

EXPLORE,
PROTECT,
STUDY AND
PROMOTE
HUMANITY'S
SUNKEN
HERITAGE

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FROM SHIP TO SHORE... DRASSM



The *André Malraux*. Photo F. Osada/DRASSM, 2014

FROM DA VINCI TO COUSTEAU AND MALRAUX... THE ORIGINS OF DRASSM

In the collective imagination the words 'shipwreck' and 'treasure' are all but indissociable. But in a case of fact being more extraordinary than fiction, it became clear in the twentieth century that the sunken remains of ships offer a unique window into the past. And yet until recently the historian remained firmly on the land, never venturing into the silent underwater world.

All that changed in 1943 when Jacques-Yves Cousteau and Émile Gagnan developed their self-contained breathing apparatus. Leonardo da Vinci's dream of a *homo aquaticus* exploring the oceans was suddenly a reality. Fascinated by the secrets concealed in the depths, several scientists based in Marseilles created in the 1950s, while working on the Grand Congloué site, a brand new discipline of science: underwater archaeology.

Famous author, modernist and intuitive genius André Malraux, then France's minister for culture, understood the importance of this development. In 1966 he established under the aegis of his ministry the world's first underwater archaeological research department, or DRASSM for short. He immediately gave structure to his visionary instinct when, in 1967, he commissioned the archaeological research vessel *Archéonaute*. Emblematic figure of the profession, the *Archéonaute* served under several generations of underwater archaeologists until 2012 when a new ship, one better suited to the new challenges of the discipline and to the exploration of the deep seas, replaced her. It was only right and fitting that her successor should be named the *André Malraux*.

DRASSM IN 2 MINUTES

- DRASSM (*Département des Recherches Archéologiques Subaquatiques et Sous-Marines*) is **France's underwater archaeological research department responsible, at national level, for the administration and study of submerged cultural heritage.**
- Employs 38 staff, researchers and administrators.
- **Headquartered in Marseilles**, the historic capital of diving and the cradle of underwater archaeology.
- Supervises a vast, international maritime area of **11 million square kilometres: France's exclusive economic zone**, which stretches from the Atlantic to the Pacific and the Indian Ocean to the Mediterranean Sea.
- **Administers and promotes a considerable number of heritage sites** of great typological and chronological diversity, from the Cosquer Cave (28,000 BP) to the wrecks of the Normandy Landings (1944).
- To date, carried out surveys, directed studies and supervised excavations on more than **1,600 underwater archaeological sites** in France, her overseas departments and territories, and a host of other countries (Brunei, Egypt, Gabon, Libya, Madagascar, Malta, Pakistan, the Philippines, the Solomon Islands, the USA and more).
- Occupies a strong position internationally and possesses unrivalled experience in deep-sea diving. DRASSM is the world's oldest administrative department responsible for managing underwater heritage.
- Recognized expertise in assessing and studying sites as varied as shipwrecks, prehistoric settlements, submerged funeral and ritual sites, coastal, river and harbour development projects and flooded caves.
- Contributes regularly to programmes focusing on climate change models, from prehistory to our own times.
- **Provides training for future generations of underwater archaeologists**, a role which has steadily increased in importance as the decades pass.
- Spectacular discoveries such as **the bronze statues of Agde and the bust of Caesar**, located in September 2007 on the bed of the Rhône at Arles, continue to add weight to Salomon Reinach's prescient words of 1928: *'The sea is the largest museum in the world.'*

THE 12 LABOURS OF DRASSM

DRASSM is responsible for the application of France's Heritage Code (Book V, Title II, Chapter 4, Title III, chapter 2 and Title IV, Chapter 4) to ensure the protection, study and promotion of underwater cultural heritage (UCH) in cooperation with the Préfectures Maritimes (naval administration), Directions départementales des territoires et de la mer (coastguard), Douane (customs) and other agencies.

*'Continents separate the world's peoples,
the sea brings them closer.'*

André Malraux

EXPLORE AND EXCAVATE

Surveys and archaeological operations

- **DRASSM** inventories and assesses all discoveries and underwater cultural heritage (UCH) that fall within its remit. From a total of forty-nine shipwrecks inventoried in 1966, the number rose to nearly 6,000 in 2018. There are potentially 20,000 UCH sites along the coasts of Metropolitan France alone...
- **DRASSM** authorizes ground surveys and trial excavations, prepares requests for planned excavations, and monitors archaeological operations in France's maritime zone.
- **DRASSM** directs operations to survey, assess and excavate archaeological sites.
- **DRASSM** occasionally carries out operations overseas at the request of foreign governments in order to audit or excavate sites.

IDENTIFY AND ANALYSE

Assessing and directing research

- **DRASSM** prepares cases for preventive archaeology in France's maritime zone: aggregate dredging, wind farms, coastal development, harbours, dykes, anchorages, fish farms, outfalls, gas pipelines, and so on.
- **DRASSM** is drawing up an inventory known as the *carte archéologique nationale* (national archaeological map) to improve the management of underwater cultural heritage, to ensure its conservation and to better define research priorities.
- **DRASSM** prepares on behalf of France's archaeological research council the scientific assessment of requests for reward submitted by the finders of archaeological artefacts.

TRAIN AND RAISE AWARENESS

Educating archaeologists and partners

- **DRASSM** contributes to the training of archaeologists and divers in the management of archaeological excavations, such as providing site experience, documentary resources, and joint supervision of masters' degrees. Since 2013 the Department supervises in partnership with Aix-Marseilles University a master's degree course in Maritime and Coastal Archaeology (MoMArch: <https://momarch.hypotheses.org>).
- **DRASSM** raises awareness of heritage issues among administrations and public institutions which are involved in managing France's maritime zone.

SHARE AND PROTECT

Disseminating knowledge and resources

- **DRASSM** disseminates information through its *Bilan Scientifique* (annual report), scientific meetings (DRASSM open days, symposiums and more), conferences and numerous exhibitions (*César*, *Le Rhône pour mémoire – Le Mystère Lapérouse – La Mer pour mémoire – Mémoire à la mer – Secrets d'épaves*).
- **DRASSM** manages collections of archaeological artefacts recovered from France's maritime zone and organizes their devolution to museums.
- **DRASSM** curates a reference library on underwater archaeology which comprises excavation reports and archives, photos, videos, and national and international publications.

IDENTIFYING & ANALYSING HERITAGE AT RISK



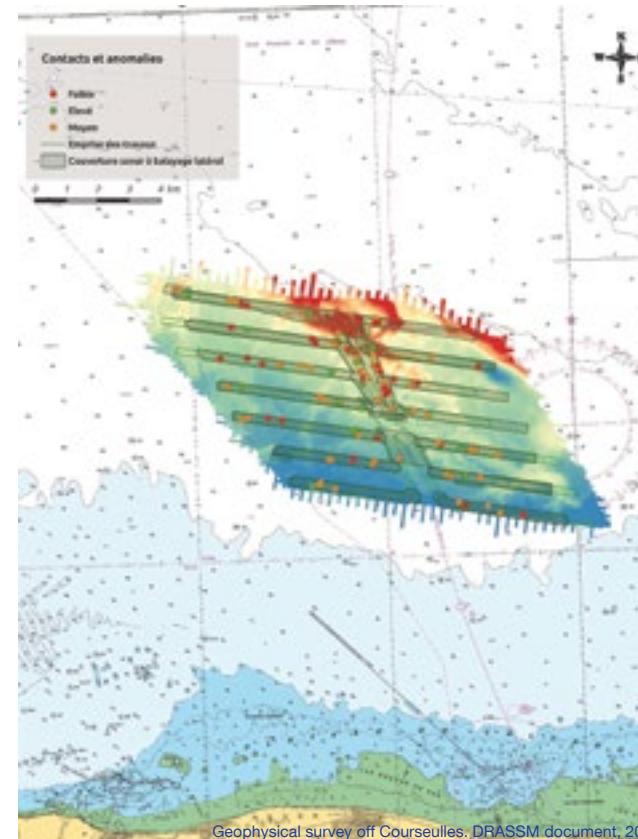
8 Paragan 1 (18th c.) Photo L. Damelet/CNRS-CCJ, 2017

UNDERWATER ARCHAEOLOGY AND CONSERVATION

Strengths and weaknesses of underwater cultural heritage

Nearly 60% of remains recovered from submerged archaeological sites dating from the modern era are made of organic material (wood, vegetable fibres, leather, seeds, and so on). While the humid environment in which they lie since immersion ensures their good conservation, it also profoundly alters their original characteristics.

Consequently, once brought to the surface, such remains are in great danger if they are not immediately returned to an environment which is similar or, preferably, identical to the one that initially ensured their survival. Many other materials, wrongly considered more stable, are subject to this same constraint. For instance, glass, ceramics and metals cannot be stored and allowed to dry without undergoing special conservation treatments. DRASSM has acquired decades of experience and expertise in this area.



