wharf staff who receive the awareness training so that they may add them to their working portfolios. These are emailed to each Site Champion or wharf manager after a wharf is visited. Additionally, a feedback form is also handed to the attending wharf staff at the end of each visit (or emailed) in order to gather comments and suggestions so that we can continue to make improvements to Protocol Awareness and the way we deliver the training.

Visits have been undertaken this year to British wharves receiving marine aggregate. Contact has been maintained with other British wharves, vessels and Continental wharves through regular emails, the Facebook page, the annual report and the *Dredged Up* newsletter.

If you would like to arrange a Protocol Awareness Visit, or would like to receive more advice on finds and finds reporting, please contact Wessex Archaeology via protocol@wessexarch.co.uk.

Biosecurity

As of 2019, another element was added to the archaeological awareness training in the form of Biosecurity. Due to the success of existing Protocol Awareness materials, BMAPA invited Wessex Archaeology to produce awareness material on biosecurity; specifically focusing on the 12 most high risk Invasive Non-Native species (INNS) within the UK. The materials and information could then be delivered in person, as an addition to the archaeological awareness training. The aim of this training is to raise awareness of biosecurity as an issue, and to explain what steps the marine aggregate industry is taking to manage it. The booklet provided outlines the 12 species to look out for; giving information on what they look like, where they are commonly found and how they are impacting on our native species. The booklet also reiterates the legalities of dealing with these species.

Poster (top) and booklet (right)

Dredged Up newsletter

Newsletter issues 24 and 25

In 2018–2019, two issues of the biannual *Dredged Up* newsletter were produced; issue 24 and issue 25.

Issue 24 was distributed in April 2019 and outlined some of the year's finds as well as publishing the winners of the annual Finds Awards. The issue also gave an insight in to some of the Site Champions that are the driving force behind the success of the Protocol.

Issue 25 was distributed in October 2019 and shared information and images of the new promotional material as well as images of some of the staff using them! The issue also had news from the wharves segment which included the arrival of a new CEMEX dredger.

The newsletters are distributed to every wharf, all vessels and BMAPA member companies as well as The Crown Estate, Historic England, the Receiver of Wreck and a variety of other organisations, individuals and the general public during conferences and events. A wider audience is reached by a digital copy of the newsletter that is downloadable from the Wessex Archaeology website (https://www.wessexarch.co.uk/our-work/marine-aggregate-industry-protocol-reporting-finds-archaeological-interest) and relevant social media pages.

The newsletters reach a wide audience to promote the operation of the Protocol and provide a positive showcase for the industry's activities. They are also an important tool for raising and maintaining awareness and interest by publicising dredged finds and the dredging process.

Finds Awards

The 2017–2018 Finds Awards were made to the following wharf and vessels, published in Issue 24 of *Dredged Up*.

Best Attitude by a Wharf

This year, the winner of the best attitude by a wharf was Tarmac's Marchwood Wharf. Despite not reporting any finds themselves, the attitude of this wharf towards the Protocol was second to none and they have recently purchased cabinets to display past finds. During the summer of 2018, Marchwood Wharf was visited by two members of the Implementation Team and all the staff were great sports when asked to pose with us for photographs.

Runner up of best wharf went to Hanson's Antwerp Wharf who submitted a find from the Humber area, which does not happen regularly. Hanson_0873 consisted of a hook and two bullets which were discovered by Dirk Geleyn from Licence Area 106/3. The hook is similar to a crane hook that would have been attached to the crane via the hole at the top with a secure D ring rather than a fishing hook. Images of the two bullets were sent to Trevor Parker of the Ordnance Society who said that he thinks both are examples of British 20 mm cannon shells. Based on the image, he says they resemble Hispano bullets that are fired from aircraft, rather than Oerlikon bullets that are fired from ships.

Hanson_0873

Tarmac_0850

Best Attitude by a Vessel

The best attitude by a vessel goes to Tarmac's *City of Cardiff* with a big thank you from the Implementation Team for reporting the first finds from the north-west dredging region since 2007 and not only one, but two objects!

Tarmac_0849 is an animal bone (see below) discovered in Licence Area 392 by Paul Warren Sinclaire. Images of the bone were sent to our in-house animal bone specialist, Lorrain Higbee. She said that this example is a tibia from a sheep or goat. She said that it looks quite gracile which means it is an unimproved breed and could be anything from prehistoric to medieval in date. Animal bone can enter the archaeological record offshore in a number of ways. There is the potential for the bones to be washed into the sea from terrestrial deposits. Alternatively, animal bones on the seabed may derive from an animal carried on-board a vessel. In the 18th and 19th centuries, ships would carry livestock as a source of fresh meat, with animals such as cattle, pigs, goats and poultry carried on-board.

Tarmac_0850 is a pulley sheave (see above), also discovered in Licence Area 392 by a member of the crew of *City of Cardiff* and reported by Phil Robertson. The sheave measures approximately 220 mm in diameter and has a thickness of 40 mm. In a maritime context, sheaves are a wheel or disc with a grooved rim, used as a pulley as part of the ship's rigging system that sits inside a rigging block. Prior to the 19th century, sheaves and blocks were made entirely from wood; therefore, this find may date to this period. After this date, while the rigging blocks themselves remained to be made of wood for a period of time, the sheaves themselves changed to be made of metal as the groove around the rim would not wear down as quickly.

Tarmac_0849

Best Find

The best find award went to a beautiful example of a hand grenade that came from CEMEX's Leamouth Wharf. CEMEX_0825 was dredged from Licence Area 137 in the South Coast dredging region and discovered by the Site Champion, Steve Bomber.

In accordance with industry procedures, the find was reported to the police and removed from site by the Explosive Ordnance Disposal (EOD) team. Finds like this one are not uncommon offshore and staff in the aggregate industry have been trained to recognise and report them for their safety. Unexploded ordnance (UXO) pose a significant risk as degradation of the detonator or fuse can render them unstable and an impact could potentially detonate the device, therefore it is vital that they are reported immediately.

Images of the find were sent to Trevor Parker of the Ordnance Society. He said that the find looked like a British hand grenade which had split open and therefore was probably completely inert. He said that the marks on the surface of the grenade are quite common on First World War grenades and are most likely batch numbers. Based on the shape of the remains of the spoon pin retainer towards the top of the grenade, it has been determined that this is a No. 36 or No. 36M grenade, known as a Mills bomb. William Mills, a hand grenade designer from Sunderland, patented, developed and manufactured the 'Mills bomb' at the Mills Munition Factory in Birmingham, England, in 1915. The Mills bomb was adopted by the British Army as its standard hand grenade in 1915 and over the years, undertook a series of modifications. The final variation of the Mills bomb, the No. 36M, was designed and waterproofed for use in the hot climate of Mesopotamia in 1917, but was still manufactured in the UK up until 1972 and later in some countries. Over 70 million of the British Mills Bomb hand grenades were manufactured from 1915 to 1972.

CEMEX_0825

The No. 36M grenade was an anti-personnel bomb with a danger zone on detonation of approximately 400 yards (365 m). The grenade had a cast iron body which was filled with a high explosive, Baratol 20/80 through the filling hole in the shoulder, which was closed by a screw-threaded plug. The centre piece was made of aluminium or tinned brass and comprised of two adjacent chambers. The smaller chamber received the detonator and was empty until the grenade was primed. The larger or Striker Chamber was positioned in the centre of the body and contained the Striker and Striker Spring; the head of the striker protruded through the circular hole at the top; the opening in the base received the cartridge end of the Igniting Set. There were two types of Igniting Set that varied in time of burning of the fuse; seven second fuses were coloured yellow while four second fuses were coloured white and had a rubber band around them which was never to be removed as it provided the means of identification at night.

Engagement with the next generation of maritime archaeologists

When work experience students visit Wessex Archaeology's Coastal & Marine team, the work they do with us often revolves around the Protocol and the finds that have been reported.

Recently, work experience students created photogrammetry models of previous finds, having chosen the finds each student found the most interesting. Photogrammetry entails taking a series of images with a 50–70% overlap from various heights and angles to create a 3D model of some real-world object. The results were fantastic! And have been published on Wessex Archaeology's social media platforms.


Photogrammetry model of CEMEX_0280

A more in-depth assessment of Protocol finds was undertaken by Elise Van Loon, a Masters student at the University of Southampton. She spent almost 20 days with the Coastal & Marine team, learning about commercial marine archaeology including this Protocol and ORPAD. She did photogrammetry training, timber recording and spent time reviewing ROV footage of seabed anomalies. On a day with the geoservices department, she GIS modelled sea-level rise. But most of her time was spent studying Protocol finds to produce a thematic analysis report and submit as coursework. Her report illustrated the wide range of finds that have been recovered, from Palaeolithic handaxes to modern aircraft, and focussed particularly on Palaeolithic, medieval/post-medieval and modern discoveries.

Discoveries from the Protocol play an important role in helping the next generation of maritime archaeologists to develop an understanding of the wide range of material that can be recovered from the sea, and how industries like the aggregate industry play an important role in uncovering these finds and ensuring that they are assessed and conserved for future generations.

Hanson_0898
(scale unknown)

0 25 mm

Tarmac_0890

Protocol reports

During the fourteenth year of operation Wessex Archaeology received 43 reports through the Protocol Implementation Service. These reports encompassed details of 96 separate finds. Further details of each discovery are shown below and included in the wharf reports appended to this report.

Finds reported in 2018–2019

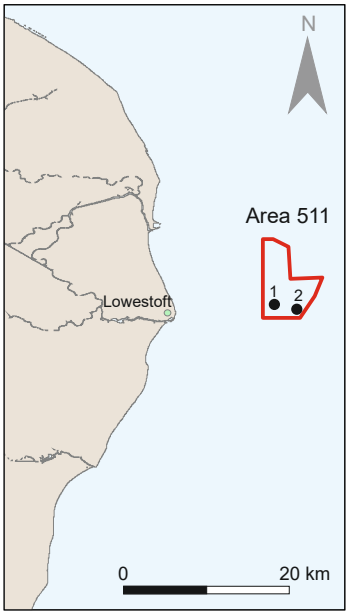
Report ID	Licence Area	Region	Wharf/Vessel	Description	No.
CEMEX_0888	340	South Coast	Wharf	Shell	1
Tarmac_0890	500/3	South Coast	Wharf	Plate fragment	1
Tarmac_0891	460	East English Channel	Wharf	Alloy construction	1
Tarmac_0892	460	East English Channel	Wharf	Iron nail	1
Tarmac_0893	395/1	South Coast	Wharf	Metal object	1
Tarmac_0894	395/1	South Coast	Vessel	Threaded bar	1
Tarmac_0895	351	South Coast	Wharf	Metal rod	1
Tarmac_0896	351	South Coast	Wharf	Brake shoe	1
Brett_0897	461	East English Channel	Wharf	Two cannonballs and metal object	3
Hanson_0898	401/2B	East Coast	Vessel	Bone	1
Tarmac_0899	351	South Coast	Wharf	Brass universal joint	1
CEMEX_0900	340	South Coast	Wharf	Four shell fragments	4
Brett_0901	Unknown	Unknown	Wharf	Small cannonball	1
Tarmac_0902	460	East English Channel	Wharf	Bar shot	1
Tarmac_0903	Unknown	Unknown	Wharf	Wood Fragment	1
CEMEX_0904	512	East Coast	Wharf	Part of anchor	1
CEMEX_0905	512	East Coast	Wharf	Hook	1
CEMEX_0906	137	South Coast	Wharf	Minesweeping cutter	1
Tarmac_0907	430	East Coast	Vessel	Aircraft propeller blade	1
CEMEX_0908	137	South Coast	Wharf	Submarine Pyrotechnic	1
Tarmac_0909	395/1	South Coast	Wharf	Naval round	1
CEMEX_0910	340	South Coast	Wharf	Shell	1
Hanson_0911	240	East Coast	Vessel	Cannonball	1
DEME_0912	351	South Coast	Vessel	Steel wreckage	1
CEMEX_0913	340	South Coast	Wharf	Shell	1
CEMEX_0914	511	East Coast	Wharf	Aircraft components	8
CEMEX_0915	511	East Coast	Wharf	Aircraft components, bollard, munition, three shoes	12
CEMEX_0916	137	South Coast	Wharf	Shell	1
CEMEX_0917	137	South Coast	Wharf	Shell	1
CEMEX_0918	511	East Coast	Wharf	Aircraft components	2
CEMEX_0919	458	East English Channel	Wharf	Cannonball	1
CEMEX_0920	511	East Coast	Wharf	Collection of munitions	24
CEMEX_0921	340	South Coast	Wharf	Munition	1
CEMEX_0922	340	South Coast	Wharf	Munition	1
CEMEX_0923	340	South Coast	Wharf	Munition	1
Britannia_0924	Unknown	Unknown	Wharf	Animal Bone	1
CEMEX_0925	514/1	Humber	Wharf	Animal Bone	1
Hanson_0926	240	East Coast	Wharf	Collection of flints	5
Hanson_0927	240	East Coast	Wharf	Animal Bone and Mammoth Tooth	3
Hanson_0928	240	East Coast	Wharf	Engine Valve	1
Hanson_0929	240	East Coast	Vessel	Mammoth Vertebra	1
CEMEX_0930	407	South Coast	Wharf	Munition	1
Hanson_0931	240	East Coast	Wharf	Tusk	1

Specialists

If finds cannot be successfully identified by a member of the Protocol Implementation Service team at Wessex Archaeology, experts both in-house and from external companies and organisations are consulted. Since the implementation of the Protocol in 2005, the collection of willing and valuable experts we consult has grown to include a range of fields. Occasionally, the experts are consulted to add additional information about objects, or in order to ensure that discoveries are identified accurately and the archaeological value of each object is understood. The table below provides a list of the specialists who gave advice during the 2017–2018 reporting year. Specialists that we have contacted in the past but not during this operational year are still included in Wessex Archaeology's internal lists, but have been omitted from the table below. We are extremely grateful to all the specialists who have assisted in the identification of Protocol finds over the last twelve years.

Expert	Advice given concerning	Institution/Organisation
Ewen Cameron	Military aircraft	RAF Museum
Bob Davis	Archaeological artefacts	Wessex Archaeology
Alistair Byford-Bates	Maritime artefacts	Wessex Archaeology
Graham Scott	Maritime artefacts	Wessex Archaeology
Lorrain Higbee	Zooarchaeology	Wessex Archaeology
Dr Adrian Lister	Mammoth remains	Natural History Museum
Phil Magrath	Ordnance	Royal Armouries Museum
Jonathan Ferguson	Ordnance	Royal Armouries Museum
Anthony Mansfield	Mechanics and engineering	Senior Naval Engineer
Lorraine Mepham	Pottery	Wessex Archaeology
Trevor Parker	Ordnance	Ordnance Society
Steve Vizard	Aircraft	Airframe Assemblies
Robert Clarke	Aircraft	Wessex Archaeology
Matt Leivers	Flint artefacts	Wessex Archaeology
Quita Mould	Leather artefacts	Leather specialist
Charles Trollop	Medieval ordnance	Historical ordnance expert

Case Study 1 – Area 511



1. CEMEX_0914, CEMEX_0920
2. CEMEX_0915, CEMEX_0918

During this reporting year, a variety of material, including aircraft material, was recovered from Licence Area 511 and all reported from Angerstein Wharf. Licence Area 511 is in the East Coast dredging region, approximately 9 km north-east of Lowestoft.

Previous finds of aircraft material from Licence Area 511 include CEMEX_0230 found in 2009 (Wessex Archaeology 2009), CEMEX_0290 found in 2010 (Wessex Archaeology 2010), WA2034, WA2035 and WA2036 all found in 2013 (Wessex Archaeology 2013) and more recently, CEMEX_0867 found in 2018. CEMEX_0230 consisted of two aluminium fragments approximately 240 mm and 210 mm in width and 180 mm and 130 mm in width, with cross rivets on their surface. One of the pieces has holes drilled for possible anchor nuts. The type of aircraft could not be determined. CEMEX_0290 consisted of three pieces of aircraft wreckage that were identified as coming from a United States Air Force McDonnell-Douglas F-4 Phantom. This type of aircraft was flown from the mid-1960s and they are still in use today. CEMEX_0867 was believed to be an extrusion, as opposed to a section of formed sheet metal. The section seemed thick, meaning that it was quite substantial to the structure of the aircraft, suggesting it may be part of the wing structure or rib section. It was thought that the rivet type appeared to be British rather than American. WA2034 represented fragments of aircraft wreckage believed to be that of a Wellington MKIC X9634, a British heavy bomber. WA2035 was a 930 mm long fragment of an aircraft's tail wing spar and may be indicative of a crash site in the vicinity. WA2036 was a fragment of an aircraft hydraulic jack.

CEMEX_0914 was the first set of finds reported from the area in 2019 and comprised eight separate aircraft components; some with rivets still *in situ*. The largest piece measured 380 mm by 200 mm while the smallest piece measured 130 mm by 110 mm. Images of the find were sent to our in-house specialist Robert Clarke and an external aircraft specialist, Steve Vizard. Steve said that although they were definitely aircraft parts, there was nothing evident to establish type. However, from the general look of the items, and the appearance of the nuts on the mechanical/system component in one of the photographs, he suggested that they may well be German. The in-house specialist, Robert said that within the images there were possibly a couple of engine parts and the rest from the structure of the airframe. He said that the D-shaped item may have been a strengthening bracket that went around a foot or hand hold to get into the cockpit. He said the screw holes on the piece are countersunk, suggesting it was an external item. The idea was to strengthen the structure at the point where the boot or hand goes into a slot, stopping the weight of the pilot bending, or distorting the skin at this point.