Geophysical survey off Courseulles. DRASSM document, 2014



Natière 2 (1749) Photo T. Seguin/DRASSM, 2007

UNDERWATER ARCHAEOLOGY AND RESCUE ARCHAEOLOGY

Great challenges in Metropolitan France

The maritime zone is no less disrupted by human activities than its terrestrial equivalent. In addition to vast port developments to accommodate the extraordinary growth in containerized shipping (an example being Port 2000 in Le Havre), numerous offshore projects linked to renewable energy, such as water and wind turbines (wind farms off Courseulles, Dieppe, Dunkirk, Fos sur Mer, Groix, Gruissan, Leucate, Noirmoutier, Saint Brieuc, Saint Nazaire and others) and the laying of submarine power cables (Aquind, FAB, Gridlink, IFA2, Sud-Gascogne, etc.) all have an impact on the seabed in France's territorial waters.

Construction and civil engineering works also affect the marine environment because they require a constant supply of aggregates. Ashore, natural sources of building sand are facing relative depletion and the opening of new quarries is strictly regulated. As a result, requests for permission to extract aggregates from the seabed are on the increase. Of the hundred or so infrastructure projects DRASSM reviews each year, extraction permits are the most significant in terms of surface area (up to 53 sq. km). Not only that, they are predominantly located in sensitive areas for maritime heritage, such as the mouths of large rivers.

In December 2017 a shake-up of the tax system in France adapted the *redevance d'archéologie préventive* (RAP – preventive archaeology tax) to include coastal areas (*Journal Officiel* dated 29 December, article 79 LFR2017-177; decree No. 2018-537 dated 28 June 2018).

UNDERWATER ARCHAEOLOGY AND MANAGING ENVIRONMENTAL RISKS

The problem of historic wrecks containing dangerous cargoes

In 1978, shocked by the disaster of the *Amoco Cadiz* and the subsequent oil spill, France suddenly became aware of the danger of shipping accidents and their potentially lasting impact on the environment. Surprisingly as it seems, measures put in place subsequent to the crude oil catastrophe still failed to take into account the sad legacy of past wrecks. Indeed, for almost two centuries now fossil fuels have been powering our ships, and the volume of dangerous materials, chemicals and explosives transported by sea has continued to grow, particularly during periods of war. If we add to this worrying observation the significant quantity of fissile and toxic material that has been deliberately abandoned at sea during the twentieth century, and the insatiable appetite of marine corrosion which slowly devours metal hulls and containers, we have no choice but to recognize that there are countless 'time bombs' lying at the bottom of the world's oceans. As a result, since the mid-1980s DRASSM has been compiling accurate databases on all the potentially dangerous anthropic remains that litter the seabed. These databases should, in the long term, help authorities in their efforts to limit the risks.

A dynamic seaboard: coastal erosion and a receding shoreline...

Climate change subsequent to the development of human activities and the increase in greenhouse gas levels have contributed in the last few decades to producing, at a greater frequency, major environmental phenomena, in particular storms whose effects on the coastline are becoming ever more visible. Relentlessly eroded by the power of the waves, the coastline has brutally retreated on some shores to reveal archaeological sites that are, as a result, immediately under threat from destruction. Consequently DRASSM is increasingly mobilized at very short notice to collect data from such sites and ensure the conservation of any remains that may be retrieved from structures that, sadly for archaeology, are destined to disappear.

In 2014 and 2015 powerful storms combined with high spring tides suddenly exposed on the beach known as La Lède du Gurp, next to the town of Grayan et L'Hôpital in the Gironde region of France, wicker fences which were interpreted to be part of a Neolithic brine tank. Removed in a single block in July 2015 and deposited in the municipal workshop of nearby Soulac, the structure was partially excavated in November 2015 before being sent in January 2016 to the ARC-Nucléart laboratory in Grenoble to ensure its conservation.



La Lède du Gurp. Photo N. Prévôt/LaScArBx, 2014



Training excavation off Fos sur Mer. Photo L. Damelet/CNRS-CCJ, 2015

UNDERWATER ARCHAEOLOGY AND TRAINING

DRASSM, founder of an international training centre for underwater archaeology

Recent decades have seen a considerable increase in the pressure that human activities place on all maritime areas and in particular the deepest parts of the oceans, those regions inaccessible to human divers that underwater archaeologists considered in the 1980s to be the ultimate and supremely intact repository of the most fundamental resources of their discipline. However, it must now be recognized that this vision of a protected archaeological Eden has been rendered obsolete under the continuing expansion of deep-sea trawling operations, the laying of intercontinental cables and international pipelines... and, less frequently, the commercial deep-water salvage of hitherto protected historic wrecks such as the *Nuestra Señora de las Mercedes* which was excavated for financial gain in 2007 by the American company Odyssey Marine Exploration.

The situation spurred the archaeological community into action. Alerted by scientists, numerous countries are now demonstrating their desire to see their submerged maritime heritage protected and made accessible to the public. This willingness to act is however hindered by a serious worldwide shortage of specialists capable of applying such high-level decisions on the ground. The need for training is enormous. France, whose pioneering role in the discipline is universally recognized, is constantly called upon to play a significant role. For this reason, in 2003 France's Ministry of Culture tasked DRASSM with looking at the problem and undertaking consultations for the purpose of finding a suitable solution to the discipline's training requirements.

Aix-Marseilles University and DRASSM eventually joined forces in 2013 to establish, organize and structure a Master's of Maritime and Coastal Archaeology (MoMArch). Recognized very quickly for its efficiency, combining classwork with training in the field (excavation of ancient harbour structures off Fos sur Mer, the modern era wrecks of Girolata and Paragan, and others), the training programme was honoured in 2016 with the creation of a UNESCO Chair in Maritime and Coastal Archaeology. In 2015 this MoMArch course joined the UNITWIN Network for Underwater Archaeology.

An underwater photograph showing two divers in blue gear examining a large collection of ancient, reddish-brown pottery vessels on the seabed. The vessels are of various shapes, including amphorae and jars, some with visible openings. The water is clear and blue.

The challenges facing underwater archaeology in the twenty-first-century mean that submerged cultural heritage is becoming increasingly a focus of state intervention at sea, in areas as diverse as maritime safety and security, preventing smuggling, and national sovereignty.

Site reconstruction off Marseilles. Photo F. Bassemayousse, 2010

UNDERWATER ARCHAEOLOGY, TOURISM AND ECONOMIC DEVELOPMENT

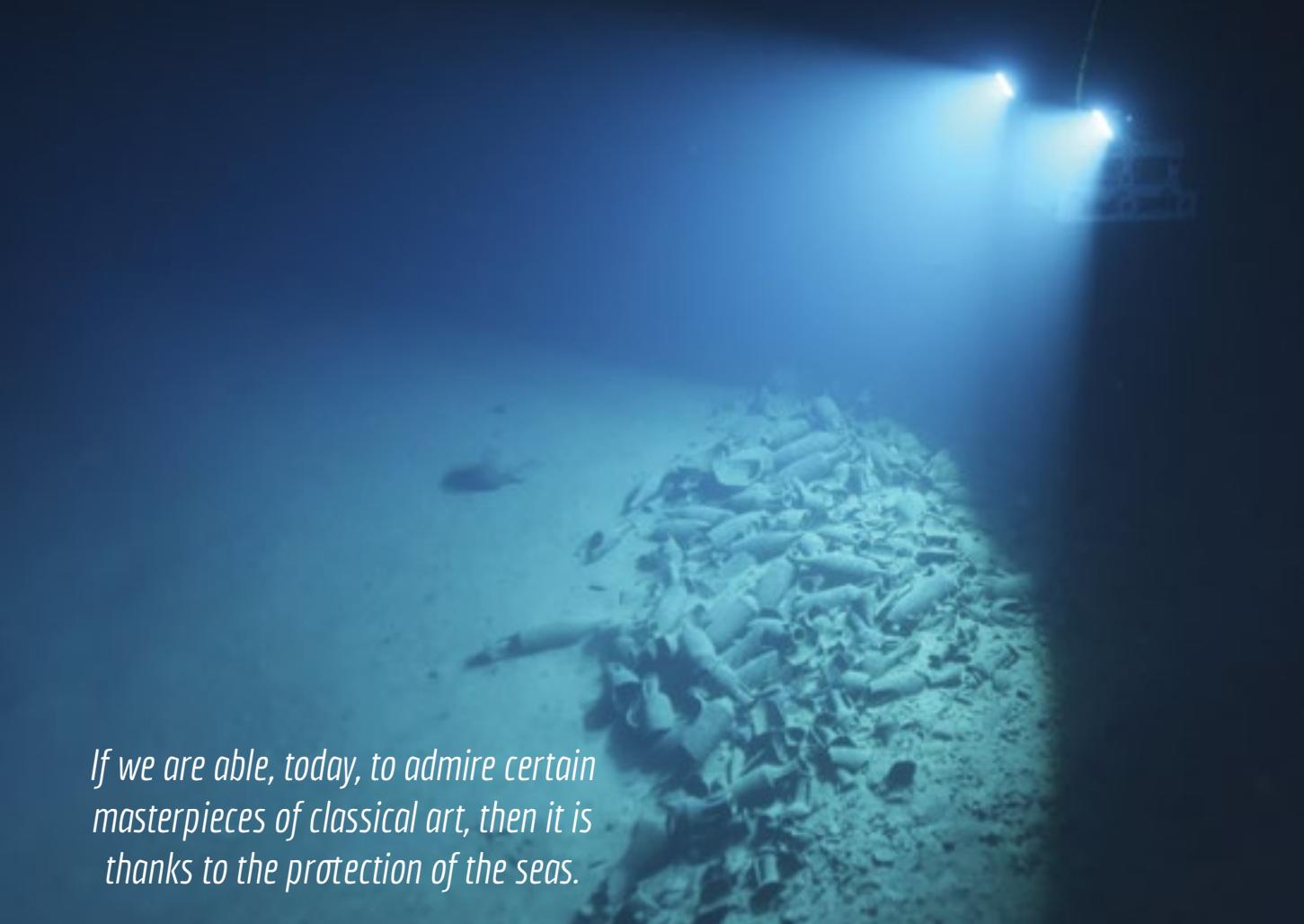
Coastal shipwreck trails: combining tourism and maritime culture

Inspiring the compassion of coastal communities, or in some cases their brutal greed, shipwrecked sailors have long been standard figures in maritime legend while the wrecks themselves have contributed to the construction of many a wooden building along the shore. In this way maritime accidents have played an integral role in the history of France's maritime regions, and DRASSM intends to gradually reintegrate them into the cultural landscape of our shores. Coastal interpretation trails could be established to recount the tales of famous shipwrecks, of maritime routes and the many ships and crews who once sailed them. They could also serve to remind the public of the danger inherent in the coastline. Disseminated via information boards and Web applications, these stories would enable the general public to appreciate the maritime aspect of French culture. They are also a pertinent illustration of the infinite diversity and constant evolution of the world of the sea.

Underwater Trails: diving on real shipwrecks

A recurring but elusive ambition, leisure diving on real shipwrecks *in situ* has become to some extent a hackneyed subject... The difficulties associated with diving, the proliferation of seaweed and the absence of visibility along many stretches of the coast render the task of organizing such trails problematic, to say the least. Nevertheless the idea is a tantalizing one and has garnered much interest from the public. DRASSM has been studying its feasibility for many years. While access to recent wrecks might appear more easily achievable, because they are often more visible above the sediment than mediaeval and ancient ones, it forever depends on the humour of a natural environment which is rarely docile. A pragmatic compromise would be to recreate ancient underwater sites using archaeological material of lesser interest. DRASSM has been pursuing this promising solution since 2010 with the opening of three sites to visitors in the Mediterranean Sea (in the Var and near Marseilles).

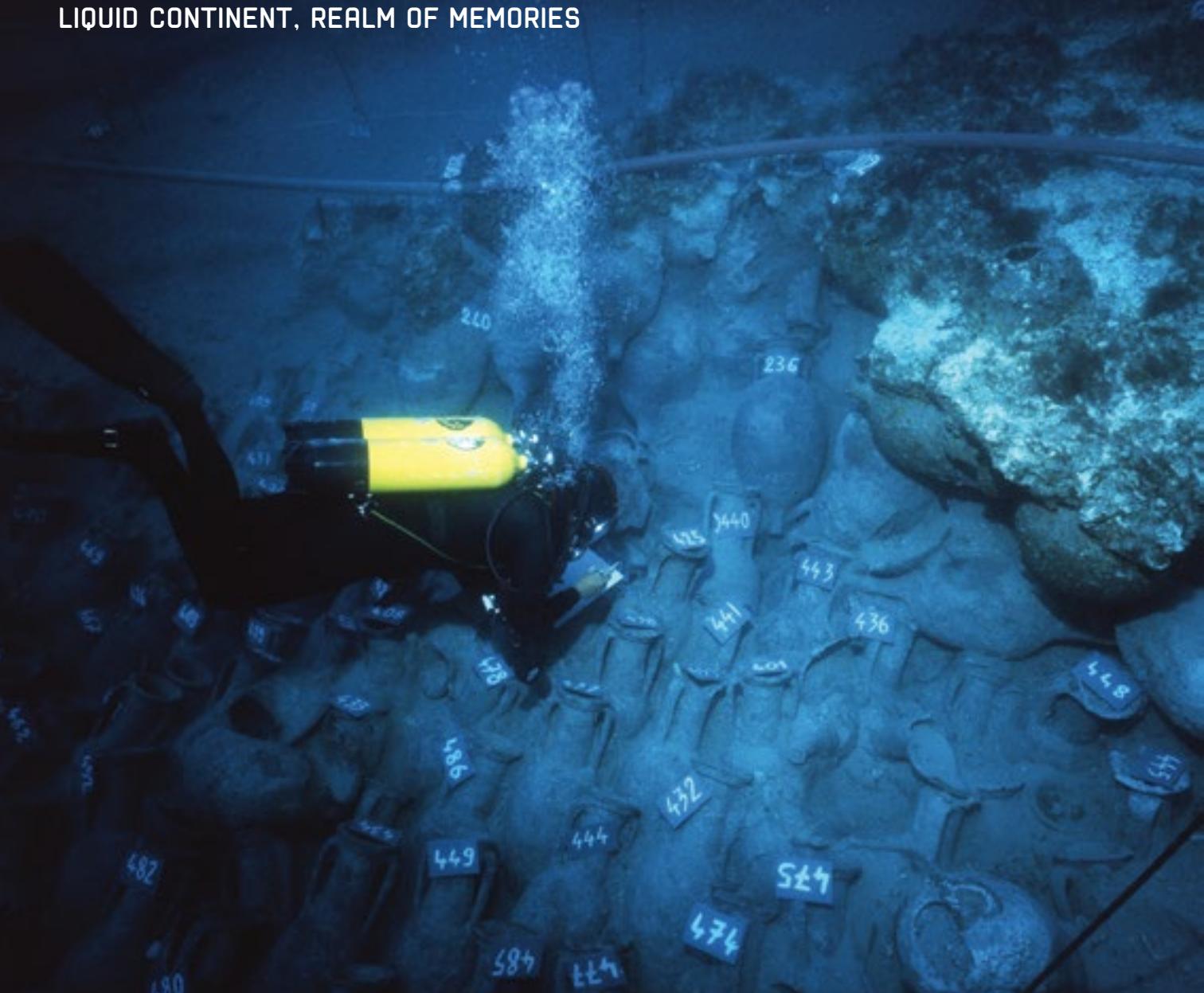
EXPLORING THE SEAS IN SEARCH OF HISTORY

A large underwater photograph showing a diver swimming over a massive pile of ancient pottery vessels on the seabed. The scene is dimly lit, with a bright light source from above creating a strong beam of light that illuminates the diver and the surrounding area. The water is dark blue, and the seabed is covered in a dense layer of pottery.

If we are able, today, to admire certain masterpieces of classical art, then it is thanks to the protection of the seas.

THE MEDITERRANEAN SEA

LIQUID CONTINENT, REALM OF MEMORIES



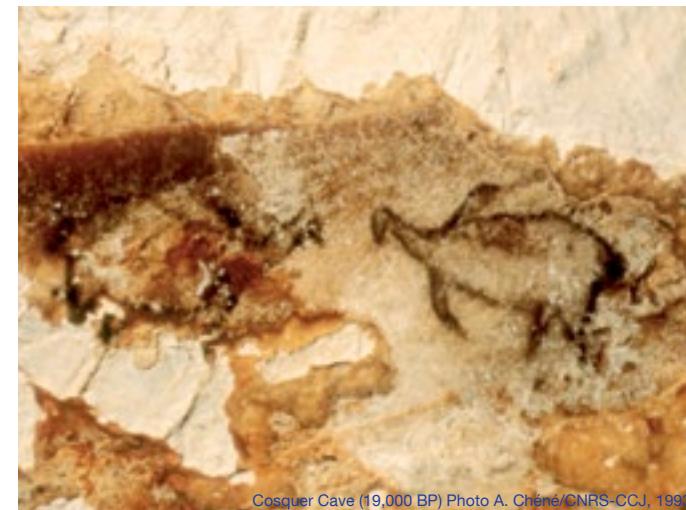
Cosquer Cave, a key example of western Palaeolithic art

Discovered in 1991 in the department of Bouches du Rhône, these cave paintings shed light on a rarely represented period of prehistory in the south of France. Coastal archaeological sites of the Palaeolithic were gradually submerged by rising waters and, today, are nearly 120 metres below sea level. Five hundred painted and engraved images mark the two occupation periods of the cave, around 27,000 and 19,000 years ago. Depictions of marine animals (auks, fish, seals and jellyfish) offer a unique and remarkable insight into the maritime environment of the era.