CEMEX_0915 was made up of 12 separate items including seven aircraft fragments, a possible mooring bollard, a munition head and three different fragments of shoe all discovered in the same cargo. The largest aircraft fragment was 480 mm long by 90 mm while the smallest was 140 mm by 60 mm. Some of the aircraft components had rivet holes around their extremities, however there were no visible markings or numbers stamped on them that would aid in identification. The largest shoe fragment was a complete sole measuring 310 mm by 110 mm while the smallest fragment was 80 mm by 80 mm. The two smallest shoe fragments had visible markings on them. One of the soles had 'Made in' in raised letters on it while the other had a series of stamps present including '10C' '73' and 'VIII'. Images of the aircraft components, shoes and possible mooring bollard were sent to an external aircraft specialist, Steve Vizard. Steve confirmed that all the lightly coloured metal components were definitely aircraft but were too fragmented to determine much else. He said that the shoe remnants did not appear to be flying boots. The possible bollard was a cylindrical iron object measuring 190 mm long with a diameter of 185 mm at the thicker end. Steve agreed that the iron bollard is a modern mooring fixture of some sort that may have come off a vessel. Once it was concluded that the shoes were not related to the aircraft, the images were sent to an external leather shoe specialist, Quita Mould. She said that she believed that on the tip of one of the shoes, that she could see 'Made in England'. She said there were two components to the stamped shoe; the sole and probably the midsole from a shoe bottom of adult male size which originally had a separate, low, D-shaped heel attached, which is now missing. Quita said that as it had no upper it cannot be closely independently dated but said it looks to be a 20th century mass produced item.

The CEMEX_0915 munition head measured 120 mm by 50 mm at its base. Images were sent to Wessex Archaeology's in-house specialist, Bob Davis, who said that it was difficult to identify as it was very corroded. He said it wasn't very clear what it was made of (ferrous or alloy) or if there was a join toward its base. He said if it was solid, then it would most likely a steel shell, whereas if it was alloy then it could possibly be a cap. Ballistic caps normally attach to the main body of the shell via a thread. They can also be made of light weight alloy (aluminium) as they are sacrificial and only are used for ballistic aerodynamics. Bob said that if this example was a ballistic cap, he would expect it to have a sharper point but, given its small diameter of approximately 50 mm this might not be needed. Further contact with the wharf confirmed that the munition head was solid rather than hollow, in order to aid Bob in identifying it. In this case, he said that he would tend towards a 50 mm solid armour piercing common point round head. An armour piercing (AP) shell, is a type of ammunition designed to penetrate armour and this example was probably fired from a heavy machine gun. It is not possible to determine whether the munition is definitely related to the aircraft components. However, Bob said it could be related as the aircraft in question may have been shot at by heavy calibre machine guns on board ships or, alternatively the munition could be from an aircraft as 50 mm browning machine guns (American) were fitted to aircraft such as the P-47 and bombers for protection.

Within a week of CEMEX_0914 and CEMEX_0915 being reported, CEMEX_0918 was reported from Angerstein wharf. The report was made up of two separate aluminium aircraft components with number stamps visible on their surface. The largest piece measured 200 mm by 40 mm while the smallest piece measured 195 mm by 20 mm. There were rivets still visible *in situ* on the larger piece along with an unidentified stamp. The smaller piece had the numbers '81431' stamped on the surface.

Images of both these components were sent to external aircraft specialist Steve Vizard. Steve said that they confirmed his identification of the components reported as CEMEX_0914 in that it looks to relate to a German aircraft. The indistinct stamp appears a Luftwaffe type, and the numbers also look that way. It certainly points in the direction of not being British or RAF as the numerals are not correct for the period. Britain tended to always use a 'flat top' 3. The Luftwaffe was the aerial warfare branch of the combined German Wehrmacht military forces during the Second World War, developed under Nazi rule. Several aircraft were built as a result of slave labour and despite being one of the most technologically advanced air forces in the world when the Second World War began, the Luftwaffe was a defeated force by 1944.

CEMEX_0915


Image 1


Image 2


Image 3


Image 4


Image 5


Image 6


Image 7


Image 8

CEMEX_0920 was a collection of munitions found at Angerstein wharf. Images of the munitions were sent to Trevor Parker from the Ordnance Society, and external aircraft specialist, Steve Vizard as they could have been related to the previous aircraft discoveries, and to Wessex Archaeology's in-house specialist, Bob Davis. All three made the comment that the munitions are extremely varied. Steve said that based on the images, it seems the majority of the heads are fired, as denoted by the rifling grooves on the copper drive bands, and are quite heavy calibre, so likely to be Naval. The smaller rounds could be aircraft related but would normally be found in clusters or drums if we were dealing with an aircraft crash site.

The rounds were identified as a British 20 mm cannon shell, a couple of .50 calibre heavy machine gun shells, with the remainder being rifle calibre but could be further identified by inspecting the head stamps. Trevor said one of the single rounds was a 20 mm Oerlikon round used on close range anti-aircraft ship mounted guns, made in 1943 by the Raleigh Cycle Company in Nottingham. These are usually explosive with a brass nose fuse. Some of those are also 20 mm but might be Hispano as well as Oerlikon; American 0.5-inch Browning and possibly some 0.303-inch and 0.3-inch machine gun. Trevor said that the larger calibre items may still be aircraft linked, as three out of four appear to be 6-pounder armour- piercing solid shot, which were fired by a modified Mosquito mounting a single barrel gun. This was quite successful in the anti-shipping role and was credited with a number of surfaced U-boats as well as surface ships. Some of the ammunition might be German (like the aircraft material), but without seeing the stampings on the base of the brass casings, it is impossible to tell. Bob said that image 1 has four small medium artillery shells, all fired examples and that the second from the right may have a tracer element to the base. The middle row has what looks like a large round on the left with a used drive band so a small artillery piece while the rest of the row looks like mostly 20 mm and 37 mm cartridges and shells. The 20 mm rounds may have come from a Navy version of the Oerlikon gun, a 20 mm machine cannon or aircraft cannon. The shells appear to be solid shot, meant to damage aircraft and the like. He said that image 2 and 3 most probably represent an aircraft round commonly known as Hispano 404 cannon used widely in Second World War British aircraft. He said image 4 appears to be a 50 calibre bullet. A 50 calibre is usually defined as half and inch therefore .50. Bob identified image 5 as a fired solid armour piercing round as the rifling marks are still visible on the driving band. Without a scale, it is difficult to tell which type of gun it came from. He suggested image 6 may be a bofors round, however more could be said if the markings on the base were visible. Image 7 is a 50 calibre bullet that appears to be made of copper. As the munition in image 8 is heavily concreted, it is difficult to identify. It appears to be a solid armour piercing round of perhaps a small calibre and possibly belongs to a bofors gun.

As a collection of munitions, these finds wouldn't normally necessarily be associated with aircraft, however due to other recent finds from the same area and the comments from the specialists, it is believed they may be related. After looking at all the images, Bob said that it is unusual that there are fired large rounds and unfired possible aircraft rounds all from the same area, making it seem as if there were some sort of battle at sea or that they were dumped there after the war.

The collection of recent finds; CEMEX_0914, CEMEX_0915, CEMEX_0918 and CEMEX_0920 all from Licence Area 511 are not believed to represent a discreet aircraft crash site as there are no diagnostic features to identify one certain craft. Rather, it is believed that the material is spread out over a wider area. Discussions with Historic England over the course of the discoveries kept them informed of all the findings and made sure that all necessary steps were taken. We have asked staff at the wharf to be vigilant if processing any further cargo from Licence Area 511.

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Case Study 2 – Area 137

Despite only two finds coming from Licence Area 137 this year, they are both significant finds that are believed to represent marine warfare on the south coast. Licence Area 137 is approximately 10 km south of the Needles.

● CEMEX_0906, CEMEX_0908

CEMEX_0906

CEMEX_0906 is thought to be a minesweeping cutter and was discovered by Steve Bomber at Leamouth Wharf. The broken metal object measures 400 mm long by 150 mm at its widest point. The head of the find tapers in to a rounded head that may have been positioned in such a way as to pivot the object. A series of rivet holes are to be seen along the inner edges of the find where a second, smaller metal piece of the same shape was once attached. Only a small section of this second piece still remains, held in place by one rivet.

Graham Scott, a Senior Maritime Technical Specialist at Wessex Archaeology, suggested the find is a minesweeping cutter.

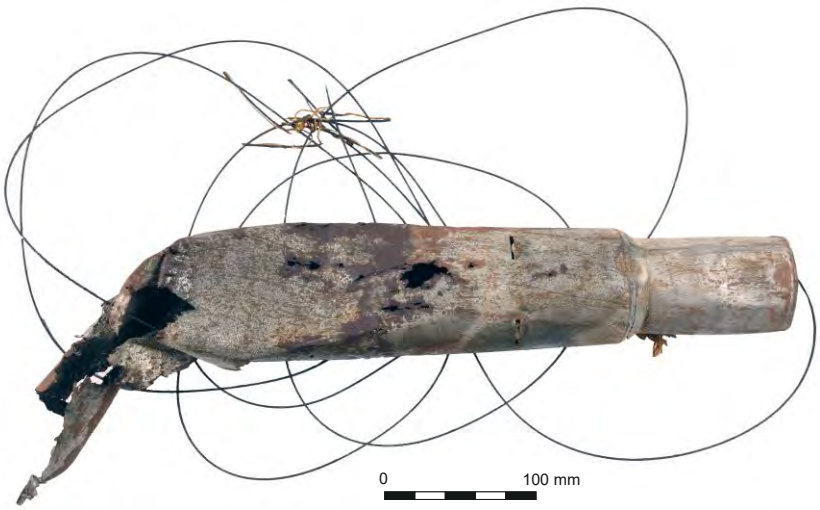
During the First World War, the importance of minesweepers became apparent as vessels were fitted with mine sweeping gear to clear moored contact mines. This gear consisted of a long cable with a serrated edge to cut the Contact Mine's mooring cable. During the Second World War, the minesweepers had the mammoth task of keeping the sea lanes open to Britain's major ports. These mines were laid in British waters by the enemy, usually at night by minelayer ships, such as Destroyers or E-boats and occasionally by submarines.

Even before the Second World War started, ships suitable to be used as minesweepers were requisitioned by the Admiralty. These were mainly trawlers and drifter fishing vessels. Trawlers were the larger Ocean-going vessels fishing with trawl nets while Drifters were smaller fishing vessels using drift nets. When requisitioned, their crews would often volunteer to come with them.

Additional supports had to be added to the vessels to strengthen the hull and decks to bear the extra weight of the guns and mine sweeping gear. Holds which were once used to store fish were fitted out as mess decks with tables, benches and provision to hang hammocks. Rifles required to sink mines and the ammunition for them were stored in a secure magazine beneath the mess deck.

Minesweeping vessels were armed with an assortment of weapons, often left over from the First World War, which arrived covered in a thick layer of grease. A 4 inch or 12-pounder was mounted on the forecastle, an Oerlikon (or a Bofors or 0.5 machine guns) was mounted aft and Lewis or Hotchkiss guns were mounted on the bridge wings.

Initially, the vessels were fitted with mine sweeping gear to clear Moored Contact Mines, which were oval and had horns on the top, floating close to the surface of the sea, connected by a cable to a sinker on the sea bed. The horns were the firing points and contact with them activated the mine with devastating results. When the horn was bent, a sealed glass tube of acid inside broke, flowing over the battery, completing the circuit of the electric detonator.



CEMEX_0908 submarine pyrotechnic fragments

During the Second World War, cable cutters such as CEMEX_0906 were called Sharks Mouths by the crew and were attached to the minesweeping cable. On the end of the cable there was a float designed to move away from the minesweeper allowing a strip of sea to be swept. Once the Contact Mine's tether was cut and floating on the surface, the Minesweeper's crew would fire their rifles at it. They were not aiming at the prongs on the mine to explode it, but at the body of the mine to puncture and sink it, as a large explosion close to the minesweeper would be dangerous. (http://www.wildfire3.com/drifters-and-trawlers.html accessed September 2019).

It is thought that this cutter may represent a 'sharks mouth' cutter as it resembles various images found during research. The fact that no trace of a blade is visible on this minesweeping cutter may mean that it was heavily used and possibly discarded as it had reached the end of its working life. Alternatively, it could have been lost overboard during every day shipping operations or during wartime activities. A similar minesweeping cutter (CEMEX_0838) was found in the 2017–2018 reporting year from the same licence area as this one (Wessex Archaeology 2018). Although it is uncertain whether both cutters are related at this time, further finds of this nature should continue to be reported as they may be indicative of an area heavily associated with wartime activity.

CEMEX_0908 cylinder tube extended (above) and detail of brass ring (below)

CEMEX_0908

CEMEX_0908 is an extraordinary find consisting of two parts, thought to be a submarine pyrotechnic discovered at Shoreham Wharf by Michael Pettitt, Tim Bethune and Mark Nichols. The first element is a broken metal cylindrical tube that measures 820 mm long and 70 mm wide that appears to be made of aluminium with an associated brass mechanism. On one of the brass rings at its ends are inscribed 'Ejector No. 2 MK I/L ll MB/44' as well as the Navy Broad arrow. It appears that wire is present at one broken end of the cylinder while a series of electrical components are visible at the other. The second component of this find is a canvas parachute, that despite a few holes is complete with the remains of the string that would have held it to its origin.

Images of the finds were sent to our in-house specialists Alistair Byford-Bates, Bob Davis and Robert Clarke. Alistair and Bob both said that it looked 'percussive' and suggested that both finds were connected. Alistair also suggested that the 44 on the brass ring may be indicative of a date of manufacture.

After research, Bob Davis suggested that this find may be an example of a Submarine Emergency Identification Signal, Star, Mk 2 Mod 2 or Mk 3 Mod 0. These signals were for either day or night use. They were for use exclusively with the submarine signal ejector and were ejected by compressed air. On rising to the surface of the water, Submarine Emergency Identification Signals Mk 2 Mod 2 and Mk 3 Mod 0 project a Single Star Grenade Mk 5 to a height of 250 feet (76 m), where a parachute would open to support the star, which would burn for approximately 13 seconds. The complete signal was available in one of three colours – red, green or yellow. It is interesting to note that in the Surface Pyrotechnics and Projectors Ordnance Pamphlet 1177, it stated that 'Signals of this type now in service are expected to give only 50 per cent performance. For this reason, at least three signals should be fired in actual operations for each star required' (Navy Department Bureau of Ordnance 1945).

Submarine Emergency Identification Signals Mk 2 Mod 2 and Mk 3 Mod 0 consisted of a buoyant tube of aluminium 18.5 inches (470 mm) long and three inches (76 mm) in diameter, which contained the Single-Star Grenade Mk 5 Mod 0. One end was closed with an ogive nose cap. The other end carried the ignition device, which consisted of a firing pin lever and spring, a tripping lever and pin, a lock spring and pin, and a safety cotter pin which is of the ring-pull type. Above the firing-pin lever was the primer in its holder, which flashed into the combination delay unit and ejection charge (Navy Department Bureau of Ordnance 1945).

Early issues of Submarine Emergency Identification Signal Mk 2 Mod 2 contained either Smoke Grenade Mk 3, for day use, or Three-Star Grenade Mk 4, for night operation.
The submarine signal ejector was a device that was usually located in the control room of submarines and extended through the shell of the vessel to the superstructure deck, so that the muzzle was flush with the deck plates. It was designed to eject, by compressed air, when surfaced or submerged, however Submarine Emergency Identification Signals Mk 2 Mod 2 and Mk 3 Mod 0 should not have been ejected at depths greater than 160 feet (79 m), as the time required to reach the surface was limited to the 27 seconds allowed by the fuse. The ejector mechanism was similar to, but smaller than, the conventional torpedo tube. An auxiliary air connection to the outboard section of the ejector permitted the blowing out of water from the barrel after a signal was been fired through a one-inch drain line into the control room bilge. In the Surface Pyrotechnics and Projectors Ordnance Pamphlet 1177, it stated that 'It should be impressed on all personnel that when the signal projects the grenade, the recoil of the signal case is violent' (Navy Department Bureau of Ordnance 1945).

Robert Clarke had a different idea for the find. He said it looks more like a 2-inch UP (unrotated projectile) Anti-Aircraft Rocket. The name 'unrotated projectile' was a cover name to disguise the use of a rocket system and comes from the fact that the projectile was not spin-stabilized. The 2-inch (51 mm) and 3-inch (76 mm) UP systems were successfully deployed in the anti-aircraft Z Batteries which were operated by the Home Guard and was the basis of the RP-3 air-to-surface rocket and the Mattress surface-to-surface multiple rocket launcher (Furneaux-Smith 1961). Robert Clarke also said that the parachute featured is a drogue chute which are used to pull out bigger chutes or used to slow objects down. He said the chute looks to be 5 feet (1.5 m) based on the images, which unfortunately is a standard size. He said it may not be associated with the other find.

This item is believed to be related to war time activity, particularly the Second World War, in which case it may have lain undisturbed on the seabed for over 70 years. It may have been deployed as a flare from a submarine or fired from a vessel at an aircraft. If this object is a Submarine Emergency Identification Signal, Star, Mk 2 Mod 2 or Mk 3 Mod 0, it is interesting to note that the Surface Pyrotechnics and Projectors Ordnance Pamphlet 1177, stated that 'These signals should be inspected frequently. Any corrosion of the safety mechanism is cause for disposal by dumping in deep water' (Navy Department Bureau of Ordnance 1945). This could be the reason that this proposed Emergency Identification Signal was on the seabed, although the visible damage to the object indicated that it may have been fired. Alternatively, it could have been damaged on the seabed. It is not possible to confirm whether both finds are associated with each other at this time although it is believed to be the case. Any further items of this nature dredged in this vicinity should be reported immediately as it may be an area that was important during the war or, although less likely, there may be remnants of submarine wreckage nearby.