Coastal settlements during the Bronze Age

Lake and coastal sites in the Languedoc constitute an exceptional potential for multidisciplinary research. Both the region's coastal waters and the lower reaches of its rivers deserve investigation within the scope of a comprehensive collective programme. In addition to the remarkable level of conservation of underwater remains, the last twenty years have been characterized by the innovative contribution of submerged data, in particular chronological elements. The study of settlement sites in humid environments helps us understand how numerous aspects of this cultural group developed. Today, geomorphological research projects are focusing on how to better characterize the context and the dynamic of occupations in the Bronze Age, and to identify the potential of earlier periods.

The Languedoc coast will probably divulge essential data on the interactions with the Eastern Mediterranean and on the sea-going folk who visited the northwestern coasts of the Mediterranean in protohistoric times.



Cosquer Cave (19,000 BP) Photo A. Chéné/CNRS-CCJ, 1993



Royal child, Agde. Photo J.-G. Aubert/Arc'Antique, 2002.

Agde: promising beginnings and recent discoveries

If we are able, today, to admire several masterpieces of classical art, then it is thanks to the protection of the seas. The discovery of *The Youth of Agde* in the river Hérault in 1964 was the first such example to be located in French waters. Thirty-seven years later, excavations on the Languedoc coast have uncovered three beautiful and very finely made works of art: the statues of an Eros and a young boy, and a mosaic picture or *emblemata*.

Roman trade in the depths of the Bonifacio Strait...

Several of the most important Mediterranean trade routes of the classical period crossed paths off the coast of Corsica. Describing a straight line between one of the richest provinces of the Roman world, Spain, and the heart of the Empire, one of these routes carried towards Rome a wide variety of products. Lead and copper ingots loaded into the bottom of the hold accompanied cargoes of agricultural products from the Guadalquivir Valley (olive oil, wine, olives) or perhaps amphorae filled with the miraculous catches of fish in the Strait of Gibraltar.

Protected by the deep waters of the Bonifacio Strait where it foundered, like so many others, the Sud Lavezzi 2 wreck apparently carried the cargo of a single charterer, judging by the epigraphs on its ingots. On the other hand, the Sud Perduto 2 wreck is undoubtedly an example of joint chartering. The numerous wrecks littering the treacherous reefs of the Lavezzi and Maddalena archipelagoes demonstrate the spectacular dangers of an area that remains perilous for sailors even today.

New wrecks loaded with marble

Today a shimmering landmark for pleasure boaters, the Carrare quarries produced—during the entire period of the Roman Empire—architectural marble for the most prestigious buildings of the western Roman world's provincial capitals. While the Saint Tropez wreck and its cargo of marble are recognized as one of the pioneering sites where, in 1951, developed the discipline of underwater archaeological research, it was to be almost forty years before the discovery of another wreck of its type was made. The first was in the waters off South Corsica and later five others, off the Camargue. In Corsica the Porto Nuovo site produced some exceptional and rather unusual clues as to the identity of the vessel's passengers, in particular a wide variety of tools belonging to two stonemasons of Eastern origin and the weapon of a military officer who must have served as an official escort.



Ouest-Giraglia 2 (AD 1) Photo T. Seguin/DRASSM, 2011

Dolia wrecks: the Roman world in search of technico-economic efficiency

The discovery of ships carrying *dolia* was a revelation for archaeologists and the historians studying classical economics. Designed to remain in place in the ship's hold, these large jars had a maximum capacity of 3,000 litres. Their presence indicates an obvious concern for profitability and efficient technology (speed of handling in port, optimal ratio of content weight to container volume) in a Roman sector perceived as generally lacking in innovation. These classical wine carriers operated in the wholesale wine trade, transporting their bulk cargoes to the main centres of consumption, such as Rome and, perhaps, the Germanic limes.



Porto Nuovo (AD 1) Photo J. Chiapetti, 1994



Jeanne-Elisabeth (1755) Photo P. Grandjean/DRASSM, 2011

Investigating the *Jeanne-Elisabeth* (1755), a remarkable vestige of an already globalized economy

The Swedish merchant ship *Jeanne-Elisabeth* sank in a storm on 14 November 1755 off the coast of the Hérault in the Mediterranean, near Maguelonne Abbey. This 200-ton snow sailed from Cadiz for Marseilles with, hidden in a cargo of wheat, 24,360 silver *piastres* from Latin America. This trade in silver dollars involved Geneva bankers, a ship charterer from Marseilles and an intermediary from Saint Malo based in Cadiz. Costly colonial products also featured in the cargo (gum, tobacco, cochineal and indigo). Following its discovery the wreck was subjected to dreadful looting. A patient investigation by DRASSM and French Customs succeeded in mitigating the losses and in 2015 the court of Montpellier meted out heavy sentences to the perpetrators. The very great number of coins recovered from the wreck constitutes the largest treasure trove dating from the modern era to be discovered in French waters. Given the wealth of available archive material and the exceptional quality of the remains and excavated artefacts, the site of the *Jeanne-Elisabeth* is a reference for students of the naval architecture and material culture of the eighteenth century.



Ouest Embiez 1 (AD 3) Photo C. Durand/CNRS-CCJ, 2002

West Embiez 1: Beneath the waves, the magic of glass and what it reveals

Analyses of the glass recovered from the West Embiez 1 wreck in the Var revealed a remarkable homogeneity in the composition of glass in the classical period. Results strongly suggest the existence of a stable, long-term source of semi-finished products. They also attest to the dependence of glass manufacturers on primary suppliers located along the southern shores of the Mediterranean (the Levantine coast and Egypt). Carrying eighteen tons of transparent raw glass, as well as a cargo of tableware (cups and stemmed wine glasses) and window glass (rectangular and circular), the West Embiez 1 wreck foundered at the beginning of the third century. It represents a unique example of the western trade in the raw materials of glass-making.

NEW RESEARCH PROGRAMMES

From Narbonne to *Fossae Mariana*, great shipping hubs already operating in antiquity...

As early as 2005, DRASSM and several scientific partners began researching Narbonne's port complex and its various lagoon sites. This same research theme was extended to investigate the river port of Arles and its related harbours in the Camargue. Further to the east, as part of the common research programme *Fossae Mariana* launched in 2016, the now submerged port structures of Fos sur Mer, one of the largest ports in the Mediterranean during the classical period, were also studied.

Complex sites linking land and sea

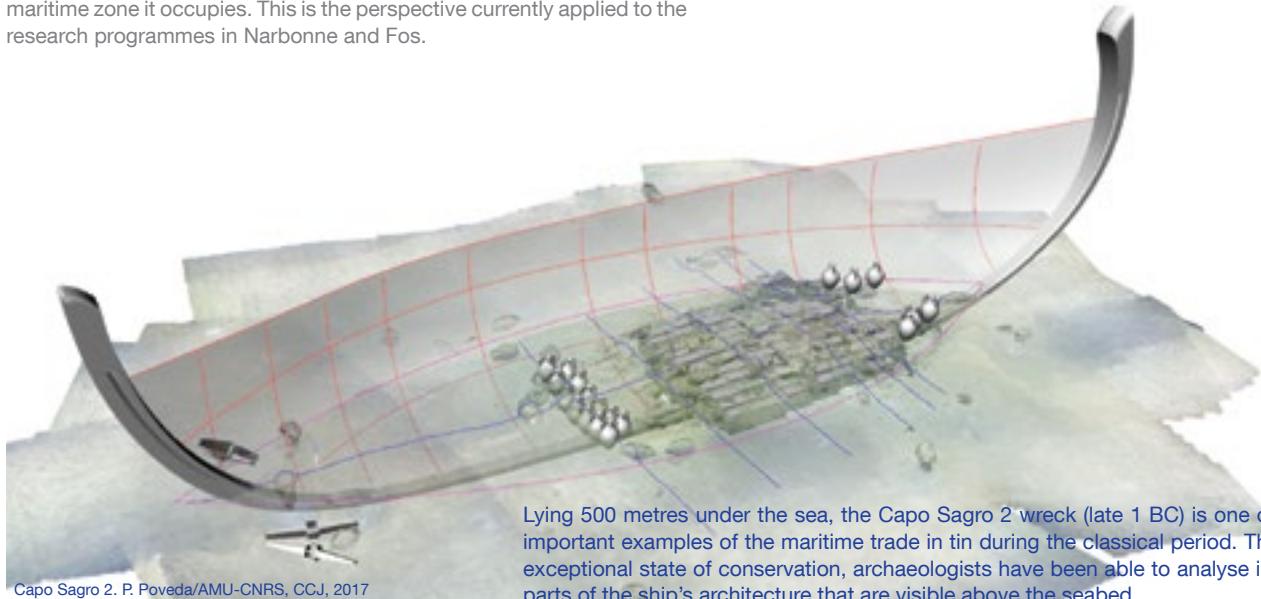
As points of transition and trade, port infrastructures mirror the duality of their condition. These include submerged features at the land-sea interface, such as dykes, piers, docks, quays, lighthouses and wrecks. On land we find warehouses, public and private buildings linked to port business, hangars and shipyards, and so on. Such features do, nevertheless, constitute a coherent whole and must be viewed as such to fully understand them. Especially since the shores of seas and rivers are by their nature subject to numerous natural and anthropic phenomena which modify the landscape over time. Many features which were originally above sea level are now submerged, while many remains that were once underwater are now on dry land. Consequently the archaeologist's approach to ports must be holistic, geo-archaeological and environmental. It must integrate the study of port infrastructures in the widest context of the environment's evolution, from the mobility of its palaeo-shore to the maritime zone it occupies. This is the perspective currently applied to the research programmes in Narbonne and Fos.



Fos sur Mer. Photo L. Damelet/CNRS-CCJ, 2017

A testing ground for the future: deep-water wrecks

Situated several hundred metres below the waves off the east coast of Corsica, a new hunting ground for wrecks has been occupying the attention of DRASSM in recent years. This rich corpus of more than forty ship remains is already helping DRASSM archaeologists develop and refine their expertise at depths beyond those that are accessible to human divers. French archaeology is rising to the challenge of deep-water excavation.



Lying 500 metres under the sea, the Capo Sagro 2 wreck (late 1 BC) is one of the most important examples of the maritime trade in tin during the classical period. Thanks to its exceptional state of conservation, archaeologists have been able to analyse in detail the parts of the ship's architecture that are visible above the seabed.

Capo Sagro 2. P. Poveda/AMU-CNRS, CCJ, 2017



THE WEST

GATEWAY TO THE WORLD

Natière 1 (1704) Photo T. Seguin/DRASSM, 2005



Saint Vaast la Hougue (1692) Photo F. Osada/DRASSM, 1994

In the early 1980s the western and northwestern seaboard of France, where underwater archaeological operations had until then been in their infancy, suddenly began to grow in importance. The discovery and subsequent excavation of the Ploumanac'h wrecks (fourth century) and then those of Aber Wrac'h (early fifteenth century) played a pivotal role in demonstrating the extraordinary potential of the Atlantic and Channel coasts of France which had previously been largely ignored. The excavation from 1990 to 1995 of the wrecks of the Battle of La Hogue (1692), followed by those of Natière 1 (1704) and Natière 2 (1749) from 1996 to 2008, not only confirmed the legitimacy of this new-found interest, it was also the driving force of a thorough renovation and modernization of the discipline of underwater archaeology in France. In addition to encouraging the emergence of a new generation of talented researchers, these excavations provided DRASSM with an opportunity to reorganize, a process which has since turned it into a leader on the international stage.

From archaeology to astrophysics: cargo secrets

The west coast of France is not lacking in ancient shipwrecks, especially in the Channel where the wrecks of Dover and Guernsey offer a British counterpoint to the gold torques of the late Bronze Age discovered off Sotteville sur Mer (Seine Maritime) and the Late Empire wreck located near Ploumanac'h in 1983. The latter site is situated in the Sept Îles archipelago off the north of Brittany and constitutes a rare example of the exportation of lead produced in the fourth century by the Ioeni and the Brigantes, two Celtic tribes of Roman Britain. In addition to the archaeological study of the very many inscription-covered ingots found in the cargo, the Ploumanac'h wreck gave DRASSM the opportunity to place the productions of antiquity at the disposal of today's cutting-edge technology because the equally numerous plain ingots recovered from the wreck were entrusted to the physicists at the CNRS astrophysical laboratory in the Modane Underground Laboratory. This lead, devoid of all residual radioactivity, is today serving fundamental research in its endeavours to isolate dark matter. Another site of the classical period currently being studied, the Bloscon 1 wreck discovered off Roscoff, features a cargo of stamped tin ingots. This archaeological deposit is material proof of the diverse character of the trade in raw materials in the Channel during the classical period. Prior to this discovery, such trade was known to us only through written accounts.



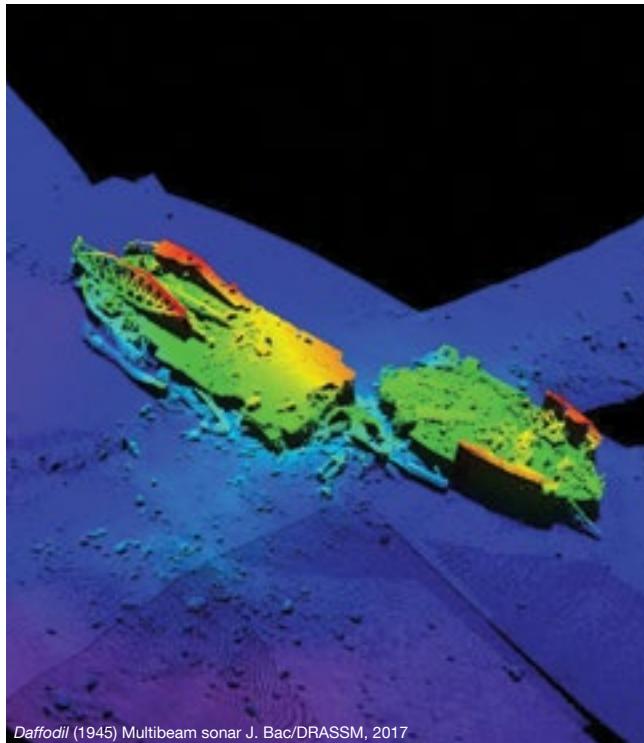
Ploumanac'h (AD 4) Photo Ph. Mura, 1984

Fragile sites of the foreshore

The intertidal zone is particularly at risk in this era of climate change, coastal anthropization and developments designed to facilitate and secure public access to the coast. Foreshore sites exhibit a great variety, for example Mesolithic shell middens (Roch Louet), Bronze and Iron Age pit and wicker features, fish weirs in the north of Brittany, village and necropolis near Urville-Nacqueville, and coins in Donville les Bains. Discovered on Tardinghen Beach (Pas de Calais), the small but exceptional bulwark fragment belonging to a galley of the *Classis Britannica*, the Roman Empire's 'British Fleet', reminds us of the great potential of tidal zone wrecks. It is imperative that we define special methods of investigation to study these remains which are briefly accessible on foot at low tide. Excavations on the Erquy les Hôpitaux wreck revealed some astonishing peculiarities in naval architecture and, since 2012, have enabled DRASSM to devise efficient methods for dealing with similar sites situated on the foreshore.



Sables d'Or les Pins 3 (18th c.) Photo F. Osada/Drassm, 2016



Daffodil (1945) Multibeam sonar J. Bac/DRASSM, 2017

A new field of research: contemporary wrecks

Ignored for many years by professional archaeologists in favour of more ancient sites, contemporary wrecks are now considered a field of research in their own right. Under the threat of corrosion in the medium term, these metal wrecks are currently the subject of several heritage projects to ascertain their level of deterioration, propose solutions for their conservation, and raise greater awareness among the public of their cultural importance.

The study of contemporary wrecks, whether they be built of metal or wood and lie on the seabed or the foreshore, provides precious information on naval architecture, the history of technology, fishing practices, trade networks and even the history of war, such remains contributing to the latter by their quality as sites of remembrance. In the last fifteen years DRASSM has got to grips with the issues relating to their study. A good example of this is the research undertaken on the Erquy coasters, the battleship *Danton*, the remains of the Normandy Landings, and the inventory of the submarine sites around Saint Pierre and Miquelon.



Sherman tank (1944) Photo F. Osada/DRASSM, 2018

Operation D-Day Mapping Expedition

In the morning of 6 June 1944 the largest armada in the history of the world ranged itself along the Normandy coast: 300,000 men and 6,939 ships. By sundown on D-Day more than 20,000 men had perished. The waters of Seine Bay still contain the vestiges of some 150 wrecks dating from this event. The material remains of warships, landing barges, amphibious tanks and the two artificial harbours constitute a unique corpus of sites associated with a specific historic event. Their diversity attests to the variety of equipment deployed by the Allies in the course of the most gigantic landing operation in history.

Since 1994, DRASSM has supported several projects—both by French and overseas teams—to inventory the remains of the Normandy Landings, and in recent years has taken direct responsibility for the task. Using a combination of electronic detection (multibeam sonar), survey dives and archive research, DRASSM is aiming to safeguard through study these remains whose deterioration is accelerating. This research complements the project launched in 2008 by Normandy Regional Council to add the World War II landing beaches to the list of world heritage. It also illustrates archaeology's recent and growing interest in the remains of contemporary wars.