Two views of the CEMEX_0908 parachute

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Furneaux-Smith, F 1961 The Professor and the Prime Minister: The Official Life of Professor F. A. Lindemann Viscount Cherwell. Boston: Houghton Mifflin Company.

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Wessex Archaeology 2019 Marine Aggregate Industry Protocol for the Reporting of Finds of Archaeological Interest. Annual Report to BMAPA 2017–2018. https://www.wessexarch.co.uk/sites/default/files/field_file/annual_report_2017-2018-final%20%28low%20res%29.pdf

Liaison and accessibility

Details of each discovery have been sent to:

Mark Russell	British Marine Aggregate Producers Association
Stuart Churchley	Historic England, Marine Planner
Neil Guiden	Historic England, National Record of the Historic Environment
Andrew Cameron	The Crown Estate
Nick Everington	The Crown Estate
Mark Wrigley	The Crown Estate

Details of discoveries regarded as wreck under the *Merchant Shipping Act* 1995 have been forwarded to the Receiver of Wreck, Alison Kentuck. In 2018–2019 the following reports that have droit numbers were deemed to represent items of wreck:

Report ID	Droit number
CEMEX_0888	319/18
Tarmac_0890	320/18
Tarmac_0891	321/18
Tarmac_0892	322/18
Tarmac_0893	323/18
Tarmac_0894	324/18
Tarmac_0895	325/18
Tarmac_0896	326/18
Brett_0897	329/18
Hanson_0898	331/18
Tarmac_0899	338/18
CEMEX_0900	339/18
Brett_0901	346/18
Tarmac_0902	005/19
Tarmac_0903	006/19
CEMEX_0904	021/19
CEMEX_0905	022/19
CEMEX_0906	023/19
Tarmac_0907	047/19

Report ID	Droit number
CEMEX_0908	055/19
Tarmac_0909	059/19
CEMEX_0910	065/19
Hanson_0911	068/19
DEME_0912	069/19
CEMEX_0913	072/19
CEMEX_0914	073/19
CEMEX_0915	091/19
CEMEX_0916	092/19
CEMEX_0917	093/19
CEMEX_0918	097/19
CEMEX_0919	104/19
CEMEX_0920	105/19
CEMEX_0921	109/19
CEMEX_0922	110/19
CEMEX_0923	111/19
Hanson_0928	210/19
CEMEX_0930	212/19

In the 14th year of the Protocol, five discoveries were made relating to aircraft. Although a military context could not be confirmed or disproven, the following reports were forwarded to Deborah Morgan at the Ministry of Defence for her interest:

Tarmac_0891
Tarmac_0907
CEMEX_0914
CEMEX_0915
CEMEX_0918

Although the Protocol received a number of reports of artefacts which may relate to vessels as wreck material, none of them was thought to directly relate to unknown and uncharted wreck sites. Consequently, no reports were forwarded to the United Kingdom Hydrographic Office in the 2018–2019 reporting year.

Information on each find has been forwarded to each county HER relevant to the location of the archaeological discovery. In the case of a discovery where the original location is known, this will be the HER closest to the dredging licence area. Discoveries made at wharves where the licence area is unknown are reported to the HER nearest to the wharf.

Further details of liaison and the dissemination of data to interested parties are included in the wharf reports appended to this report.

Discussion

Importance

Forty-three individual reports were raised during the 2018–2019 reporting year, although less than the number of reports last year and less than the Protocol Implementation Service's expectation of around 50 reports a year, the reports comprised 96 individual finds, and therefore more than the 67 finds reported in 2017−2018.

The finds reported through the Protocol this year represent a diverse range of periods, emphasising that the awareness training is successful in providing background information from all periods. The oldest finds were Palaeolithic (Hanson_0929: Mammoth Vertebra) and they ranged through to the modern period (Tarmac_0907: Aircraft Propeller Blade). The various archaeological material and the amount that is still reported reiterates the importance of the Protocol and demonstrates the wealth of archaeological material still on the seabed. Investigations into these finds expand our knowledge of the past and contribute to our understanding.

Success

During the first five weeks of 2018−2019 reporting year, the Implementation Team received reports from CEMEX, Tarmac, Brett and Hanson which is rare!

Key issues

The Protocol has not been rewritten since its inception and has only had minor addendums appended to it relating to the handling of specific finds, demonstrating the robustness and effectiveness of the scheme. During each year of Protocol implementation, minor operational situations are recognised and the Protocol Implementation Service develops and adapts to overcome these. This year the following points have been raised for discussion.

Timely reporting

The Receiver of Wreck must be notified of any wreck-related material within 28 days of it being removed from the seabed. Wreck-related finds include any artefacts that have come from a ship or aircraft. The reporting time limit is a legal requirement of the *Merchant Shipping Act* 1995 that exists regardless of the presence of a Protocol, and this is why the Protocol Implementation Team will urge all finds to be reported through the console as soon as they are found. It is vitally important that any material discovered at the wharves or on vessels be reported to the Protocol Implementation Team as soon as possible. There have been instances where by material is being kept together to be reported in one go or due to the busy nature of the job roles of the Nominated Contacts. The longer the items are kept without being reported, the more detail is lost. We therefore ask that all material is reported in a timely fashion. The Protocol Implementation Team will notify the Receiver of Wreck with the positional details of the find as soon as possible and will follow up with additional information as the find is assessed and a Wharf Report is produced.

Lack of contact with some wharves

A spreadsheet is kept with all the contact information we have with each wharf. During the summer months, the wharves that would benefit from a visit are identified and contacted. It is unfortunate that some wharves do not respond to emails from the Implementation Team despite reminders being sent. It is clear that those who do not respond do not report material either which is concerning to the team.

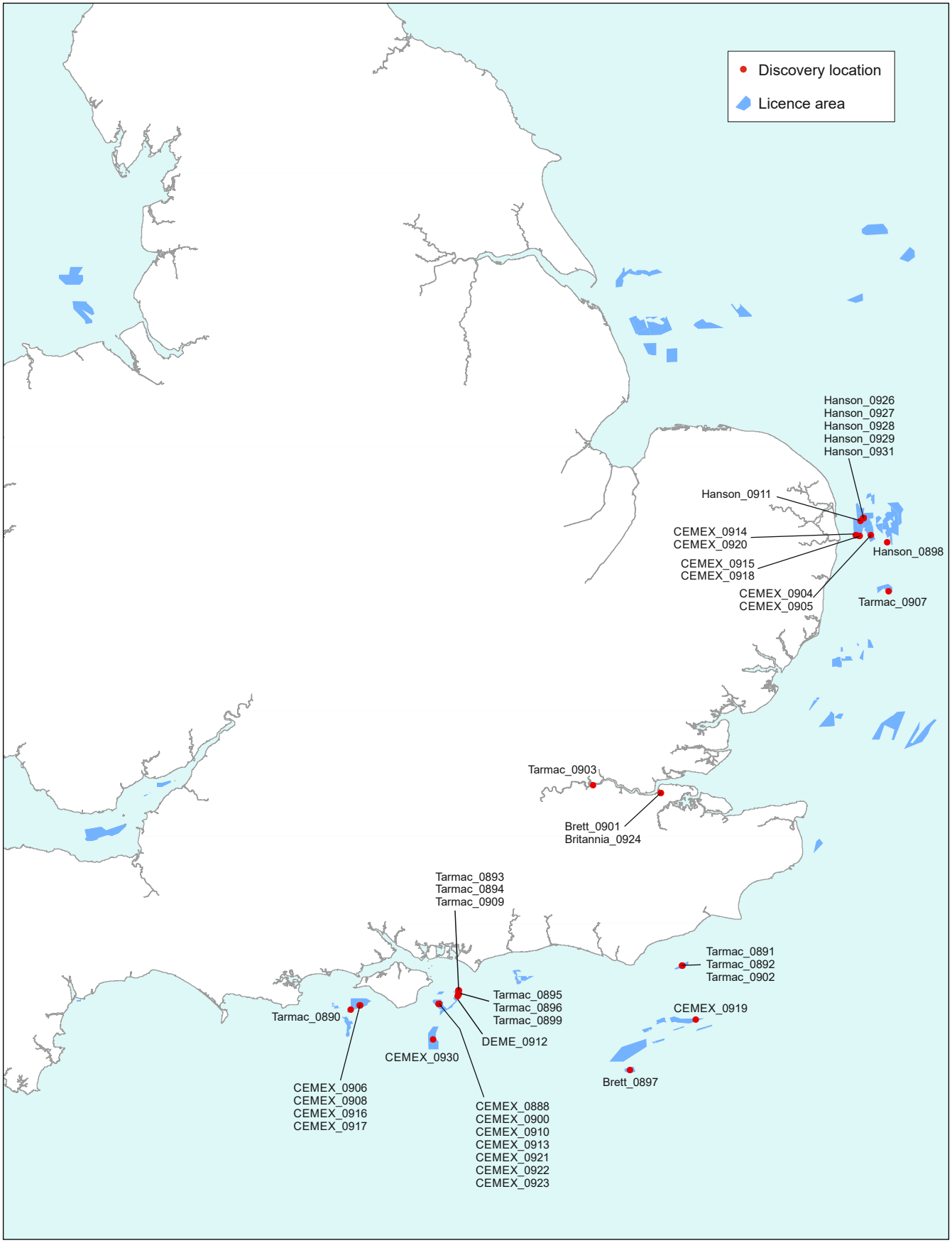
The closing down/hand over of wharves

Sometimes there is a lack of communication between Nominated Contacts and the Implementation team as a few of the wharves have been mothballed or are no longer run by a particular company. Often, this information only comes to our attention via another source or if copies of the *Dredged Up* newsletters or the mugs are returned. It would be greatly appreciated if Nominated Contacts could provide more regular updates.

Regions with nil return

This year, there were no reports of finds among material dredged from the Thames Estuary, North West or South West regions compared to last year when three finds were reported from the Thames Estuary, and two from the North West.

Discoveries 2018–2019



Artefact patterns and distribution

Through the use of GIS (ArcMap 10.6), patterns and trends such as artefact discovery location and concentration can be analysed. During the reporting process, the Site Champions or Nominated Contacts are asked to give the licence area number of the object, if known. This allows us to assess finds on a regional basis, which is helpful when considering future licence applications within existing dredging regions. Patterns in artefact concentration can potentially identify sites of archaeological interest or debris fields or alternatively, licence areas which are more likely to yield finds of archaeological interest in the future. As in case study 1, when a large concentration is discovered from one area, it is useful to look back at previous years to compare what that particular licence area has yielded in the past.

Archaeological Exclusion Zones (AEZs) are also plotted within the GIS, which is useful when plotting finds of a contentious nature to note the distance of discovery from a previous AEZ as tides are able to move lighter objects from within these zones.

Archaeological material is not distributed evenly on the seabed. Some areas have a higher potential than others to contain material that entered the archaeological record either accidentally or deliberately. Some areas, such as the East Coast are known to have had Palaeolithic activity when sea levels were lower than the present day. Other areas are known to be post Second World War dumping grounds which has become apparent from artefact type and quantity in that area. We also know which licence areas tend to yield more munitions and should be approached with caution.

The survival of artefacts will depend on the marine environment in which they lie. Most of the finds reported this year, as in previous years, are modern and made of metal which is not unusual as it tends to be a more durable material in a harsh underwater environment in comparison to organic finds. Finds such as wood or bone and teeth from the submerged prehistoric landscapes or shipwrecks may be poorly preserved unless they are buried beneath fine grained sediments, which may account for the low percentage of finds received of this material. For finds to be discovered, the high potential for loss or discard must coincide with a high potential for the preservation of archaeological materials.

Based on potential and survival, some licence areas will therefore contain more archaeological finds than others and may be associated with more specific time periods than others. Other factors, such as whether finds are discovered in isolation or grouped with similar items, also add to their context. In most cases, objects are reported as single isolated finds, but we do occasionally receive reports of multiple items found in the same location; this year aircraft material and munitions being prime examples. The significance of a find can therefore depend on its location as much as the nature of object in itself.

Distribution of artefacts by dredging region

There are seven dredging regions around the UK:

- Humber
- East Coast
- Thames Estuary
- East English Channel
- South Coast
- South West
- North West

In the 2018–2019 dredging year a trend established in previous years whereby most of the finds come from the South Coast has continued. This year, 20 out of the 43 reports came from the South Coast. The South Coast region yielded 3.77 million tonnes of construction aggregate in 2017 (https://bmapa.org/documents/BMAPA_CE_20th_Ann_Rep_Aug18.pdf).

Fourteen of this year's 43 reports came from the East Coast and five from the East English Channel. Only one report came from the Humber region. Three reports were from an unknown region as it was not possible to determine the cargo they were recovered from.

No reports were received from cargoes dredged from the North West, South West or Thames Estuary.

Region	Millions of tonnes of construction aggregate dredged in 2018 (2017 quantity)	Number of finds reported in 2018–2019 (2017–2018 number)
Humber	2.78 (1.88)	1 (3)
East Coast	4.24 (4.26)	32 (9)
Thames Estuary	1.75 (1.85)	0 (4)
East English Channel	4.08 (3.97)	7 (4)
South Coast	3.44 (3.77)	53 (19)
South West	1.24 (1.34)	0 (0)
North West	0.29 (0.32)	0 (2)
Unknown	—	3 (26)
Totals	**17.82**	**96 (67)**

Distribution of artefacts by archaeological typology

Palaeolithic finds

During the 2018–2019 reporting year, four finds were determined to be Palaeolithic in date, and all originated from Area 240 which has produced previous finds of this date. Hanson_0927: Animal Bone and Mammoth Tooth, Hanson_0929: Mammoth Vertebra and Hanson_0931: Mammoth Tusk are all thought to be related and may represent the same mammoth.

Medieval artefacts

Three artefacts reported during this year were believed to be medieval in date and consisted of cannonballs of various sizes; Brett_0901, Hanson_0911 and CEMEX_0919.

Maritime artefacts

A few reports made through the Protocol this year were thought to have come from boats or ships. These include part of an anchor (CEMEX_0904), Minesweeping cutter (CEMEX_0906) and an Engine Valve (Hanson_0928).

None of the finds were thought to be related to a wreck site; all of the finds appear to be isolated discoveries, which could have been lost overboard, purposely dumped at sea, or have been moved along the seabed from wreck sites elsewhere.

Ordnance and munitions

While not considered classic munitions, cannonballs of varying sizes came from the East English Channel and South Coast this year. Five individual cannonballs have been reported (Britannia_0897 (2), Brett_0901, Hanson_0911, CEMEX_0919). A bar shot (Tarmac_0902) was also discovered from the East English Channel.

As well as the solid munitions, reports included shell bodies, shell cases and shell fragments ranging in age from the Victorian period (CEMEX_0913) to the Second World War (CEMEX_0923).

Company operational and health and safety procedures should always be followed before any ordnance is reported through the Protocol.

Aircraft

Several discoveries were made relating to aircraft this year including a propeller (Tarmac_0907). More can be read about other aircraft discoveries in Case Study 1.

Hanson_0929 mammoth vertebra

Brett_0901 cannonball

Tarmac_0902 bar shot

CEMEX_0913 Victorian munition


Tarmac_0907 propeller

Conclusion

The Marine Aggregate Industry Archaeological Protocol continues to be a relevant mitigation programme for offshore aggregate works. It also continues to be a model from which other industries draw inspiration and a framework for reporting. It remains a successful and applicable template for preserving heritage on the seabed, for gaining understanding about the unexpected discoveries and for reaching audiences within the aggregate industry to improve their knowledge and understanding of archaeology. This is reiterated by the reports received this year from wharf and vessel staff and the contact that has been maintained with Nominated Contacts and Site Champions this reporting year.

The application of the Protocol ensures that archaeological information is preserved through recording and timely reporting and is disseminated as widely as possible, so that everyone can enjoy and explore our underwater cultural heritage. The fact that reports and images are uploaded to the website and on to social media platforms and that *Dredged Up* is handed out at several outreach events ensures a wider audience is targeted than just the aggregate industry. When work experience students visit the Coastal & Marine team, the work they do with us often revolves around the Protocol and the finds that have been reported. Recently, photogrammetry models were made of previous finds a student found most interesting and the results have been published on Wessex Archaeology's social media platforms.

The enthusiasm and diligence of wharf and vessel staff ensures the success of the Protocol. This was particularly true this reporting year when new staff at Angerstein contacted the team for advice with regards to aircraft material that had been found (see Case Study 1). Everyone's support has ensured that the Protocol has become embedded in commercial processes, which in turn reduces the impact of dredging on underwater cultural heritage, by making the archaeological record available for future generations. At the end of each wharf visit, there are always questions and discussions between a member of the Implementation Team and wharf staff in which questions are asked and answered and ideas gathered on how to make the Protocol more relatable or easier to use. It is because of such talks that the mugs were developed in to an idea that became a reality this reporting year and they were greatly received by all the staff.

The Protocol Implementation Service Team would like to thank everyone who has helped to support the Protocol during the 2018–2019 reporting year.

The future

Protocol Implementation continues to be run by Wessex Archaeology and finds are reported regularly. If you have any questions about finds reporting and the Protocol, please contact us via protocol@wessexarch.co.uk.

CEMEX_0888: Shell

This shell was discovered in Licence Area 340 in the South Coast dredging region, approximately 11.5 km south-east of the Isle of Wight. Michael Pettitt discovered it at Shoreham Wharf.