OVERSEAS

THE SEA AT THE HEART OF FRANCE

Often even the French themselves don't realize that their home country possesses the second-largest maritime area in the world (the USA comes first and Australia, third), totalling eleven million square kilometres spread across every ocean. Consequently, 95% of the waters that fall within DRASSM's remit are in overseas departments and territories. For many years archaeologists ignored these faraway territories for the simple reason that a vast number of wrecks in Metropolitan France required their attention. However since the early 2000s they have been the subject of systematic research. Initially concentrating on establishing an inventory, DRASSM is now starting to plan systematic excavations.

Featuring a wide variety of cultures and coasts, these overseas territories are mostly islands and give rise to a very diverse heritage. The primary consideration of archaeologists is to ascertain the evolution of their coastlines, the latter being rarely static over the centuries.

The Scattered Islands: a rich potential for underwater archaeology

Towards the end of the 1980s, DRASSM began taking an interest in the territories that France owns in the Mozambique Channel and the area under Mahoran influence (the Bassas da India mission in 1987 and the exhibition *L'Homme et la mer, le passé retrouvé : l'archéologie sous-marine dans l'Océan Indien* held in Saint Denis, Réunion, in 1992). This interest resulted in archaeological teams taking part in the *Épaves* 2009 and *Épaves* 2011 campaigns organized by the authorities of the French Southern and Antarctic Lands (TAAF). These operations aboard the *Marion Dufresne* enabled the systematic survey of the coral flats and fringe reefs of the French islands in the Mozambique Channel, as well as Tromelin Island. Thirty-eight sites dating from the modern and contemporary periods were identified.

TAAF's committee for historic heritage and toponymy regularly calls on DRASSM to provide expert opinion.



Sussex (1738), Bassas da India, Photo M. L'Hour/DRASSM, 2011



Saint Pierre and Miquelon, Photo M. L'Hour/DRASSM, 2016

Investigating Guyana's inland waters

The dense network of rivers and streams criss-crossing the Guyanese landscape makes it prime territory for fluvial archaeology. Traces of Amerindian occupations along the riverbanks (polishing stones for axes, engraved rocks) are mirrored in the ceramics and wooden and stone tools found in the water. The study of these sites is in its infancy.

Recent surveys have underscored the strong ties binding the large agricultural properties, the 'dwellings', and the network of waterways which constituted the only practical means of communication in this tropical and tree-covered habitat during the colonial period. In 2009, DRASSM assessed the heritage potential of Guyana's inland waters. In 2013 and 2018, the Department worked with Amsterdam University in an effort to locate the remains of the slave ship *Leusden* which foundered in 1738 at the mouth of the Maroni River on a passage to Paramaribo.

Saint Pierre and Miquelon, an exceptional French archipelago in North America

In September 2016, DRASSM completed an initial mission to ascertain the pertinence of undertaking a systematic inventory of the maritime cultural heritage, including wrecks and harbour structures, present on the coast or in the surrounding waters of the Saint Pierre and Miquelon archipelago. A thorough exploration of the territory in 2017 provided an opportunity to meet divers in the archipelago and to establish a preliminary list of sites known to the locals. The task of making an archaeological map of the area began in 2018 and, progressing in instalments, will take several years to complete. Work will also be undertaken to compare existing archives to the data collected for the map. An initial map featuring 213 archaeological items has already been drafted from information contained in shipwreck archives and wreck maps published in works of varying precision. At the same time DRASSM has commissioned a methodical examination of France's national archives and other available documentary sources, in particular archaeological reports relating to missions undertaken in Saint Pierre and Miquelon in the early 1980s. Iconographic collections have not been forgotten and will undergo similar treatment. Coastal sites on the foreshore, predominantly wrecks and harbour structures, will also be targeted in this thorough archaeological mapmaking campaign.



Anémone (1824) Photo C. Michaud, 2017

Archaeological heritage predating the European colonial presence

Prior to the European colonial phase the palaeo-eskimos of Saint Pierre and Miquelon, the Amerindians of the Caribbean and the Mahorans of Mayotte all occupied a zone between land and sea which is today hidden from view and perhaps even submerged.

From the Caribbean to the Indian Ocean, coastal settlements and funeral sites offer huge potential for pioneering research. They give access to materials that have rarely been studied, and in a context where archaeology meets environmental research.

Archaeology in France's faraway maritime zones: linking territories

The influence of the sea in these territories is omnipresent. In recent years the systematic investigation of coastlines from Guadeloupe to Reunion Island has given rise to an inventory of moorings, jetties, landing stages and other structures designed for receiving shipping. Such work highlights the importance of these locations and infrastructures in their essential role as antechamber and gateway to the oceans.

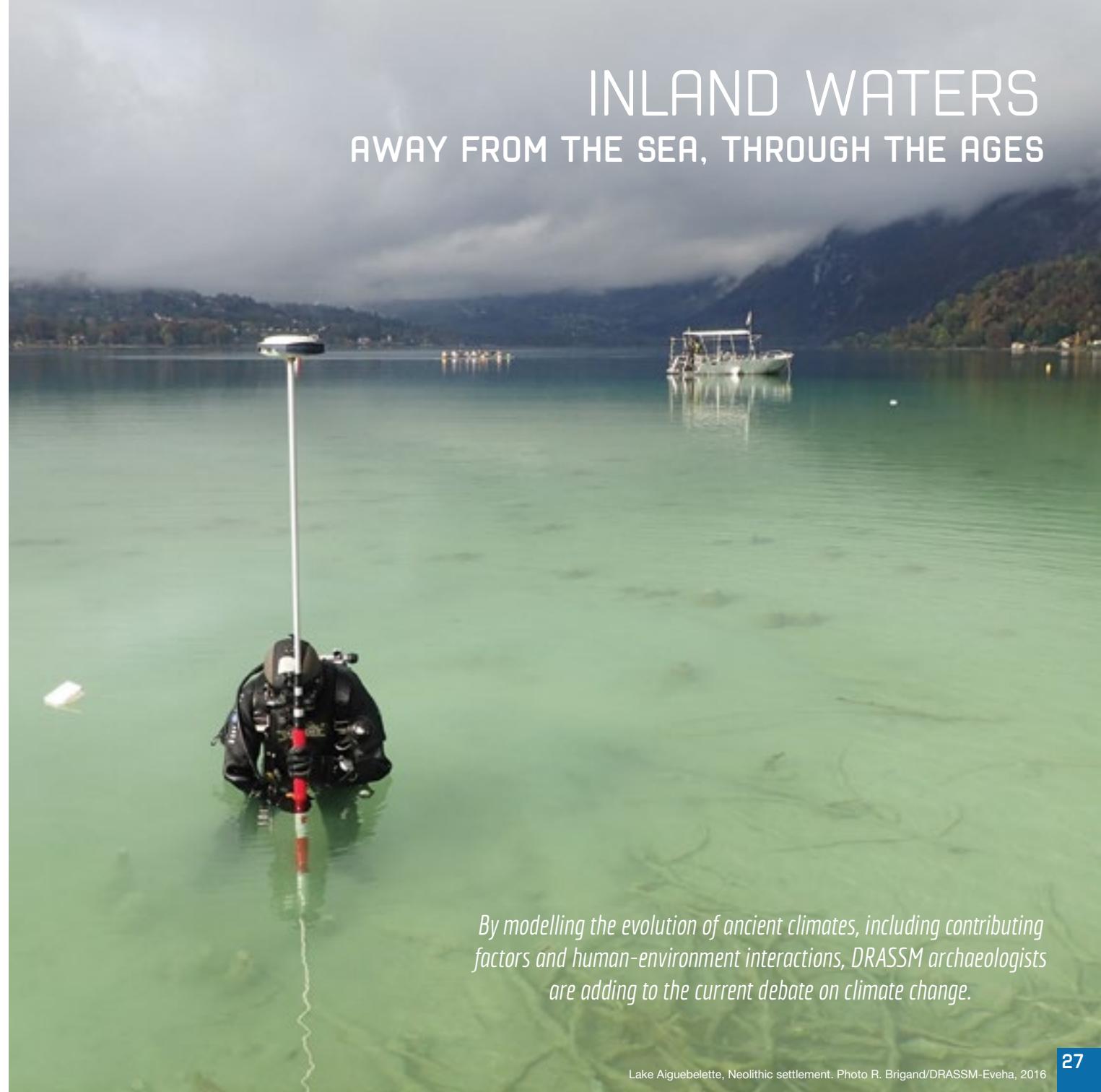
Shipwrecks which are mentioned in archives, and which academic investigation endeavours to estimate the number, constitute an avenue of research that has for many years been ignored. Excavations of wrecks such as the *Anémone*, a schooner of the French Royal Navy assigned to Guadeloupe Customs which foundered in 1824 in the Bay of Les Saintes, give archaeologists the opportunity to view the history of societies through the prism of maritime trade or wars and to assess their influence on the evolution of overseas communities.

From Aubagne to Doban*, the ceramics trade in Martinique

Situated in Saint Pierre Bay, the site designated *ponton de la quincaillerie Gouyer* (Gouyer chandlery pontoon) might bear some relation to the wreck of a merchant schooner sunk at the time of the Mount Pelée eruption in 1902. The volcano discharged a cloud of ash over Martinique, burying the town of Saint Pierre and causing 30,000 deaths. Saint Pierre, the 'pearl' of the French West Indies and the island's capital, attracted merchant ships from ports across Metropolitan France, in particular from Provence. Indeed, ceramics from Provence were the artefacts most frequently encountered during the Gouyer pontoon excavation: earthenware stewpans and saucepans from Vallauris, tian dishes from Saint Zacharie, jars from Biot and ceramics from Aubagne. The 2010 survey of the site took place within the context of interregional research into locally produced and imported pottery found in the French islands of the Americas. Involved in the project were DRASSM, Martinique's Regional Department for Culture (DRAC), CNRS research unit LA3M and the non-profit organization Arkaeos.

*A local corruption of *d'Aubagne*.

INLAND WATERS AWAY FROM THE SEA, THROUGH THE AGES



By modelling the evolution of ancient climates, including contributing factors and human-environment interactions, DRASSM archaeologists are adding to the current debate on climate change.

Rivers, bridges, fords and fisheries... an avenue for multidisciplinary research

Throughout the ages rivers and streams have been used for irrigating fields, fishing, communications and generating energy. Such variety offers the archaeologist a multitude of research subjects. Today their study is not limited to the watercourse itself, but takes into account the wider environment and how it changes over time. This level of understanding requires collaboration between numerous disciplines, for example history and archaeology are called upon to establish a chronological framework. These studies play an integral role in the development of new ways to manage watercourses.



Medieval bridge on the Loire. Photo: A. Dumont/DRASSM

Wrecks and inland waterway transport: resources for naval archaeology

Inland waterways frequently produce remains of small craft. Many dugouts have been discovered. Such craft have been in use since the Mesolithic and up to the Middle Ages. As for inland waterway shipping, wrecks of all types and age have been identified: seventh-century fluvio-maritime freighter in Charente (Port Berteau 2 Wreck), fifteenth-century Loire barge and its cargo of stone blocks and slate in Saint Satur (Cher), fifteenth-century cog in the Canche River at Beutin (Nord-Pas de Calais), seventeenth-century transport barge at Bredannaz in Lake Annecy, and a large nineteenth-century Lake Geneva cargo vessel in Saint Gingolph (Haute Savoie). Above and beyond considerations of economic history in the shipping sector, naval archaeology, which is primarily concerned with the study of ships, sheds light on the history of technology, both in terms of form and development.



Saint-Satur (15th c.) Photo A. Dumont/DRASSM, 2017



Fontaine de Vaucluse. Photo R. Huttler, 2004

A great variety of flooded cavities

Submerged caves and karst springs can produce many types of remains: rock art, for example in the Cosquer Cave, as well as palaeontological and archaeological deposits shaped by the flow of water, lost or deliberately abandoned objects, etc. A particular and very significant use of these geological phenomena involves cultic practices linked to water. DRASSM had to develop special protocols for surveying these very particular sites whose access is often fraught with danger. One DRASSM campaign, on the karst spring of Fontaine de Vaucluse, produced a collection of 1,600 coins from the classical period. These coins provided information on who visited the site and on the practices that developed there between 1 BC and the start of the fifth century.

Ship mills on the river Doubs (Saône et Loire): a long tradition

In order to harness the energy of the river Doubs whatever its depth, local river folk adopted a novel solution: floating mills. Comprising two boats either side of a waterwheel and a wall of wooden piles to guide the flow of water, this type of structure has existed on the Doubs since the twelfth century and as recently as 1923. The excavation of a floating mill which foundered in the seventeenth century in the village of Sermesse produced new information on shipbuilding and the daily life of the miller. The latter would have passed a large part of his life aboard.



Nérée 2 on Lake Geneva. Photo Y. Billaud/DRASSM, 2017

Palafittes of the great Alpine lakes: from inventory to protection

The slow emergence of some exceptional heritage

Identified in the middle of the nineteenth century, the stilted settlements of the great Savoyard lakes are not as well documented as their Swiss counterparts which were discovered in the same period. Lying under several metres of water, they have been subjected to decades of dredging which has been fruitful in material terms but has, unfortunately for archaeologists, produced artefacts that are entirely disconnected from their stratigraphic context. Eventually developments in diving techniques enabled the first *in situ* observations and, with the creation of a specialist archaeological research department, systematic research could at last begin.

Ground surveys and dating operations have provided us with an inventory of these waterside settlements which were established when the water levels of the lakes were lower, from the Middle Neolithic to the end of the Bronze Age, that is to say 3800 to 800 BC. Campaigns to assess the condition of the largest sites on Lake Bourget found them to be in an excellent state of conservation. Fresh data was also collected on the layout of dwellings, the organization of the sites, and their relationship with the wider region.

This work was carried out in tandem with specialists in environmental sciences as part of several programmes of greater scope. By modelling the evolution of the landscape and interactions between humans and their environment, the scientists involved were able to contribute to the current debate on climate change and its impact.

UNESCO recognition and its consequences

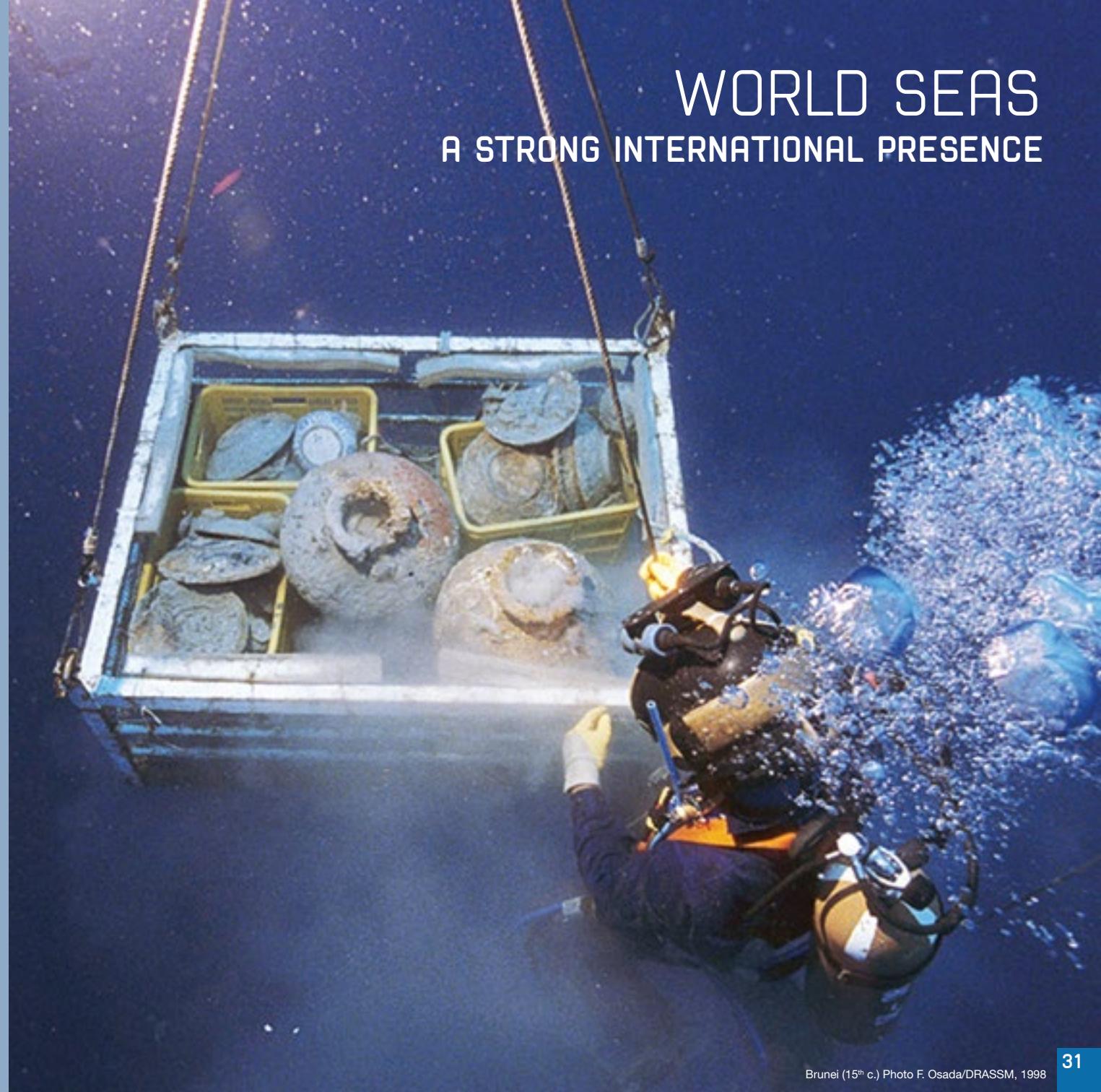
In 2011, UNESCO designated the transnational cultural property that is the series of prehistoric pile dwellings in the Alps as a World Heritage Site. Of the 111 sites listed from six countries, a total of eleven are situated in France. Two of the French lake sites are in the Jura and nine in Savoie. UNESCO recognition shows just how valuable these sites are for our understanding of the first societies of farmers and artisans. But it also means that each country has to provide the necessary means with which to protect, monitor and promote the sites.