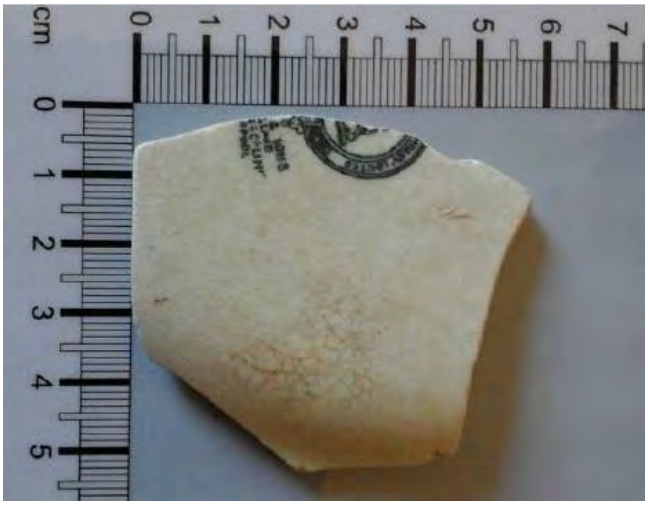
This find was reported as a shell measuring 16 inches (400 mm) long by 4 inches (100 mm) wide. It was discovered on the magnet at Shoreham wharf and reported to the EOD who came to the wharf to detonate the munition on site the same day it was found. The copper driving band just visible at its base displays several notches which means that the shell has been fired. When the shell is fired, the pressure of the propellant swages the metal into the rifling of the barrel, providing a seal preventing the gases from blowing past the shell and engaging with the rifling to spin-stabilize the shell.

Images of the shell were sent to Trevor Parker from the Ordnance Society. Trevor said that it was very difficult to identify due not being able to see the complete item; with no view of the base and no visible markings. Despite this, he said that it looks like a fired armour-piercing shell. The small, visible section of the driving band reminds him of a British 4-inch Naval shell. After researching First World War 4-inch naval shells, there are two versions that are 16 inches (+/- 1/2") long therefore this could well date to that period.

Most ordnance found in British waters relates to the First or Second World War meaning that they could have lain undisturbed for 70-100 years. Though considered an isolated find, further finds of this type should be reported, as they may be indicative of an unrecorded site, debris field, or provide further information about naval warfare or training in the area.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 319/18)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight



Tarmac_0890: Plate Fragment

This plate fragment was discovered in Licence Area 500/3 in the South Coast dredging region, approximately 11 km south-west of the Isle of Wight. Barry Gardner discovered it at Burnley Wharf.

Tarmac_0890 is a fragment of a white or cream glazed plate fragment measuring 60 mm by 55 mm. Half a printed stamp is visible on its surface. The text inside the circular area reads “MPANY LIMITED” while the text under the circle reads “& SONS” “GLAND” “Co LIM” and “RPOOL”.

Images of the find were sent to our in-house pottery expert, Lorraine Mepham, who said that after analysing and looking for the stamp among sources, it became apparent that too much of it was missing to be able to properly identify it. Based on the “RPOOL”, it is assumed that the pottery originated from Liverpool. Liverpool, England, has been the site of many pottery and porcelain factories since the eighteenth century and produced a great variety of wares and some figures. The main production being blue and white. Some printed wares, over and under glaze, were made as well as polychrome decorated pieces. Despite research, we have been unable to locate a company from Liverpool with an “& SONS” in their name or found a suitable equivalent to this stamp. Based on the glaze and colours, this fragment is most likely late 19th century or early 20th century in date.

It is not clear whether this find entered the marine environment already broken or whether the damage occurred at a later stage. It is most likely that someone aboard the vessel using this plate broke it and threw it away overboard as waste. There are rumours of dishes and cutlery being thrown overboard when approaching port as a means of avoiding washing up!

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 320/18)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

Tarmac_0891: Idler Arm

This idler arm was discovered in Licence Area 460 in the South East Coast dredging region, approximately 14 km south of Hastings. Paul Scrace discovered the find at Greenwich wharf on shore.

Tarmac_0891 is a modern piece of alloy construction measuring 180 mm by 170 mm. There is '1960' printed in raised letters on the side of this object which may indicate the construction date of the object.

Images of the find were sent to Bob Clarke, Wessex Archaeology's Research Manager and Anthony Mansfield, a senior Naval Engineer. Bob said that the piece of alloy construction is an idler arm or similar from a control or torque tube system also known as flying controls making this a piece of aviation equipment. An idler arm is a pivoting support for the steering linkage in several automated vehicles. Anthony also agreed that the item belonged to aviation world and believes that it is an actuator arm. An actuator is a component of a machine that is responsible for moving and controlling a mechanism or system, for example by opening a valve.

Alistair Byford-Bates, Wessex Archaeology's Marine Archaeologist, also examined photos of the same piece and suggested that this could be a hatch related piece from an aircraft.

There are several possibilities as to how this object to enter the marine environment. It may have been as a result of dumping at sea as some aircraft material was disposed of in this way after the war, although if the '1960' refers to a construction date, then it would rule this out. It may also have ended up on the seabed as a result of an aircraft crash. Pieces of the aircraft may move along with the current and end some distance away from the original crash site. Any further discoveries should be reported and may provide more information.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Ministry of Defence
- The Receiver of Wreck (Droit 321/18)
- The National Record of the Historic Environment
- The Historic Environment Record for East Sussex

Tarmac_0892: Iron Nail

This iron nail was discovered in Licence Area 460 in the South East Coast dredging region, approximately 14 km south of Hastings. Paul Scrace discovered the find at Greenwich wharf on shore.

This round head iron nail has a rectangular shank and measures 125 mm in length with a 25 mm wide rounded head. The base tapers to a finer point 5 mm wide. Based on the image, the nail looks as though it has been struck on its head in the past.

Based on the rectangular profile of this nail, it is thought that it may date to the 19 th century and may be handmade. Modern nails are more commonly round in profile. The term ‘spike’ is generally preferred for large nails of predominantly square section. The head profile of a spike is longer on one side as they could act as a retaining ‘hook’ for planks on vessels and on railways where they were also commonly used. The head profile appears to be of equal measure on this nail although that may be due to wear. This nail may have been used for woodworking however there is no way to be able to determine what it would have been used for.

This object may have entered the marine environment as a result of dumping. Alternatively, it may have been lost overboard by accident. Whether this item was discarded on purpose or accidentally, is uncertain. However due to the lack of hammer damage to the head, it is most likely that this nail was discarded accidentally.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck
- The National Record of the Historic Environment
- The Historic Environment Record for East Sussex

Tarmac_0893: Metal Object

This metal object was discovered in Licence Area 395/1 in the South East Coast dredging region, approximately 31 km south west of Littlehampton. Garry Phillips discovered it at Ridham Wharf.

This object measures 270 mm long by 210 mm wide. The wharf reported impressed markings on the surface of the object that read MK V111 274 18" 229 291. There are small holes visible around the outer edge of the object which may indicate that it was riveted to another piece at one stage. There is a small broken plate on the back that looks to be made of brass.

Images of the find were sent to our in-house specialist Bob Clarke, and an external aircraft specialist, Steve Vizard. Bob thought that it was related to something to reduce flow of a fluid from one side to the other but said that more images were needed to confirm this theory. Steve said that it does not look like an aircraft part that he has seen before, and the materials do not appear to be aeronautical. He said that usually aircraft part numbers are prefixed by a letter, and there will be small circular inspection stamps nearby.

It has been suggested that this may be associated with some sort of high pressure boiler system due to the material it is made out of and the possible rivet holes visible on its outer edge.

As we are unsure of what this object is, it is difficult to ascertain how it may have come to be on the seabed. All crashed military aircraft are protected by law under the *Protection of Military Remains Act* 1986. However, as it is unlikely that this object came from an aircraft, therefore it is assumed to be related to a more modern maritime vessel. The back of the object appears to have been broken which may mean it was discarded overboard, although whether this damage occurred before or after entering the marine environment is unknown.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The MOD
- The Receiver of Wreck (Droit 323/18)
- The National Record of the Historic Environment
- The Historic Environment Record for West Sussex

Tarmac_0894: Metal Rod

This metal rod was discovered in Licence Area 396/1 in the South Coast dredging region, approximately 31 km south west of Littlehampton. Karl Brown discovered it on board *City of Chichester*.

Tarmac_0894 is a metal rod measuring 290 mm by 30 mm and is possibly made of brass. It has a bolt on one side as if to screw into another piece of metal work and at the other end displays a hole with a small piece of thread protruding from it. It is unclear from the photos whether this thread runs the length of the metal rod. The rod shows a slight bend in the centre, which may be due to damage either while in use or sustained in the marine environment.

It seems unlikely that this piece was connected to any type of machinery since the bolt would eventually shake loose with any sort of vibration. It was initially suggested that, instead, this is more of a functional piece, such as railings for the side of a ship, however the thread seems too small to be of much use for a railing. Images of the find were sent to Anthony Mansfield, a senior Naval Engineer who said that it perhaps may be a stanchion fitting. Stanchions are common on most vessels. They are upright bars along the outer edge of a vessel that thread in to the deck and hold up guard rails or lifelines around the perimeter of the vessel to decrease the risk of falling overboard.

There are many ways in which this metal rod may have ended up on the seafloor. Although an isolated find, it could be associated with remains from a modern shipwreck. Alternatively, if it is a stanchion, it could have broken off a floating vessel during strong winds or may have been broken and discarded over board. Vessels and staff working in licence area 351/1 should remain vigilant for future finds which may shed light on maritime activities in this region.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 324/18)
- The National Record of the Historic Environment
- The Historic Environment Record for West Sussex

Tarmac_0895: Metal rod

This metal rod was discovered in Licence Area 351 in the South Coast dredging region, approximately 13 km south west of the Isle of Wight. Dean Lutman discovered it at Bedhampton wharf whilst unloading cargo from the *Arco Dee*.

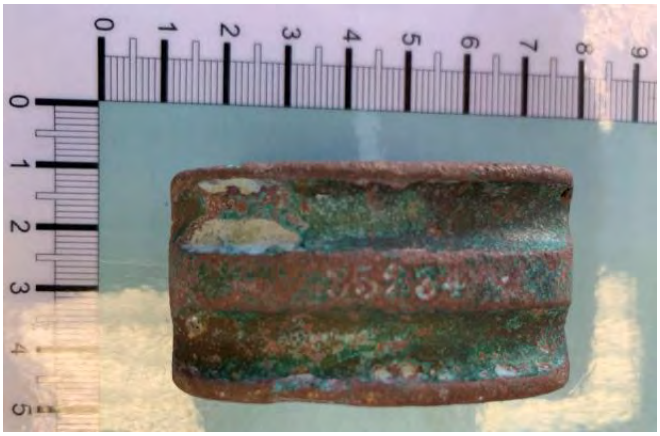
Tarmac_0895 is a metal rod approximately 40 mm width and 430 mm in length. A quarter of the way down the rod is notches which could possibly fit an o-ring or some type of fitting. The end closest to this fitting appears to have a rectangular hole, this clearly is an insert. However, the use of this insert is unclear. The other end appears to be broken off.

Images of the find were sent to Anthony Mansfield, a senior naval engineer, who said that the find looks like a pipe with fitting nut in the middle. The fixing nut could be a feature that allows the pipe to be threaded on to another section so that if any of the components should fail, the damaged component can be removed and replaced. The pipe may have been broken at some point and discarded overboard. What the pipe would have been used for is unclear at this time.

This object may have entered the marine environment via a number of routes. The item is not broken and therefore could be indicative of an unknown wreck site or from material lost or thrown overboard during every day shipping operations. License Area 351 has produced a mixture of items that could possibly indicate the dumping of material. Though considered an isolated find, further finds of this type should continue to be reported, as they may be indicative of an unrecorded wreck site or related debris field.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 325/18)
- The National Record of the Historic Environment
- The Historic Environment Record for the Isle of Wight



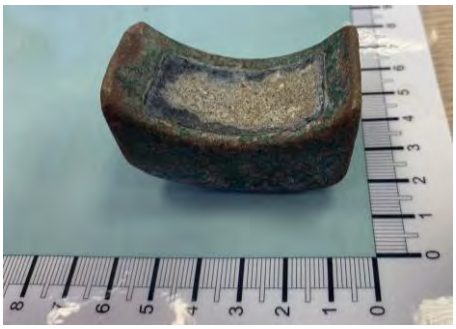
Tarmac_0896: Brake Shoe

This brake shoe was discovered in Licence Area 351 South Coast dredging region, approximately 13 km south west of the Isle of Wight. Dean Lutman discovered it at Bedhampton wharf in cargo from *Arco Dee*.

Tarmac_0896 is a curved piece of metal with two grooves on one side measuring 70 mm in length and 40 mm in width, with a series of raised numbers on the central band reading 35234, presumed to be a serial or part number. The back is completely smooth, although there does appear to be a something that looks like an infilled rectangular slot that displays evidence of concretion due to being on the seabed. It is thought that this object is made of bronze.

Images were sent to Anthony Mansfield, a Senior Naval Engineer who said that he thinks it may be some kind of brake shoe. He said the black insert on the back looks like the remains of a brake pad and the grooves on the back would have been for the tension bands. He also said that this is the sort of part that gets thrown overboard when it wears out. Anthony suggested that this part may possibly be from a small deck winch and said that the shoe is usually quite small for this type of device.

As stated by Anthony, this type of object is likely to be thrown overboard when it comes to the end of its working life. It is therefore likely that this is how this object ended up on the sea floor.



Back of object

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 326/18)
- The National Record of the Historic Environment
- The Historic Environment Record for the Isle of Wight

Brett_0897: Two Cannonballs and a Metal Object

These finds were discovered in Licence Area 461 in the East English Channel dredging region, approximately 51 km south-south-west of Eastbourne. David Benneworth discovered it Ipswich Wharf in cargo from *Britannia Beaver*.

Brett_0897 comprises a wrought iron object measuring 380 mm by 160 mm wide at each end and two cannonballs; the larger with a diameter of 170 mm and the smaller with a diameter of 110 mm.

The metal object was identified by Alistair Byford-Bates, a marine archaeologist at Wessex Archaeology as being a large rivet. In the mid-19th century, rivets were made from good quality wrought iron. Riveting was usually carried out by hand although by the end of the 19th century hydraulic and pneumatic riveters were available - the latter gave a better and more consistent joint. The rivet was heated until red hot and then hammered close to the face of the plate. As the rivet cooled it contracted and drew together the face of the plates. Wrought iron consists of layers of almost pure iron that sandwich layers of slag which gives it a "grain" resembling wood, that is visible when it is etched or bent to the point of failure as seen on this example. It is very corrosion resistant, and it hardly rusts.

Based on 16th century British gun calibres, the larger of the two cannonballs could have been fired from a Demi Cannon. The barrels of Demi Cannon were typically 11 ft (3.4 m) long, had a calibre of 6 inches (15.4 cm) and could weigh up to 5600 lb (2540 kg). It required 18 lb (8 kg) of black powder to fire a 32 lb (14.5 kg) round shot. The Demi-Cannon had an effective range of 1600 ft (490 m) (Manucy, 2011). Ships featuring Demi-Cannons included HMS *Sovereign of the Seas*, HMS *Resolution* and HMS *James*, which fought in the Anglo-Dutch naval wars in the 17th century. The late 18th century saw the development of a new class of cannon, the Carronade, which fired the standard size cannonballs but had a shorter barrel and lighter weight, making them easier to handle aboard ship. Their shorter barrel meant that they could be bored more accurately. If the cannonball dates to this period, it would have most likely been fired from a 42 pounder (https://www.arc.id.au/Cannonballs.html accessed 19 December 2018).

Based on the diameter of the smaller cannonball, it could have been fired by a Demi Culverin (Childs 2009). A Demi Culverin is a medium sized smooth-bored brass gun with a long barrel used to bombard targets from a distance (Garrett 2010). It belongs to the Culverin class and is the second largest gun within this class (Childs 2009). The Demi Culverin was developed in the late 16th century and was similar to, but slightly larger than, a Saker and smaller than a regular Culverin. Barrels of Demi Culverins were typically about 11 feet (3.4 m) long, had a calibre of 4 inches (100 mm) and could weigh up to 3,400 pounds (1,500 kg). Following the standardization of artillery sizes by the British Board of Ordnance in 1716, rather than refer to guns by the various names, they were standardized to the weight of round ball that they fired, rounded up to the nearest pound of the commonest weights (Carpenter 1993).

Cannonballs are a common find around the coast of England as, with an extensive naval history, military training and battles have taken place along this stretch of coastline for hundreds of years. It is not possible to say whether it was fired during training, battle or perhaps just lost overboard. How the large rivet entered the maritime environment is not clear as it may have arrived via several routes. It may be associated with a modern wreck where the rivet has come loose over time on the seabed. Alternatively, it might be related to material that was accidentally or purposefully discarded, possibly from a dock where ship rivets were being made.

References

Childs, D., 2009. *Tudor Sea Power: The Foundation of Greatness*. Seaforth Publishing, Barnsley.

Garrett, R. J., 2010. *The Defences of Macau: Forts, Ships and Weapons over 450 years*. Hong Kong University Press, Hong Kong.

Carpenter, A.C., 1993. *Cannon: The Conservation, Reconstruction and Presentation of Historic Artillery*. Halsgrove Press, Tiverton.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 329/18)
- The National Record of the Historic Environment
- The Historic Environment Record for East Sussex

Hanson_0898: Bone

This bone was discovered in Licence Area 401/2B in the East English Channel dredging region, approximately 22 km east of Lowestoft. M. Morley discovered it on board *Arco Avon*.

Hanson_0898 is a fairly large fragment of bone. No scales were used in the images therefore the measurements are unknown. The shaft of the bone is broken, and the ends have been worn. It is not known whether this damage occurred before the object entered the marine environment or as a result of it.

The image of the find was sent to Lorrain Higbee, the animal remains expert at Wessex Archaeology, who examined it and determined that the bone looks like the proximal end of a femur. Using the bucket as a scale, she said that it is more than likely a cattle bone. A femur is the upper part of the leg bone; with the head (proximal end) of the femur articulating with the acetabulum in the pelvic bone forming the hip joint, while the distal part of the femur articulates with the tibia and fibula. A cow has two femurs; one in each hind leg. It was originally thought that the bone had been burnt due to the black colour appearing at each end. Lorrain said that it is difficult to say from the photo since staining can happen as a result of being in waterlogged conditions particularly if the sediment has a high organic content.

The bone looks relatively new and gives the impression that it has not been exposed on the seabed for thousands of years as it is not mineralised. The bone fragment may have entered the marine environment through being washed from terrestrial deposits by rivers or eroded from cliffs or beaches. Alternatively, it could derive from a wreck of a vessel that at the time of travelling, carried cattle on board. A cow may have been killed to be eaten on board or died on the journey and the bones thrown overboard. Alternatively, the animal could have been on a vessel at the time of sinking. Although considered an isolated find, any more bones of this nature should be reported as they could be indicative of a wreck site.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 331/18)
- The National Record of the Historic Environment
- The Historic Environment Record for Suffolk

Tarmac_0899: Brass Universal Joint

This universal joint was discovered in Licence Area 351 South Coast dredging region, 13 km south west of the Isle of Wight. James Lutman discovered it at Bedhampton Wharf on board *Arco Dee.*

Tarmac_0899 was identified by wharf staff and reported as a brass universal joint. Approximately 450 mm in length and 70mm width, this joint consists of a pair of hinges, which are located close together. These hinges are oriented at a 90 degree to each other and are connected by a cross shaft. The main metal of the joint is brass.

Images of the find were sent to Anthony Mansfield, a Senior Naval Engineer, who agreed with the wharf and said that the object is a universal drive joint with the remains of a steel drive shaft, frequently used for remote operation of valves. It is commonly a joint or coupling connecting rigid rods whose axes are inclined to each other and is commonly used in shafts that transmit rotary motion. Remotely operated valves may be used in systems such as high-pressure boiler systems for emergency isolation of hazardous substances. Brass does not spark therefore the joint could be related to fuel pipes, providing protection against fires and explosions aboard a vessel.

This object may have entered the marine environment via a number of routes. The item is not broken and therefore could be indicative of an unknown wreck site or from material lost or thrown overboard during every day shipping operations. Alternatively, it could have been discarded from a dock. License Area 351 has produced a mixture of items that could possibly indicate the dumping of material. Though considered an isolated find, further finds of this type should continue to be reported, as they may be indicative of an unrecorded wreck site or related debris field.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 338/18)
- The National Record of the Historic Environment
- The Historic Environment Record for the Isle of Wight

CEMEX_0900: Shell Fragments

These four shell fragments were discovered in Licence Area 340 in the South Coast dredging region, approximately 11.5 km south-east of the Isle of Wight. Andy Roberts discovered them at Shoreham Wharf.

This collection of four crushed and broken metal shell fragments were discovered at Shoreham wharf and reported to the EOD who came to the wharf to detonate the munitions on site the same day they were found. The components appear to be made of brass and seem to represent two different shells.

Images of the shell fragments were sent to Trevor Parker from the Ordnance Society. Trevor said that the lack of measurements and clear markings in the image made it difficult to identify them. He said that the round lump visible of the inside of the round piece on the right of the image is probably the base of a shell case, but that any identifying markings would be on the other side, therefore he is unable to comment on what it may be at this stage.

He said the two flattened pieced on the left are probably 40 mm Bofors cases. The Bofors 40 mm gun, often referred to simply as the Bofors gun, is an anti-aircraft autocannon designed in the 1930s by the Swedish arms manufacturer AB Bofors. It was one of the most popular medium-weight anti-aircraft systems during the Second World War, used by most of the western Allies. It became the British Army's standard light anti-aircraft weapon, operating alongside their 3-inch and 3.7-inch heavy weapons.

Most ordnance found in British waters relates to the First or Second World War meaning that they could have lain undisturbed for 70-100 years. Though considered isolated finds, further finds of this type should be reported, as they may be indicative of an unrecorded site, debris field, or provide further information about naval warfare or training in the area. Licence Area 340 commonly produces munitions which may indicate a training area or a dumping ground for ordnance after the war.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 339/18)
- The National Record of the Historic Environment
- The Historic Environment Record for the Isle of Wight

Brett_0901: Cannonball

This cannonball was discovered by George Lee-Amies at Cliffe Wharf. The find is from an oversize stockpile and therefore the exact licence area is unknown but it is thought to have come from Area 498 in the Thames or Area 461 in the East English Channel.

Brett_0901 is a cast iron cannonball reported as having a diameter of 110 mm or 4.3 inches. No weight was given. It has been heavily degraded in the marine environment and has cracked. Based on the diameter alone, this cannonball could have been fired by a Demi Culverin (Childs 2009).

A Demi Culverin is a medium sized smooth-bored brass gun with a long barrel used to bombard targets from a distance (Garrett 2010). It belongs to the Culverin class and is the second largest gun within this class (Childs 2009). The Demi Culverin was similar to, but slightly larger than, a Saker, and smaller than a regular Culverin developed in the late 16th century. Barrels of Demi Culverins were typically about 11 feet (3.4 m) long, had a calibre of 4 inches (100 mm) and could weigh up to 3,400 pounds (1,500 kg). Following the standardization of artillery sizes by the British Board of Ordnance in 1716, rather than refer to guns by the various names, they were standardized to the weight of round ball that they fired, rounded up to the nearest pound of the commonest weights (Carpenter 1993).

Cannonballs are a common find around the coast of England as, with an extensive naval history, military training and battles have taken place along this stretch of coastline for hundreds of years. It is not possible to say whether it was fired during training, battle or perhaps just lost overboard.

References

Childs, D., 2009. *Tudor Sea Power: The Foundation of Greatness*. Seaforth Publishing, Barnsley.

Garrett, R. J., 2010. *The Defences of Macau: Forts, Ships and Weapons over 450 years*. Hong Kong University Press, Hong Kong.

Carpenter, A.C., 1993. *Cannon: The Conservation, Reconstruction and Presentation of Historic Artillery*. Halsgrove Press, Tiverton.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 346/18)
- The National Record of the Historic Environment
- The Historic Environment Record for Kent

Tarmac_0902: Bar Shot

This bar shot was discovered in Licence Area 460 in the East English Channel dredging region, approximately 14 km south of Hastings. It was discovered by Paul Scrace at Greenwich wharf.

Tarmac_0902 was correctly identified as being one half of a bar shot by staff at Greenwich wharf with the remains of the iron bar protruding from the ball. Despite being broken, the ball has a diameter of 120 mm. When whole, the bar shot would consist of two solid iron balls connected with an iron bar. They were only effective against wooden vessels and so fell out of use (as did cannons) when wooden vessels were replaced with steel plated vessels that did not rely on sails and masts for propulsion.

Charles Trollope, an expert in historical ordnance, studied images and the available measurements of the finds. He confirmed that this was a bar shot and very much part of a warship's armoury, used to immobilise the opposition. He suggested that these examples would have been fired from a 12-pounder gun and date from the 17th century as the cast shot ends still have the casting mark where the two halves of the mould met. He determined that based on being a 12-pounder gun, it was likely to be Dutch but cast in Sweden.

As this was found close to Hastings, Charles suggested that it may be connected to the Battle of Beachy Head that occurred in 1690 which was fought along the coast from Beachy Head to Hastings. The Battle of Beachy Head was a naval engagement fought during the Nine Years' War between the French and a coalition of the English, Dutch Republic, Spain, Savoy and the Holy Roman Empire. The Dutch lost nine ships while their English allies also lost one. The French did not lose a single vessel and control of the English Channel temporarily fell into French hands.

It is therefore highly likely that this bar shot came to be on the seabed as a direct result of naval conflict. Staff should be vigilant during any future dredging in this area as other related finds may still be on the seabed.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 005/19)
- The National Record of the Historic Environment
- The Historic Environment Record for East Sussex

Tarmac_0903: Wood Fragment

This wood fragment was discovered at Greenwich Wharf from an unknown Licence Area.

Tarmac_0903 is fragmented plank of wood that is broken at both ends. The plank is approximately 560 mm long and 90 mm wide. There are two circular holes in the fragment of wood; one of which still has a wooden treenail or plug in it. The species of wood is unknown at this time. The condition of the plank would indicate that it has been in the maritime environment for a prolonged period of time as it has been subjected to deterioration from marine borers or wear from the current.

Based on the two circular holes seen in the image, it is thought that they may be treenail holes. Treenails (or trunnels) are a type of fastening used in wooden ship building. Circular pegs of wood are shaped and driven into a hole bored through two or more pieces of structural wood in order to secure them together. Increased water content causes wood to expand, so that treenails gripped the planks tighter as they absorbed water. They had the advantage of not giving rise to decay commonly seen around metal fasteners. However, when the treenail was a different wood species than the planking it usually caused rot. Treenails and iron nails were most common until the 1780s when copper nails over copper sheathing became more popular, however they are still in use today in some wooden ships.

While it cannot presently be confirmed as such, the possibility that this piece of wood derives from a vessel should not be ruled out. Shipwrecks represent an important part of our marine historic landscape and are important in understanding some of the most fundamental aspects relating to human past and experience. Having said this, the timber fragment may relate to a maritime structure such as a pier, jetty or timber groyne that has broken off and ended in the marine environment. Treenails were also used in railroad construction.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 006/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Greater London

CEMEX_0904: Part of Anchor

This part of an anchor was discovered in Licence Area 512 in the East Coast dredging region, approximately 14.5 km east-north-east of Lowestoft. David Bennett discovered it at Northfleet Wharf.

This relatively small metal object was reported by aggregate staff as part of an anchor. It is likely that the top end of the anchor has broken off as it only measures 330 mm long by 300 mm wide although whether this damage occurred before or after the object ended up on the seabed is unknown. The anchor appears to be made of wrought iron.

Images were sent to one of Wessex Archaeology's maritime archaeologists, Graham Scott, who concluded that the object was a small, very corroded crown stocked anchor missing its flukes and possibly part of both arms. The arms of the anchor are the curved pieces either side of the shank or body. The flukes are the wide pointed ends at the end of the arms of an anchor that grip the seabed when mooring. The stock of an anchor runs perpendicular to the shank, however, as this example is believed to be missing the upper part of its shank, it cannot be confirmed whether a stock was present when it was in use. Based on its size, it is thought that this anchor was used on a smaller vessel.

Anchors are important symbols of the maritime world and are common artefacts found on the seafloor. There are a number of reasons why an anchor may end up on the seabed such as being lost during a storm, being fouled, as part of a shipwreck event or lost due to broken chains or ropes. Whatever the reason they came to be there anchors are important to record and can tell us a great deal about the history of an area, where an anchorage was located, areas of danger to ships and the location of shipwrecks.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 021/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Suffolk

CEMEX_0905: Hook

This hook was discovered in Licence Area 512 in the East Coast dredging region, approximately 14.5 km east-north-east of Lowestoft. David Bennett discovered it at Northfleet Wharf.

CEMEX_0905 measures approximately 180 mm in length and 20 mm at its widest end. It is believed to be a fishing hook due to its shape, that has concreted over time and probably broke off a larger component while it was being used. The tip also appears to have been broken.

The earliest hooks date back to the Neolithic period and were usually made from bone, shell, horn, bird's beaks, or constructed with a wooden shank and a flint point. The first mention of the use of steel to make hooks is in *The Treatyse of Fishing with an Angle*, published in London in 1496. Hook making was very labour intensive. In the early 19th century, the larger companies often farmed it out as piece-work, with local families earning pennies by bending the hooks, while the sharpening and polishing was carried out in nearby mills. The Norwegian firm Mustad, which was founded in 1876, paved the way for modern and reliable hook production to begin by introducing hook making machines to its factory [http://www.fishingmuseum.org.uk/hooks_overview.html accessed 22 March 2019]. Fishing hooks have kept the same relative shape for a long period of time therefore dating this example is difficult. It is thought to be modern.

This object may have entered the marine environment via a number of routes. The item appears to have broken off from another element, possibly while in use or on deck and as a result thrown overboard as discarded material. The same cargo also produced part of an anchor (CEMEX_0904), suggesting there could be further discarded material from ships passing by. Though considered an isolated find, further finds should continue to be reported, as they could provide more information about the marine usage of this area over time.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 022/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Suffolk

CEMEX_0906: Minesweeping Cutter

This minesweeping cutter was discovered in Licence Area 137 in the South Coast dredging region, approximately 10 km south of the Needles. Steve Bomber discovered it at Leamouth Wharf.

This broken metal object measures 400 mm long by 150 mm at its widest point. The head of the find tapers in to a rounded head that may have been positioned in such a way as to pivot the object. A series of rivet holes are to be seen along the inner edges of the find where a second, smaller metal piece of the same shape was once attached. Only a small section of this second piece still remains, held in place by one rivet.

Graham Scott, a Senior Maritime Technical Specialist at Wessex Archaeology, suggested the find is a minesweeping cutter. During the First World War, trawlers and drifters were fitted with mine sweeping gear to clear moored contact mines. During the Second World War, cable cutters, which the crew called Sharks' Mouths, were attached to the minesweeping cable. On the end of the cable there was a float designed to move away from the minesweeper allowing a strip of sea to be swept. Once the contact mine's tether was cut and floating on the surface the minesweepers crew would fire their rifles at it (http://www.wildfire3.com/drifters-and-trawlers.html accessed April 2018).

The fact that no trace of a blade is visible on this minesweeping cutter may mean that it was heavily used and possibly discarded as it had reached the end of its working life. Alternatively, it could have been lost overboard during every day shipping operations or during wartime activities. A similar minesweeping cutter (CEMEX_0838) was found in the 2017-2018 reporting year from the same license area as this one. Although it is uncertain whether both cutters are related at this time, further finds of this nature should continue to be reported as they may be indicative of an area heavily associated with wartime activity.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 023/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight.

Tarmac_0907: Aircraft Propeller Blade

This aircraft propeller blade was discovered in Licence Area 430 in the East Coast dredging region, approximately 28 km east-south-east of Southwold. Chaminda Tennekoon discovered it on board *City of Westminster*.

This aircraft propeller blade was found in the draghead of *City of Westminster* where it was removed to deck and photographed. The dimensions are unclear at this stage.

Images of the find were sent to Steve Vizard, an external aircraft specialist, and to Bob Clarke, an aircraft specialist at Wessex Archaeology. Bob said that metal propeller blades, made of aluminium alloy (duralumin) came into production in the late 1930s, mainly in America, with Britain following suit in the 1940s. He said that the hollow hub is characteristic and used for balancing. The curve that can be seen on the propeller blade is distinctive evidence of damage to a rotating prop hitting water.

Steve said that it's a British blade from an RAF aircraft and that the configuration of the blade, the way it would be attached to the actual hub unit, at its base, strongly indicates that it is a DeHavilland type prop unit. Unfortunately, this would not tell us the aircraft type, as the DeHavilland propellers were fitted to a variety of different RAF aircraft throughout the Second World War. He said it could, however, be from an early Spitfire, or at least that period.

A collection of aircraft material has previously been found in Area 430 in 2006 and 2007 (see below images). In 2006, a small number of various metal aircraft parts (UMA_0061) were discovered in dredged material along with a rudder pedal and a lamp (UMA_0062). The pedal was subsequently identified by Andy Simpson at the RAF Museum in Hendon to have belonged to an American aircraft, either a P-51 Mustang fighter or a B-25 Mitchell bomber. The lamp's origin was not discovered and may be unrelated to the aircraft as it is not a standard part of either model.

A very large collection of aircraft wreckage was discovered in 2007 when it was landed at Ridham wharf. UMA_0080-UMA_0083 consists of hundreds of pieces of aircraft wreckage including a saddle magazine that was identified by Ian Jones of the Metropolitan Police as belonging to a German MG 15 machine gun. A complete right humerus from an adult male was also discovered with the wreckage and is believed to have belonged to the pilot.

The 2007 parts are most certainly German. John Romain of the Aircraft Restoration Company stated that the various alloy pieces riveted together were of classic German design, as is the combination of steel to alloy present in some of the pieces. German text is also visible on one object and part numbers are found on others. One object was identified as the lower part of a Lku 4 course indicator gyro compass, part number Fl 22561. In the early 1940s this type of gyro compass was used in only four types of aircraft: Heinkel 111; Junkers Ju 88; Messerschmitt Bf 110; and Dornier Do 24. Other parts, such as engine components, indicate the aircraft is either a Ju 88 or He 111 and is most likely to be a Ju 88. The date on which the aircraft crashed post-dates June 1940, as July 1940 is the latest date stamped on the ammunition within a magazine recovered as part of find UMA_0081. It therefore seems likely that the aircraft crashed in late summer 1940, during the Battle of Britain, before using up this ammunition.

With regard to the 2007 finds, Wessex Archaeology recommended that UMA and CEMEX cease to dredge in the area of the finds soon after the reports were lodged. In accordance with the Protocol a wide Temporary Exclusion Zone (TEZ) was implemented to cover the dredging vessel tracks from which aircraft wreckage was recovered in both 2006 and 2007. This TEZ covered approximately the eastern half of the licence area as it was in 2007 (the licence area is much larger now).

To reduce the area closed to dredging, UMA and CEMEX commissioned Wessex Archaeology to assess the most recent sidescan sonar data which covered the whole of Area 430 with the specific aim of identifying any anomalies likely to be parts of the aircraft. When the location of the aircraft crash site was not established, Wessex Archaeology recommended that a high-resolution geophysical survey be carried out with the specific objective of locating the site so that a localised Archaeological Exclusion Zone (AEZ) could be implemented. This was completed in August 2007. Although the aircraft was again not definitely located, the improved quality sidescan sonar data and new magnetometer data did reveal three definite clusters of material and supports the interpretation of a widely dispersed crash site. As a result, these three spots were designated as AEZs and the TEZ was lifted. None of these clusters were situated around the area where this find was discovered although the survey covered the area where this material was discovered.

Combining all the aircraft material now recovered from this area, it would seem that they represent three different aircraft and varied nationalities; with American, German and now a possibly British part having been discovered.

All crashed military aircraft are protected by law under the *Protection of Military Remains Act* 1986. The discovery of aircraft remains is thus incredibly important, particularly as aircraft crash sites may contain human remains. This discovery appears to comprise isolated remains rather than representing a coherent crash site although the damage on the prop would indicate the vessel crashed into water. No obstructions were identified on the seabed during dredging, and no further finds were discovered in the dredged load. For this reason, the remains are not considered to be contentious, although the discovery of further remains from the same area should be reported immediately.

References:

Wessex Archaeology, 2007. *Aggregate Licence Area 430 Aircraft Crash Remains – Technical Report* (internal reference 65220.02)

Wessex Archaeology, 2007. *Aggregate Licence Area 430 Geophysical Investigation of an Aircraft Crash Site – Technical Report* (internal reference 65220.04)

Wessex Archaeology, 2011. *Area 430, Marine Aggregate Extraction - Archaeological Assessment of Geophysical Data Archaeological Monitoring Report* (internal reference 65221.02)

Wessex Archaeology, 2006. Protocol for reporting finds of archaeological interest Annual Report to BMAPA 2005-2006 (available at: https://www.wessexarch.co.uk/sites/default/files/field_file/Protocol_annual_report_2005_2006.pdf)

Wessex Archaeology, 2007. *Protocol for reporting finds of archaeological interest Annual Report to BMAPA 2006-2007* (available at: https://www.wessexarch.co.uk/sites/default/files/field_file/Protocol_annual_report_2006_2007.pdf)

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The MOD
- The Receiver of Wreck (047/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Suffolk

Finds from 2007

CEMEX_0908: Submarine Pyrotechnic

This submarine pyrotechnic was discovered in Licence Area 137 in the South Coast dredging region, approximately 10 km south of the Needles. Michael Pettitt, Tim Bethune and Mark Nichols discovered it at Shoreham Wharf.

This find is in two parts. The first element is a broken metal cylindrical tube that measures 820 mm long and 70 mm wide that appears to be made of aluminium with an associated brass mechanism. On one of the brass rings at its ends are inscribed “Ejector No. 2 MK I/L II MB/44” as well as the Navy Broad arrow (pictured below). It appears that wire is present at one broken end of the cylinder while a series of electrical components are visible at the other. The second component of this find is a canvas parachute, that despite a few holes is complete with the remains of the string that would have held it to its origin.

Images of the finds were sent to our in-house specialists Alistair Byford-Bates, Bob Davis and Bob Clarke. Alistair and Bob Davis both said that it looked ‘percussive’ and suggested that both finds were connected. Alistair also suggested that the 44 on the brass ring may be indicative of a date of manufacture.

After research, it has been suggested that this find is an example of a Submarine Emergency Identification Signal, Star, Mk 2 Mod 2 or Mk 3 Mod 0. These signals were for either day or night use. They were for use exclusively with the submarine signal ejector and were ejected by compressed air. On rising to the surface of the water, Submarine Emergency Identification Signals Mk 2 Mod 2 and Mk 3 Mod 0 project a Single Star Grenade Mk 5 to a height of 250 feet (76 m), where a parachute would open to support the star, which would burn for approximately 13 seconds. The complete signal was available in one of three colours, red, green or yellow. Submarine Emergency Identification Signals Mk 2 Mod 2 and Mk 3 Mod 0 consisted of a buoyant tube of aluminium 18.5 inches (470 mm) long and three inches (76 mm) in diameter, which contained the Single-Star Grenade Mk 5 Mod 0. One end was closed with an ogive nose cap. The other end carried the ignition device. Early issues of Submarine Emergency Identification Signal Mk 2 Mod 2 contained either Smoke Grenade Mk 3, for day use, or Three-Star Grenade Mk 4, for night operation. Submarine Emergency Identification Signals Mk 2 Mod 2 and Mk 3 Mod 0 should not have been ejected at depths greater than 160 feet (79 m), as the time required to reach the surface was limited to the 27 seconds allowed by the fuse (https://maritime.org/doc/pyro/part3.htm accessed 17 April 2019).

Bob Clarke had a different idea for the find. He said it looks more like a 2-inch UP (unrotated projectile) Anti-Aircraft Rocket. The name "unrotated projectile" was a cover name to disguise the use of a rocket system and comes from the fact that the projectile was not spin-stabilized. The 2-inch (51 mm) and 3-inch (76 mm) UP systems were successfully deployed in the anti-aircraft Z Batteries which were operated by the Home Guard and was the basis of the RP-3 air-to-surface rocket and the Mattress surface-to-surface multiple rocket launcher (Furneaux-Smith 1961*).*

Bob Clarke also said that the parachute featured is a drogue chute which are used to pull out bigger chutes or used to slow objects down. He said the chute looks to be 5 feet (1.5 m) based on the images, which unfortunately is a standard size. He said it may not be associated with the other find.

This item is believed to be related to war time activity, particularly the Second World War, in which case it may have lain undisturbed on the seabed for over 70 years. It may have been deployed as a flare from a submarine or fired from a vessel at an aircraft. It is not possible to confirm whether both finds are associated with each other at this time although it is believed to be the case. Any further items of this nature dredged in this vicinity should be reported immediately as it may be an area that was important during the war or, although less likely, there may be remnants of submarine wreckage nearby.

References:

Furneaux-Smith, F. (1961). *The Professor and the Prime Minister: The Official Life of Professor F. A. Lindemann Viscount Cherwell.* Boston: Houghton Mifflin Company.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 055/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

Tarmac_0909: Naval Round

This naval round was discovered in Licence Area 395/1 in the South Coast dredging region, approximately 11 km south-west of Selsey Bill. M. Hayward discovered it at Wes Cowes Wharf on the Isle of Wight. It was removed from site by the EOD.

This find was reported as a possible munition measuring 270 mm long with a diameter of 40 mm. The item is shaped like a tube and has several numbers and letters inscribed on its base. The date of 1943 is visible on the base meaning that this find may have been on the seabed since the Second World War.

Images of the object were sent to Trevor Parker from the Ordnance Society and Bob Davis, a specialist at Wessex Archaeology. Both agreed that the find is a 2-pr Pom-Pom round for a Mkll gun. Trevor said that the example is unfired, so the brass case would still have had propellant (most likely cordite) in it. The steel head has its nose or fuse corroded away, which may have been aluminium, brass or steel, so one can't tell if it's a 'live' HE, or inert practice head. Both said that the primer protector clip or primer cover is a No.17 Mk I, with a maker's make of "INW Ltd" and the case is dated 1943, for Naval use, but the maker's mark is hidden by the encrustation. Bob added that all live rounds of this type were covered with such clip-on devices. They were meant to stop accidental ‘banging’ of the shell primer in the centre of the base of the cartridge, hence the slight dome in the middle. They carried the maker’s mark, type etc to aid your average soldier in putting the right cover on the right shell. Bob thinks there are numbers and letters on the casing which would tell the gunners about type of filling and dates etc.

Most ordnance found in British waters relates to the First or Second World War meaning that they could have lain undisturbed for 70-100 years. Though considered an isolated find, further finds of this type should be reported, as they may be indicative of an unrecorded site, debris field, or provide further information about naval warfare or training in the area.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 059/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

CEMEX_0910: Munition Shell

This shell was discovered in Licence Area 340 in the South Coast dredging region, approximately 11.5 km south-east of the Isle of Wight. Steve Bomber discovered it at Leamouth Wharf. The munition was detonated on site by the EOD.

This find was discovered on the magnet and reported as a munition measuring 290 mm long with a diameter of 80 mm. The copper driving band just visible at its base displays several notches which means that the shell has been fired. When the shell is fired, the pressure of the propellant swages the metal into the rifling of the barrel, providing a seal preventing the gases from blowing past the shell and engaging with the rifling to spin-stabilize the shell.

Images of the object were sent to Trevor Parker, from the Ordnance Society, and Bob Davis, a specialist at Wessex Archaeology. Bob said that judging from the images it is a case for a 3-inch shell. He said it looks to be made of steel and so it is likely to be the case for a shrapnel shell. Shrapnel shells acted like giant shot gun shells and when they went off, the steel case held firm and did not burst. The explosion 'pushed' out the shrapnel balls which took the comparatively weak nose cone and fuse with it leaving these fired but empty cases. There were a few guns of this calibre, so it is difficult to identify and date the exact gun it was fired from. As it was dredged up, it may possibly be off a ship mounted anti-aircraft weapon or similar.

Trevor said the shell is from a 'fixed round', which means that a brass shell-case is crimped around the bottom of the shell, just below the driving band and is loaded into the gun as a unit. This means that there won't be any markings on the base of the shell, but there would have been some on the body of the shell; although rusted away by now. The nearest calibre to the 80 mm diameter is 3.3-inch (84 mm) which equates to the First World War 18-pounder field gun. He said that he has no record of it being used at sea, although there was an anti-aircraft version which may have been used at sea. The likelihood of it being an 18-pounder is increased by counting the rifling grooves in the driving band which he thinks are 18 in number.

Most ordnance found in British waters relates to the First or Second World War meaning that they could have lain undisturbed for 70-100 years. Ordnance has previously been discovered and reported from Licence Area 340 (the most recent being CEMEX_0900) therefore this area may be indicative of a debris field, or an area where naval warfare or training took place.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 065/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

Hanson_0911: Cannonball

This large cast iron cannonball was discovered in Licence Area 240 in the East Coast dredging region, approximately 10 km east of Great Yarmouth. Mark Morley discovered it on board *Arco Avon*.

Hanson_0911 is a large cast iron cannonball with a diameter of 200 mm or 8 inches. No weight was given. The surface has been heavily degraded in the marine environment and has pitted in places.

Charles Trollope, an expert in historical ordnance, studied the images of the find and based on the measurements provided with the scale, said that the cannonball had a diameter of 8 inches making it a 68 pounder. He said that one possibility for the origin of this 68-pounder shot and that is a “long shot”. 68 pounder guns were not introduced into the Navy until the 1830s but 68 pounder Carronades were introduced around 1780. Carronades were short heavy guns, similar to cannon. Known as the 'Smasher', they were usually mounted on traversing slide carriages so that they could slide back and forth but some were mounted on carriages and trucks (https://www.rmg.co.uk/discover/explore/what-was-carronade).

Charles said that the only known battle in the area where the cannonball was found was the Battle of the Dogger Bank fought on 5 August 1781 between the Dutch and the British. The battle was fought for 5 hours while the two fleets sailed in a South Westerly direction. The British claimed 104 killed and 339 wounded, while the Dutch claimed 142 killed and 403 wounded (Cowes 1898). The Royal Navy ship *Princess Amelia*, 80 guns, might just have had two 68 Pounder Carronades mounted on board.

Cannonballs are a common find around the coast of England as, with an extensive naval history, military training and battles have taken place along this stretch of coastline for hundreds of years. It is not possible to say whether it was fired during training, battle or perhaps just lost overboard.

References

Clowes, Sir William Laird (1898). *The Royal Navy: a history from the earliest times to the present*, Volume 3

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 068/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Norfolk

DEME_0912: Steel Wreckage

This steel wreckage was discovered in Licence Area 351 in the South Coast dredging region, approximately 13 km south west of the Isle of Wight. Pierre Nowak discovered it on board *Charlemagne*.

DEME_0912 was discovered and reported by vessel staff as steel wreckage part with a hinge mechanism and a large arm protruding from the main body. The main steel component is bolted together and measures approximately 340 mm in length and 120 mm width with the length of the mobile part reaching a length of 950 mm.

Images of the find were sent to Bob Davis, a specialist at Wessex Archaeology, and Anthony Mansfield, a Senior Naval Engineer. After thinking it was a pump at first, Bob now thinks that it appears to be some kind of door closer; with the mobile part of the object being the lever with which to open and close the door. He said it would all depend on whether there is a spring inside the bolted “drum”. Anthony on the other hand said that it may be a windscreen wiper mechanism. He said that the driving rod has corroded away but the hole remains in the long c section. The wiper would have been attached to the flat arm.

This object may have entered the marine environment via a number of routes. The item is broken and could be indicative of material lost or thrown overboard during every day shipping operations. License Area 351 has produced a mixture of items that could possibly indicate the dumping of material. Though considered an isolated find, further finds of this type should continue to be reported, as they may be indicative of an unrecorded wreck site or related debris field.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 069/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

CEMEX_0913: Munition Shell

This munition shell was discovered in Licence Area 340 in the South Coast dredging region, approximately 11.5 km south-east of the Isle of Wight. Steve Bomber discovered it at Leamouth Wharf. The find was disposed of by the EOD.

This shell measures 305 mm long with a diameter of 80 mm. The copper driving band at the base is missing and the brass plug at the base read 305 R⚓L 8/98. When the shell was disposed of by the EOD, it was found to be packed with inert material.

Images of the object were sent to Trevor Parker, from the Ordnance Society, and Bob Davis, a specialist at Wessex Archaeology. Both said that 8/98 represented the date of manufacture meaning it was made in August 1898 with the 305 being the batch number. Trevor said that it's a No.12 Mk I base fuze in what was almost certainly a 12-pounder common-pointed shell.

Bob said that the RL represents 'Royal Laboratory' otherwise known as the Woolwich Arsenal (the football team bears this name) with the ordnance arrow in between. He said the fact that it had inert contents is interesting. The drive band is missing, this is unusual as they normally have to be cut off. This would all point to a practice round which would mean that the "base fuze" would not be needed as it is not meant to be fired meaning that the base of the shell was fitted with a plug. He said it might be from a 3-inch gun and that these types of shell are known as 'common' and meant for armour piercing. He suggested it may be from a 10-pounder mountain gun as it fits the calibre and approximate date. They fired common shells as well as shrapnel.

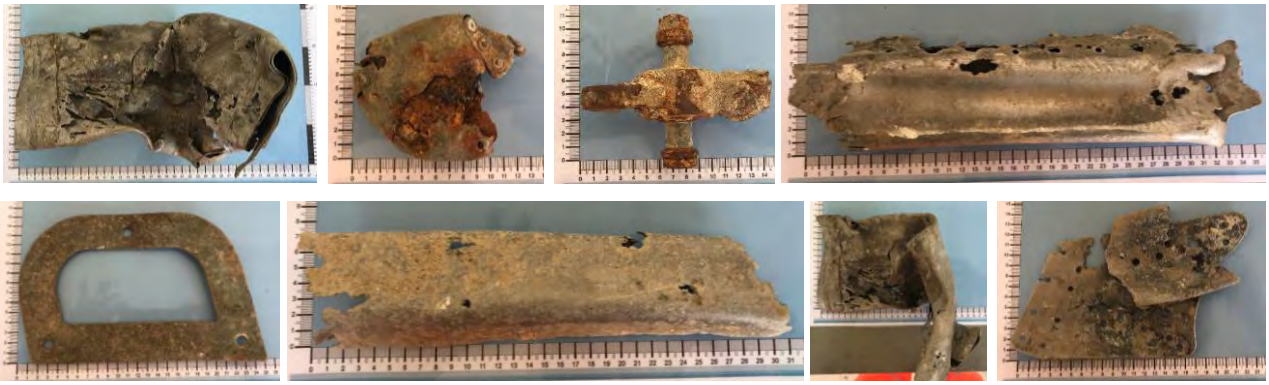
Most ordnance found in British waters relates to the First or Second World War, so it's exciting to discover ordnance from the 19th century, that has been on the seabed for over 120 years! Ordnance has previously been discovered and reported from Licence Area 340 (the most recent being CEMEX_0910) therefore this area may be indicative of an area where naval warfare or training took place.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 072/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

CEMEX_0914: Aircraft Components

These aircraft components were discovered in Licence Area 511 in the East Coast dredging region, approximately 9 km north-east of Lowestoft. Jake Goodwin discovered them at Angerstein Wharf.



CEMEX_0914 is made up of eight separate aircraft components all discovered in the same cargo. All the components seem to be made up of the same material and all vary in size. The largest piece measures 380 mm by 200 mm while the smallest piece measures 130 mm by 110 mm. There are rivets still visible *in situ* on some of the pieces.

Images of the find were sent to our in-house specialist Bob Clarke and an external aircraft specialist, Steve Vizard. Steve said that although these are definitely aircraft parts, there is nothing evident to establish type. However, from the general look of the items, and the appearance of the nuts on the mechanical/system component in one of the photos, he suggested that it may well be German.

Bob said that within the images, there are possibly a couple of engine parts and the rest from the structure of the airframe. He said that the D-shaped item is interesting and may be a strengthening bracket that went around a foot or hand hold to get into the cockpit. The screw holes are countersunk, suggesting it is an external item. The idea is to strengthen the structure at the point where the boot or hand goes into a slot, stopping the weight of the pilot bending, or distorting the skin at this point.

All crashed military aircraft are protected by law under the Protection of Military Remains Act 1986. The discovery of aircraft remains is thus incredibly important, particularly as aircraft crash sites may contain human remains. It is unclear whether this discovery is comprised of isolated remains or whether they represent a coherent crash site.

Previous finds from Licence Area 511 include CEMEX_0230 found in 2009, CEMEX_0290 found in 2010, WA2034, WA2035 and WA2036 all found in 2013 and more recently, CEMEX_0867 found in 2018.

CEMEX_0230 consisted of two aluminium fragments approximately 240 mm and 210 mm in width and 180 mm and 130 mm in width, with cross rivets on their surface. One of the pieces has holes drilled for possible anchor nuts. The type of aircraft could not be determined.

CEMEX_0290 consisted of three pieces of aircraft wreckage that were identified as coming from a United States Air Force McDonnell-Douglas F-4 Phantom. This type of aircraft was flown from the mid-1960s and they are still in use today.

CEMEX_0867 was believed to be an extrusion, as opposed to a section of formed sheet metal. The section seemed thick, meaning that it was quite substantial to the structure of the aircraft, suggesting it may be part of the wing structure or rib section. It was thought that the rivet type appeared to be British rather than American.

WA2034 represented fragments of aircraft wreckage believed to be that of Wellington MKIC X9634, a British heavy bomber.

WA2035 was a 930 mm long fragment of an aircraft's tail wing spar and may be indicative of a crash site in the vicinity.

WA2036 was a fragment of an aircraft hydraulic jack.

As the finds are not identifiable fragments of aircraft, the remains are not considered to be contentious, although the discovery of further remains from the same area should be reported immediately as they may be indicative of an unrecorded aircraft crash site or related debris.

References

Wessex Archaeology, 2013. Areas 511/512/513: Technical Report & Impact Assessment. Offshore Desk-Based Archaeological Assessment. Ref. 86240.04

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 073/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Suffolk

CEMEX_0230

CEMEX_0290

CEMEX_0867

CEMEX_0915: Aircraft components, shoes, mooring bollard and munition

This collection of finds were discovered in Licence Area 511 in the East Coast dredging region, approximately 9 km north-east of Lowestoft. Jake Goodwin discovered them at Angerstein Wharf.

CEMEX_0915 is made up of 12 separate items including seven aircraft fragments, a possible mooring bollard, a munition head and three different fragments of shoe all discovered in the same cargo. The largest aircraft fragment is 480 mm long by 90 mm while the smallest is 140 mm by 60mm. Some of the aircraft components have rivet holes around their extremities, however there are no visible markings or numbers stamped on them that would aid in identification.

The largest shoe fragment is a complete sole measuring 310 mm by 110 mm while the smallest fragment is 80 mm by 80 mm. The two smallest shoe fragments have visible markings on them. One of the soles has “Made in” in raised letters on it while the other has a series of stamps present including “10C” “73” and “VIII”.

Images of the aircraft components, shoes and possible mooring bollard were sent to an external aircraft specialist, Steve Vizard. Steve confirmed that all the lightly coloured metal components were definitely aircraft but were too fragmented to determine much else. He said that the shoe remnants certainly do not appear to be flying boots.

The possible bollard is a cylindrical iron object measuring 190 mm long with a diameter of 185 mm at the thicker end. Steve agreed that the iron bollard is a modern mooring fixture of some sort that may have come off a vessel.

Once it was concluded that the shoes were not believed to be related to the aircraft, the images were sent to an external leather shoe specialist, Quita Mould. She said that she believes that on the tip of one of the shoes, that she can see “Made in England”. She said there are two components to the stamped shoe; the sole and probably the midsole from a shoe bottom of adult male size which originally had a separate, low, D-shaped heel attached, that is now missing. Quita said that as it has

no upper it cannot be closely independently dated but it looks to be a 20th century mass produced item.

The munition head measures 120 mm by 50 mm at its base. Images were sent to Wessex Archaeology's in-house specialist, Bob Davis who said that it was difficult to identify as it is very corroded and there's not much left of it. He said it's not very clear what it's made of (ferrous or alloy) or if there is a join toward its base. He said if it's solid, then it is most likely a steel shell, whereas if it's alloy then it could possibly be a cap. Ballistic caps normally attach to the main body of the shell via a thread. They can also be made of light weight alloy (aluminium) as they are sacrificial and only are used for ballistic aerodynamics. Bob said that if this example was a ballistic cap, he would expect it to have a sharper point but, given its small diameter of approximately 50 mm this might not be needed.

Further contact with the wharf confirmed that the munition head was solid rather than hollow, in order to aid Bob in identifying it. In this case, he said that he would tend towards a 50 mm solid armour piercing common point round head. An armour piercing (AP) shell, is a type of ammunition designed to penetrate armour and this example was probably fired from a heavy machine gun. It is not possible to determine whether the munition is definitely related to the aircraft components. However, Bob said it could be related as the aircraft in question may have been shot at by heavy calibre machine guns on board ships or, alternatively the munition could be from an aircraft as 50 mm browning machine guns (American) were fitted to aircraft such as the P-47 and bombers for protection.

Although the finds are not identifiable fragments of aircraft, the remains are considered to be important as they may relate to other aircraft material (CEMEX_0914 and CEMEX_0918) recently found in the same cargo from the same area. The fragmentary nature of the remains may indicate a very dispersed aircraft crash site, but it is also possible that further, and more diagnostic, discoveries may be made in the area, and therefore any further discoveries should be reported immediately as they may provide further information about this site. As munitions have been found in the same area it may be an area where warfare or training took place.

The fact that there is such a mixture of different finds all from the same cargo from Licence Area 511 may also be indicative of a debris field where materials have been dumped over the years. A wide variety of material has been reported from Licence Area 511 through the Protocol.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The MOD
- The Receiver of Wreck (Droit 091/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Suffolk

CEMEX_0916: Shell

This shell was discovered in Licence Area 137 in the South Coast dredging region, approximately 10 km south of the Needles. Steve Bomber discovered it at Leamouth Wharf. The munition was detonated on site by the EOD.

This find was correctly identified and reported as a munition, measuring 140 mm long with a diameter of 40 mm. The copper driving band displays several notches which means that the shell has been fired. When fired, the pressure of the propellant swages the metal into the rifling of the barrel, providing a seal preventing the gases from blowing past the shell and engaging with the rifling to spin-stabilize the shell.

Images of the object were sent to Bob Davis, a specialist at Wessex Archaeology. Bob said that the shell looks like a fired 40 mm Bofors round. He said that it has the characteristic tapered 'tail' to the back end and the drive band always looks like it's too far up the shell. He said that he can't be sure if it's a tracer round or high explosive round, however the EOD confirmed that it was an anti-aircraft round with high explosives present. The Bofors 40 mm AA gun was developed in the early 1930s by the Swedish firm Bofors AB. In 1937 the British decided to buy 100 of these guns along with 500,000 rounds of ammunition. By the end of the year another 180 were ordered, and an agreement was signed authorising manufacture in England (http://maltacommand.com/bofors.html accessed June 2019). The Bofors gun was capable of firing at a rate of 120 rounds per minute. If the target was not hit, the shell would explode when the tracer element burnt out when the shell was on its way back to earth. This was done to avoid the shell exploding on the ground and causing casualties and damage.

Most ordnance found in British waters relates to the First or Second World War meaning that they could have lain undisturbed for 70-100 years. A variety of finds have previously been discovered and reported from Licence Area 137 therefore this area may be indicative of a debris field.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 092/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

CEMEX_0917: Shell

This shell was discovered in Licence Area 137 in the South Coast dredging region, approximately 10 km south of the Needles. Steve Bomber discovered it at Leamouth Wharf. The munition was detonated on site by the EOD.

This find was correctly identified and reported as a small munition measuring 70 mm long with a diameter of 20 mm. The copper driving band visible towards the one end of the munition displays several notches which means that the shell has been fired. When the shell is fired, the pressure of the propellant swages the metal into the rifling of the barrel, providing a seal preventing the gases from blowing past the shell and engaging with the rifling to spin-stabilize the shell.

Images of the object were sent to Bob Davis, a specialist at Wessex Archaeology. Bob said it appears to be a fired example of a 20 mm round. The ballistic cap has rotted off leaving the detonator exposed in the end. This could have come from an aircraft gun such as the Oerlikon 20 mm cannon. These autocannons were based on an original German design that appeared very early in the First World War. It was widely produced and by the Second World War, various models were employed by both Allied and Axis forces with many versions still in use today. The shell would have been filled with High Explosives such as TNT and the contractors initial or trade mark along with the year of manufacture would have been present on the base. On this example however, the base has been heavily concreted in the marine environment making it unreadable.

Most ordnance found in British waters relates to the First or Second World War meaning that they could have lain undisturbed for 70-100 years. A variety of finds, including munitions have previously been discovered and reported (most recently CEMEX_0916) from Licence Area 137 therefore this area may be indicative of a debris field or an area where naval warfare or training took place.

References

B.R. 932, 1945. *Handbook on Ammunition*.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 093/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

CEMEX_0918: Aircraft Fragments

These two aircraft fragments were discovered in Licence Area 511 in the East Coast dredging region, approximately 9 km north-east of Lowestoft. Jake Goodwin discovered them at Angerstein Wharf.

CEMEX_0918 is made up of two separate aluminium aircraft components with number stamps visible on their surface. The largest piece measures 200 mm by 40 mm while the smallest piece measures 195 mm by 20 mm. There are rivets still visible in situ on the larger piece along with an unidentified stamp. The smaller piece has the numbers “81431” stamped on the surface.

Images of both these components were sent to an external aircraft specialist, Steve Vizard. Steve said that they confirmed his identification of the components reported as CEMEX_0914 in that it looks to relate to a German aircraft. The indistinct stamp appears a Luftwaffe type, and the numbers also look that way. It certainly points in the direction of not being British or RAF as the numerals are not correct for the period. Britain tended to always use a “flat top” 3. The Luftwaffe was the aerial warfare branch of the combined German Wehrmacht military forces during the Second World War, developed under Nazi rule. Several aircraft were built as a result of slave labour and despite being one of the most technologically advanced air forces in the world when the Second World War began, the Luftwaffe was a defeated force by 1944.

Although the finds are not strictly identifiable, the remains are considered to be important as they relate to previous aircraft material from the same cargo discovered at Angerstein wharf (CEMEX_0914 and CEMEX_0915). The discovery of further aircraft remains from the same area should be reported immediately as they may be indicative of an unrecorded aircraft crash site or related debris.

References

Uziel, D. 2011. *Arming the Luftwaffe: The German Aviation Industry in World War II*

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The MOD
- The Receiver of Wreck (Droit 097/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Suffolk

CEMEX_0919: Cannonball

This small cast iron cannonball was discovered in Licence Area 458 in the East English Channel dredging region, approximately 39 km south of Hastings. Jake Goodwin discovered it at Angerstein Wharf.

CEMEX_0919 is a small cast iron cannonball with a diameter of 90 mm or 3.5 inches. No weight was given. Its surface had been degraded in the marine environment, visible by the striations on the surface. Based on the diameter alone, this cannonball could have been fired by a Saker (Childs 2009) and would have most likely weighed between 5 and 6 lbs (2.3 to 2.7 kg) (Garrett 2010).

The Saker was a medium bronze canon measuring 9 feet (2.7 m) in length and weighed in at 1,550 lbs (703 kg) (Childs 2009) developed in the 16th century. Sakers were used heavily during Tudor warfare while Henry VIII was expanding his Royal Navy, favouring Bronze guns over iron ones (Childs 2009). In the 16th century, cannon were given the names of birds with a 'saker' being a type of hawk (https://collection.nam.ac.uk/detail.php?acc=1991-11-41-1 accessed June 2019). Later, during the English Civil War (1642–1651), Sakers were a part of the lighter field pieces which were the most tactically interesting in battle due to their mobility (http://nantwichmuseum.org.uk/english-civil-war-cannons-and-mortar-an-overview/ accessed June 2019).

Cannonballs are a common find around the coast of England as, with an extensive naval history, military training and battles have taken place along this stretch of coastline for hundreds of years. It is not possible to say whether it was fired during training, battle or perhaps just lost overboard.

References

Childs, D., 2009. *Tudor Sea Power: The Foundation of Greatness*. Seaforth Publishing, Barnsley.
Garrett, R. J., 2010. *The Defences of Macau: Forts, Ships and Weapons over 450 years*. Hong Kong University Press, Hong Kong.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 104/19)
- The National Record of the Historic Environment
- The Historic Environment Record for East Sussex

CEMEX_0920: Collection of Munitions

This collection of munitions was discovered in Licence Area 511 in the East Coast dredging region, approximately 9 km north-east of Lowestoft. Jake Goodwin discovered them at Angerstein Wharf.

This collection of munitions all originated from the same cargo that has recently produced a variety of materials including aircraft fragments (CEMEX_0914, CEMEX_0915 and CEMEX_0918).

Images of the munitions were sent to Trevor Parker from the Ordnance Society, an external aircraft specialist, Steve Vizard as they may be related to the previous aircraft discoveries, and to Wessex Archaeology's in-house specialist, Bob Davis. All three made the comment that the munitions are extremely varied.

Steve said that based on image **1**, it seems the majority of the heads are fired, as denoted by the rifling grooves on the copper drive bands, and are quite heavy calibre, so likely to be Naval. The smaller rounds could be aircraft related but would normally be found in clusters or drums if we were dealing with a wreck site. The rounds identified are a British 20 mm cannon shell, a couple of .50 calibre heavy machine gun shells, with the remainder being rifle calibre but could be further identified by inspecting the head stamps.

Trevor said the single round in image **2** and **3** is a 20 mm Oerlikon round used on close range anti-aircraft ship mounted guns. It was obviously made in 1943, and by the Raleigh Cycle Company in Nottingham. These are usually explosive with a brass nose fuse. There are a lot of other different rounds shown in image **1** and are quite difficult to identify. Some of those are also 20 mm but might be Hispano as well as Oerlikon; American 0.5-inch Browning and possibly some 0.303-inch and 0.3-inch machine gun. Trevor said that the larger calibre items may still be aircraft linked, as three out of the four in the main image appear to be 6-pr armour- piercing solid shot, which were fired by a modified Mosquito mounting a single barrel gun. This was quite

successful in the anti-shipping role and was credited with a number of surfaced U-boats as well as surface ships. Some of the ammunition might be German (like the aircraft material), but without seeing the stampings on the base of the brass casings, it is impossible to tell.

Bob said that image **1** has four small medium artillery shells, all fired examples and that the second from the right may have a tracer element to the base. The middle row has what looks like a large round on the left with a used drive band so a small artillery piece while the rest of the row looks like mostly 20 mm and 37 mm cartridges and shells. The 20 mm rounds may have come from a Navy version of the Oerlikon gun, a 20 mm machine cannon or aircraft cannon. The shells appear to be solid shot, meant to damage aircraft and the like. He said that image **2** and **3** most probably represents an aircraft round commonly known as Hispano 404 cannon used widely in Second World War British aircraft. He said image **4** appears to be a 50 calibre bullet. A 50 calibre is usually defined as half and inch therefore .50. Bob identified image **5** as a fired solid armour piercing round as the rifling marks are still visible on the driving band. Without a scale, it is difficult to tell which type of gun it came from. He suggested image **6** may be a bofors round, however more could be said if the markings on the base were visible. Image **7** is a 50 calibre bullet that appears to be made of copper. As the munition in image **8** is heavily concreted, it is difficult to identify. It appears to be a solid armour piercing round of perhaps a small calibre and possibly belongs to a bofors gun.

After looking at all the images, Bob said that it is unusual that there are fired large rounds and unfired possible aircraft rounds all from the same area making it seem as if there were some sort of battle at sea or that they were dumped there after the war.

Although they are munitions, the discovery is considered to be important as they may relate to aircraft material (CEMEX_0914, CEMEX_0915 and CEMEX_0918) recently found in the same cargo from the same area. Any further discoveries made should be reported immediately as they may provide further information about this site.

Most ordnance found in British waters relates to the First or Second World War meaning that they could have lain undisturbed for 70-100 years. As mentioned, a variety of finds have previously been discovered and reported from Licence Area 511, therefore the area may be indicative of a debris field where materials have been dumped over the years or an area where naval warfare or training took place.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 105/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Suffolk

CEMEX_0921: Munition

This munition was discovered in Licence Area 340 in the South Coast dredging region, approximately 11.5 km south-east of the Isle of Wight. R. Newbery discovered it at Leamouth Wharf. The find was disposed of by the EOD.

This shell measures 6 inches (150 mm) in length with a diameter of 1.5 inches (38 mm). The in-tact copper driving band at the base is grooved meaning that the projectile has been fired. It was noted by the finder that there was no nose fuse present.

Images of the object were sent to Trevor Parker, from the Ordnance Society, and Bob Davis, a specialist at Wessex Archaeology. Trevor said that it was easily identified and confirmed by the size as being a Second World War 2-pounder Pom-Pom practice head that would have sat in a shell case. He said it is completely inert. The QF (quick firing) 2-pounder, known as the pom-pom, was a 40 mm (1.6 inch) British autocannon, used as an anti-aircraft gun by the Royal Navy designed by Vickers. The gun is thought to have been named after the sound that the original models make when firing. The Mark II gun was introduced to the Royal Navy in 1915 as an anti-aircraft weapon for ships of cruiser size and below which was later modified to Mark II* and then the Mark II*C. By the Second World War, the gun had modified to the Mark VIII to suit an eight gun mounting. It has been speculated that the reason that the 2-pounder shell was selected for this weapon was because there were about 2,000,000 rounds left over from the First World War. These guns were manufactured in large numbers throughout the Second World War. The Naval Gun Register shows that 6,691 guns were made in Britain.

It is believed that this ordnance relates to the Second World War, meaning it could have lain undisturbed for over 70 years. Ordnance has previously been discovered and reported from Licence Area 340 (the most recent being CEMEX_0913) therefore this area may be indicative of an area where naval warfare or training took place.

References:
http://www.navweaps.com/Weapons/WNBR_2pounder_m2.php accessed July 2019
http://www.navweaps.com/Weapons/WNBR_2pounder_m8.php accessed July 2019

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 109/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

CEMEX_0922: Munition

This munition was discovered in Licence Area 340 in the South Coast dredging region, approximately 11.5 km south-east of the Isle of Wight. R. Newbery discovered it at Leamouth Wharf. The find was disposed of by the EOD.

This shell measures 140 mm long with a diameter of 40 mm. The copper driving band at the base indicates this example has been previously fired. When encountered on site by the EOD, it was determined that this munition was a 40 mm anti-aircraft round.

Images of the object were sent to Trevor Parker, from the Ordnance Society, and Bob Davis, a specialist at Wessex Archaeology. Trevor said the shell was so heavily concreted, he could not make a positive identification but based on the assessment of the EOD, suggested it may have been fired from a Bofors gun. They confirmed that it was an anti-aircraft (AA) round with high explosives present.

The 40 mm AA gun was developed in the early 1930s by the Swedish firm Bofors. In 1937, the British Army decided to buy 100 of these guns along with 500,000 rounds of ammunition. By the end of the year another 180 were ordered, and an agreement was signed authorising manufacture in England. According to the '1940 provisional Gun Drill' for the Bofors, ten personnel manned each gun. The Bofors gun was capable of firing at a rate of 120 rounds per minute. If the target was not hit, the shell would explode when the tracer element burnt out when the shell was on its way back to earth. This was done to avoid the shell exploding on the ground and causing casualties and damage. These guns were also used by Sweden, Germany, Japan and the USA.

It is believed that this ordnance relates to the Second World War, meaning it could have lain undisturbed for over 70 years. Ordnance has previously been discovered and reported from Licence Area 340 (the most recent being CEMEX_0921) therefore this area may be indicative of an area where naval warfare or training took place.

References
http://www.navweaps.com/Weapons/WNUS_4cm-56_mk12.php accessed July 2019
http://maltacommand.com/bofors.html accessed June 2019

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 110/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

CEMEX_0923: Munition

This munition was discovered in Licence Area 340 in the South Coast dredging region, approximately 11.5 km south-east of the Isle of Wight. Steve Bomber discovered it at Leamouth Wharf. The find was disposed of by the EOD.

This shell measures 10 inches (250 mm) long with a diameter of 3 inches (76 mm). The intact copper driving band at the base is grooved meaning that the projectile has been fired. The wharf reported that a fuse plug was on the base with the markings RL and a small arrow, as well as the letters P, N and MK I.

Images of the object were sent to Trevor Parker of the Ordnance Society. He said the 'RL' on the base represents 'Royal Laboratories' otherwise known as the Woolwich Arsenal (the football team bears this name) with the ordnance arrow above it. The 'P' would indicate that this munition is a practise round used for firing practise and therefore inert and safe. Trevor said that the other marks indicate 'N' for Naval use, and it's a 'Mk I'. From the images, he said calibre looks to be about 3-inches. Practice rounds also have practice fuses (nose or base). Bob Davis, a specialist at Wessex Archaeology said the base of this shell has a base fuse with a square central 'key' hole for removal with a special tool. This would simulate removing a transit plug for a real shell which would be in place while the shells were being transported. They would then be swapped out for a base fuse when it came to firing the real shells.

Trevor believes the shell was fired from the Naval 12-pr 12-cwt family of guns. They had 16 rifling grooves, which is what he estimates this shell has from the picture. These guns were used by the British Navy in the First and Second World Wars.

Most ordnance found in British waters relates to the First or Second World War that has been on the seabed for 70-100 years. Ordnance has previously been discovered and reported from Licence Area 340 (the most recent being CEMEX_0921 and CEMEX_0922) therefore this area may be indicative of an area where naval warfare or training took place.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 111/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Isle of Wight

Britannia_0924: Animal Bone

This animal bone was discovered by George Lee-Amies at Cliffe Wharf. The find is from an oversize stockpile and therefore the exact licence area is unknown.

Britannia_0924 is a fragment of bone measuring 155 mm long and 60 mm at its widest end. The shaft of the bone is broken and there are cracks along it. The end appears to be worn.

The image of the find was sent to Lorrain Higbee, the animal remains expert at Wessex Archaeology, who examined it and determined that the bone looks like the distal end of a cattle (or possibly red deer) tibia from the right-side of the body. The distal end means that this is the end that would have connected with the lower leg bone of the cow. Lorrain said that the age of the bone was unable to be determined from the photograph alone. She also noted that the break appears to represent a bone that has been chopped mid-shaft therefore this could represent the bone of a butchered cow. Unlike human bones, the tibia and fibula are often fused in animals therefore this represents the upper hind leg bone of the cow (http://afs.ca.uky.edu/livestock/beef/skeletal/tibia-fibula accessed June 2019).

The bone looks relatively new and gives the impression that it has not been exposed on the seabed for thousands of years as it is not mineralised. The bone fragment may have entered the marine environment through being washed from terrestrial deposits by rivers or eroded from cliffs or beaches. Alternatively, it could derive from a wreck of a vessel that at the time of travelling, carried cattle on board. A cow may have been killed to be butchered and eaten on board and the bones discarded overboard. Although considered an isolated find, any more bones of this nature should be reported as they could be indicative of a wreck site.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck
- The National Record of the Historic Environment
- The Historic Environment Record for Kent

CEMEX_0925: Animal Bone

This animal bone was discovered in Licence Area 514/1 in the Humber dredging region, approximately 9.5 km east-south-east of Kilnsea, Hull. James Garbutt discovered it next to vessel sand cargo discharge hopper at Jarrow Wharf.

CEMEX_0925 is a small bone measuring 80 mm long and 25 mm at its widest, flat end end while the other, tapered end appears to be broken.

The images of the find were sent to Lorrain Higbee, the animal remains expert at Wessex Archaeology, who examined it and determined that the bone looks a like rib fragment. She said that judging by the size of it, it probably belongs to a sheep. There are 13 pairs of ribs but the occurrence of 14 pair is common. The 13th rib is often floating. 14th rib when present is also floating. On the other hand, the structure of the ribcage is more variable in lamb carcasses. Carcasses have been found with as few as 12 ribs on one side and left and right sides of the ribcage may differ in their number of ribs. In lambs, rib length is determined mainly by age while the plane of nutrition determines rib thickness.

The bone looks relatively new and gives the impression that it has not been exposed on the seabed for thousands of years as it is not mineralised. The bone fragment may have entered the marine environment through being washed from terrestrial deposits by rivers or eroded from cliffs or beaches. Alternatively, it could derive from a wreck of a vessel that at the time of travelling, carried sheep on board. A sheep may have been killed to be butchered and eaten on board and the bones discarded overboard. The wharf also pointed out that it may have been possible that the bone was carried in by local gulls.

This is the first find to ever be reported from Jarrow wharf following a wharf visit in the summer of 2019 and we would like to thank everyone there for the high-quality images, the use of a photo scale card and for the level of detail on the recording form.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The National Record of the Historic Environment
- The Historic Environment Record for East Riding of Yorkshire

Hanson_0926: Collection of Flints

This collection of flints was discovered in Licence Area 240 in the East Coast dredging region, approximately 10 km east of Great Yarmouth. Aaron Chidgey and Troy Potter discovered them at Dagenham Wharf.

Five flints were reported as a possible handaxes by the wharf due to the teardrop shape of three of them and seemingly worked marks on all of them. The largest flint measured 100 mm long by 60 mm while the smallest 80 mm long by 60 mm.

Images of the finds were sent to our in-house flint specialist Matt Leivers. After looking at the photographs, he determined that all the flint was unworked and was natural.

During the Prehistoric period, large pieces of flint referred to as cores were selected to be made into flint tools. The cores were struck or knapped in to shape using other pieces of flint and stone. As the tool become smaller, the shape could be refined, and the edges made sharp so that it could be used to hunt and butcher meat. Flint tools made in this way range in size and include arrowheads, scrapers, knives, microliths and axes. Flint also comes in various colours light or dark brown, grey or black.

All of these were dredged from Licence Area 240 which is known for producing flint artefacts. In 2007/2008, a range of Palaeolithic artefacts were discovered from Area 240, including handaxes, flakes and cores, and the remains of multiple species of large fauna. Due to these finds, The Paleo-Yare Catchment Assessment Project was created to map the extent the Palaeo-Yare deposit and to hypothesize the archaeological potential thought to be of national and international significance.

Although these examples turned out to be natural, we thank the wharf for their vigilance and for reporting them, especially given the history of Licence Area 240. Flint can be of great importance to our understanding of the past occupation of the area which we now know as the North Sea.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The National Record of the Historic Environment
- The Historic Environment Record for Norfolk

Hanson_0927: Bone and Teeth

Two pieces of animal bones and one tooth were discovered in Licence Area 240 in the East Coast dredging region, approximately 10 km east of Great Yarmouth. Aaron Chidgey and Troy Potter discovered them at Dagenham Wharf.

Hanson_0927 is comprised of two small pieces of bone measuring 110 mm by 30 mm and 110 mm by 70 mm and a mammoth tooth, measuring 200 mm by 90 mm.

Images of the find were sent to in-house specialist Lorrain Higbee and Professor Adrian Lister at the Natural History Museum for further identification. Lorrain said that the larger piece was unidentifiable however the smaller piece of animal bone resembled a cattle-sized rib fragment. It was not uncommon for vessels to carry live animals on board during the 18th century. A cow may have been killed to be butchered and eaten on board and the bones discarded overboard.

Professor Adrian Lister did not identify the two smaller pieces of bone, however, he concluded that the tooth is a single lamella (enamel plate) of an upper molar of probably a woolly mammoth.

Mammuthus primigenius or woolly mammoth were in existence in Europe during the late Middle and Late Pleistocene, dating from 350,000 to 10,000 thousand years ago (Lister and Sher 2001). European mammoths have conventionally been divided into three species: the Early Pleistocene *Mammuthus meridionalis* (2.6 to 0.7 million years ago), the early Middle Pleistocene *Mammuthus trogontherii* (0.7 to 0.5 million years ago), and the woolly mammoth, *Mammuthus primigenius* (Lister and Sher 2001) which disappeared from Britain around 14,000 years ago (http://news.bbc.co.uk/1/hi/sci/tech/8106090.stm accessed 24/09/19). Important changes can be seen in the teeth of the mammoths as each species evolves; there is an increase in the number of enamel bands (plates) in the molars, and thinning of the enamel. The dental changes resulted in increased resistance to abrasion, which is believed to indicate a shift from woodland browsing to grazing in open grassy habitats of the Pleistocene.

The remains of animal bones and teeth may end up in marine contexts having been washed from terrestrial deposits by rivers or eroded from cliffs or beaches. Alternatively, they may date to a time when the seabed was dry land. During the last 2.5 million years, there have been numerous cold periods, called 'glacials', separated by warmer periods called 'interglacials'. During colder periods, large ice sheets covered much of Britain and most of the North-west European Peninsula (http://ets.wessexarch.co.uk/recs/humber/archaeology/ accessed 24/09/19). At these times sea levels were low and large expanses of land, now forming the seabed of the North Sea and the English Channel, were available to humans and animals.

References

Lister, A. M and Sher, A. V., 2001. The Origin and Evolution of the Woolly Mammoth. *Science* (volume 294).

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The National Record of the Historic Environment
- The Historic Environment Record for Norfolk

Hanson_0928: Engine Valve

This engine valve was discovered in Licence Area 240 in the East Coast dredging region, approximately 10 km east of Great Yarmouth. Aaron Chidgey and Troy Potter discovered it at Dagenham Wharf.

Hanson_0928 is a long cylindrical object measuring approximately 250 mm in length while the diameter of the round base measures 70 mm. It was reported by the wharf as a possible engine part.

The object was identified in-house by members of the Implementation Team as being an engine valve. Images of the valve were sent to an external aircraft specialist, Steve Vizard in order to discount the possibility that this was related to an aircraft engine. He said that this object was too big to have originated from an aero engine so it would suggest that it has come from a marine/ships engine.

Anthony Mansfield, a Senior Naval Engineer confirmed this is a valve stem from a diesel engine. He said it most likely belongs to the one megawatt region, maybe higher, of diesel engine capacity judging by the size. The valve sits in the cylinder head of an internal-combustion engine and opens at the right time in the cycle to allow the fuel-air mixture to be drawn into the cylinder. Engine valves perform in an environment of intensely harsh conditions where it is subjected to severe vibration, high temperatures, and destructive friction. In order to withstand these conditions for years, it must be made from high-quality materials. Due to the ware on this particular example, it may have come to the end of its life cycle.

Anthony said the valve could could be any age from the 1950s through to present day. He said it was likely deliberately discarded at sea as it was worn out, however it doesn't appear to have been underwater very long. Though considered an isolated find, further finds of this type should be reported, as they may be indicative of an unrecorded modern wreck site or related debris field.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 210/19)
- The National Record of the Historic Environment
- The Historic Environment Record for Norfolk

Hanson_0929: Vertebra

This vertebra was discovered in Licence Area 240 in the East Coast dredging region, approximately 10 km east of Great Yarmouth. Malcolm discovered it on board *Arco Beck.*

The vertebra is largely intact and measures 240 mm by 220 mm. Only the protruding transverse process are missing either side of the vertebral body.

Images of the find were initially sent to in-house specialist, Lorrain Higbee. She said that it is a cetacea axis vertebra and that given the size, suggests it belonged to small whale rather than a dolphin or porpoise. She suggested contacting Richard Sabin at the Natural History museum for a more accurate species ID.

Images were sent to Richard who said this may be the axis vertebra of a mammoth, not a cetacean. He suggested contacting mammoth expert, Dr Adrian Lister at the Natural History museum to confirm this. Dr Lister viewed the photos and concluded that this is certainly the second neck vertebra (axis vertebra) of an elephant. Without detailed comparisons, he could not say what species it is, but its size is consistent with woolly mammoth and as it was found in the same deposit as a woolly mammoth tooth (Hanson_0927), that is a probable ID. *Mammuthus primigenius* or woolly mammoth were in existence in Europe during the late Middle and Late Pleistocene, dating from 350,000 to 10,000 thousand years ago (Lister and Sher 2001).

The remains of animal bones may end up in marine contexts having been washed from terrestrial deposits by rivers or eroded from cliffs or beaches. Alternatively, they may date to a time when the seabed was dry land. During the last 2.5 million years, there have been numerous cold periods, called ‘glacials’, where large ice sheets covered much of Britain and most of the North-west European Peninsula. At these times sea levels were low and large expanses of land, now forming the seabed of the North Sea and the English Channel, were available to humans and animals.

References

Lister, A. M and Sher, A. V., 2001. The Origin and Evolution of the Woolly Mammoth. *Science* (volume 294).

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The National Record of the Historic Environment
- The Historic Environment Record for Norfolk

CEMEX_0930: Munition

This munition was discovered in Licence Area 407 in the South Coast dredging region, approximately 18 km south-east of the Isle of Wight. Steve Bomber discovered it at Leamouth Wharf. The find was disposed of by the EOD.

This munition measures 330 mm (13 inches) long and has a base diameter of 89 mm (3.5 inches). The projectile was heavily corroded at base; however, the wharf identified that a base plug was still present at the time of discovery. The band was still visible on the munition and was grooved, indicating that it had been previously fired.

Images of the object were sent to Trevor Parker, from the Ordnance Society who said that his best guess is that it's a 3.7-inch practice, or possibly armour piercing, shell from the 3.7-inch anti-aircraft gun. He also said that while the measurement given by the wharf was 3.5-inch, the corrosion that occurred on the seabed could have reduced the diameter and the measurement may not be an accurate representation.

Trevor said that the driving band is a good guide and that the Thames Forts were armed with 3.7-inch anti-aircraft guns as well as the batteries on the South coast in particular. Given that this munition was found south-east of the Isle of Wight, it is more likely that it could have come from a battery.

The Needles Batteries are two military batteries built above the Needles stacks on the Isle of Wight to guard the West end of the Solent, manned during both the World Wars. This facility was also the site of early trials of anti-aircraft guns. In the Second World War, anti-aircraft guns defended the Isle of Wight against air attacks. The guns at the Batteries also fired on German torpedo boats attempting night landings.

Several pieces of ordnance have previously been discovered and reported from around the south coast. This area may be indicative of an area where naval warfare or training took place; either at sea or from the coastal defences nearby.

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The Receiver of Wreck (Droit 212/19)
- The National Record of the Historic Environment
- The Historic Environment Record for the Isle of Wight

Hanson_0931: Tusk

This tusk was discovered in Licence Area 240 in the East Coast dredging region, approximately 10 km east of Great Yarmouth. Aaron Chidgey and Troy Potter discovered it at Dagenham Wharf.

Hanson_0931 was reported as a possible tusk or bone marrow measuring 190 mm by 60 mm. From a side-on view, it is possible to see the curve of the profile indicating that this is a fragment of tusk.

Images of the find were sent to Professor Adrian Lister at the Natural History Museum for further identification. He confirmed that it is part of a tusk, however, from such a small fragment, he said that it is impossible to separate species on gross morphology. Dr Lister noted that as Hanson_0927 and Hanson_0929 were identified as belonging to a mammoth and are from the same licence area as this tusk, then mammoth is likely circumstantially the origin of this find. In the profile of the tusk, Dr Lister said that the criss-cross pattern visible is characteristic of ivory. The angles between these lines can sometimes be used to identify the species. *Mammuthus primigenius* or woolly mammoth were in existence in Europe during the late Middle and Late Pleistocene, dating from 350,000 to 10,000 thousand years ago (Lister and Sher 2001).

As this is the third example of mammoth remains within a week, all found from the same license area, it may be that a whole mammoth skeleton was on the seabed in this area. As the remains are very old, they may date to a time when the seabed was dry land. During the last 2.5 million years, there have been numerous cold periods, called 'glacials', where large ice sheets covered much of Britain and most of the North-west Europe and large expanses of land, now forming the seabed of the North Sea and the English Channel, were available to humans and animals, such as mammoths.

References

Lister, A. M and Sher, A. V., 2001. The Origin and Evolution of the Woolly Mammoth. *Science* (volume 294).

Information about this discovery has been forwarded to:

- Historic England
- BMAPA
- The Crown Estate
- The National Record of the Historic Environment
- The Historic Environment Record for Norfolk

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