The sites in the Savoyard lakes all being submerged, unlike those of the Jura, DRASSM was called upon to develop and implement a monitoring programme. Launched in 2015, this programme involves updating the original and partially abandoned documentary material, as well as organizing diving campaigns. Including the settlements in surrounding sectors, or buffer zones to use UNESCO terminology, DRASSM's new investigations looked at a total of more than forty archaeological deposits. Four successive campaigns were carried out on the lakes of Annecy, Bourget, Aiguebelette and Geneva. In terms of conservation, the situation in France appears to be far less of a concern than in Switzerland. Nevertheless isolated problems will have to be dealt with in the coming years.

By reviewing the existing data and conducting investigations on the ground, archaeologists were able to make significant progress in understanding and interpreting several of the sites. New discoveries such as Middle Neolithic buildings, the general plan of Final Neolithic villages, a Bronze Age fence encircling an island and other Bronze Age buildings will all contribute to future efforts to engage the general public.

Establishing relations with organizations responsible for managing lakeside areas enables DRASSM to participate in concerted and even coordinated actions aimed at protecting France's cultural and natural heritage. This comprehensive approach is undoubtedly one of the benefits of UNESCO recognition. Beyond these promising results, the challenge now facing DRASSM involves maintaining, for the long term, good quality research on the ground.

WORLD SEAS A STRONG INTERNATIONAL PRESENCE



According to UNESCO almost three million shipwrecks lie under the world's seas.



Lake Michigan. Photo M. L'Hour/DRASSM, 2010

USA 1565 Florida: *Trinité* and the failed dream of the Fort Caroline Protestant colony

In the summer of 2018, after long proceedings in the court of Orlando involving the French state and an American company, France's claim of ownership of Jean Ribault's flagship, which foundered in a storm on 10 September 1565 off Cape Canaveral, was upheld. In the name of Charles IX, Admiral Gaspard II de Coligny had chosen Ribault, originally from Dieppe, to lay the foundations of a French colony in what is now Florida. A project to survey and research the Jean Ribault wrecks is close to fruition. It will be a joint endeavour between French and American archaeologists. All the artefacts recovered from the site will be entrusted to an American museum but will remain the property of France. This is normal practice for DRASSM, the department always preferring to place archaeological collections with a museum close to the excavation site.

USA 1686: From Texas to Lake Michigan, on the trail of Cavalier de la Salle

The *barque longue* (long boat) *Belle*, whose remains were discovered in 1995 in Matagorda Bay in the Gulf of Mexico, was part of the 1686 expedition led by Robert Cavalier de la Salle to establish in the name of Louis XIV a colony at the mouth of the Mississippi. Conducted by Texas archaeologists with input on several occasions from DRASSM specialists, the excavation of this site led to the ratification of a Franco-American agreement whereby the authorities in Washington recognized France's ownership of the wreck, it being a state vessel enjoying imprescriptible immunity under the law of the flag. In 2010 the wreck thought to be that of the *Griffon*, a ship built in 1679 by the same Cavalier de la Salle on the shores of the Niagara River and lost soon after in the waters of Lake Michigan, was also surveyed by an American team including DRASSM representatives. A piece of wood provisionally identified as the bowsprit of a ship similar in size to the *Griffon* was brought to the surface. However no artefact was discovered during the survey that proved without doubt that the wreck was indeed the *Griffon*.

Brunei: The Shipwreck Project reveals the splendour of the sultanate in the fifteenth century

Under the direction of DRASSM a team of 140 international specialists from diverse backgrounds excavated in 1997 and 1998 the remains of a junk which foundered off the coast of Borneo in the fifteenth century. The comprehensive excavation produced 4,600 pieces of Ming blue-and-white porcelain, 2,200 jars from China, Thailand and Vietnam, bracelets and glass ingots, several gongs, metal bars and more. This operation and the exhibitions that followed it in France, Asia and Australia were the fruit of an ambitious project involving the Brunei authorities, France's Ministry of Culture and the oil company Elf (now Total).

This unique wreck dating from the close of the fifteenth century illustrates a fabulous period in the history of the sultanate of Brunei when the small kingdom established itself as the centre of maritime commerce in the South China Sea.



Brunei (15th c.) Photo F. Osada/DRASSM, 1998

Asia: French experience at the service of international underwater heritage

In March 2007, DRASSM and Taiwan's archaeology service signed a partnership agreement designed to encourage collaboration between researchers from both countries. This followed an archaeological survey conducted by DRASSM in the harbour of Magong (formerly Makung) in the Formosa Strait, and lectures given by French underwater archaeologists at the National University of Tainan. Since then DRASSM archaeologists have undertaken several missions in Taiwan.

In 2015, DRASSM ratified a cooperation agreement with China's National Centre of Underwater Cultural Heritage (NCUCH). That very same year a large Japanese delegation came to France to study how submerged heritage is organized and managed in the country. Initiated in 2016 by South Korea's National Research Institute of Maritime Cultural Heritage (NRIMCH), exchanges with France led in 2017 to the signing of an agreement between the two countries to cooperate in the field of underwater archaeology. DRASSM specialists and their South-Korean counterparts have been in regular contact ever since. Many other international agreements are in the process of being signed between DRASSM and specialist departments in various countries of the Maghreb and Africa.

Close collaboration with UNESCO

Since 2013, when France ratified UNESCO's 2001 Convention on the Protection of Underwater Cultural Heritage, DRASSM has been actively contributing to the work of its Scientific and Technical Advisory Body. Indeed, DRASSM's director was elected a member of this international group of twelve experts in 2013 for a term of four years. He was re-elected in 2017. Consequently, DRASSM archaeologists regularly collaborate with the United Nations Educational, Scientific and Cultural Organization in works relating to underwater heritage (audits, advice, surveys) at the behest of countries that have ratified the 2001 Convention. For example, UNESCO called upon DRASSM in 2015 to conduct the survey of underwater archaeological sites around St Mary's Island (Madagascar). DRASSM archaeologists also participated in works on the Nessebar site in Bulgaria in 2017.

Gabon: *Mauritius*, a relic of the conquest of Asia by Dutch merchants

Excavated by DRASSM, the wreck of this large merchant vessel was discovered in 1985 during bathymetric surveys requested by the oil company Elf-Gabon. The survey focused on the area around the Cape Lopez tanker terminal near Port Gentil. Built in Europe, loaded in Asia and lost off Africa during its second homeward voyage from the East Indies (1609), the *Mauritius* was carrying a precious cargo of pepper and zinc ingots, as well as some blue-and-white porcelain dating from the period linked to the Wanli Emperor, one of the last of the Ming Dynasty. This wreck is one of the oldest vessels of the VOC, the famous Dutch East India Company, to have been located and excavated. For this reason, it constitutes an important vestige of the early days of a great economic and seafaring adventure which, during almost two centuries, resulted in dynamic Dutch merchants establishing a veritable commercial empire.

Solomon Islands. Vanikoro:
The Lapérouse mystery, investigating in the South Pacific

The great voyage of exploration around the world commissioned by Louis XVI to compete with the scientific expeditions of Englishman James Cook set sail in 1785. Aboard the frigates *Boussole* and *Astrolabe* were some of the most eminent scientists of the time. After three years at sea and a final landfall in Botany Bay, Australia, in early 1788, the expedition mysteriously vanished in the South Pacific. Nothing more was known of its fate until 1827 when Irish mariner Peter Dillon stumbled on the remains of the two vessels on the island of Vanikoro in the southern part of the Santa Cruz archipelago of the Solomon Islands. With DRASSM's support, the ultimate excavations conducted on the Vanikoro site by Salomon, a New Caledonian non-profit organization, finally eliminated the last remaining doubts surrounding the fate of that great maritime adventure which set out from Europe during the Enlightenment. Both vessels were identified and scientific instruments were recovered. It is highly likely that a cyclone in the summer of 1788 blew the *Astrolabe* on to the coral reef encircling Vanikoro, while the *Boussole* was dashed upon the outer fringe of the same reef. In 2008 an exhibition on the excavations, organized in Paris by DRASSM and France's national maritime museum, was seen by more than 200,000 visitors in six months.



Mauritius (1609) Photo P. Enault, 1986



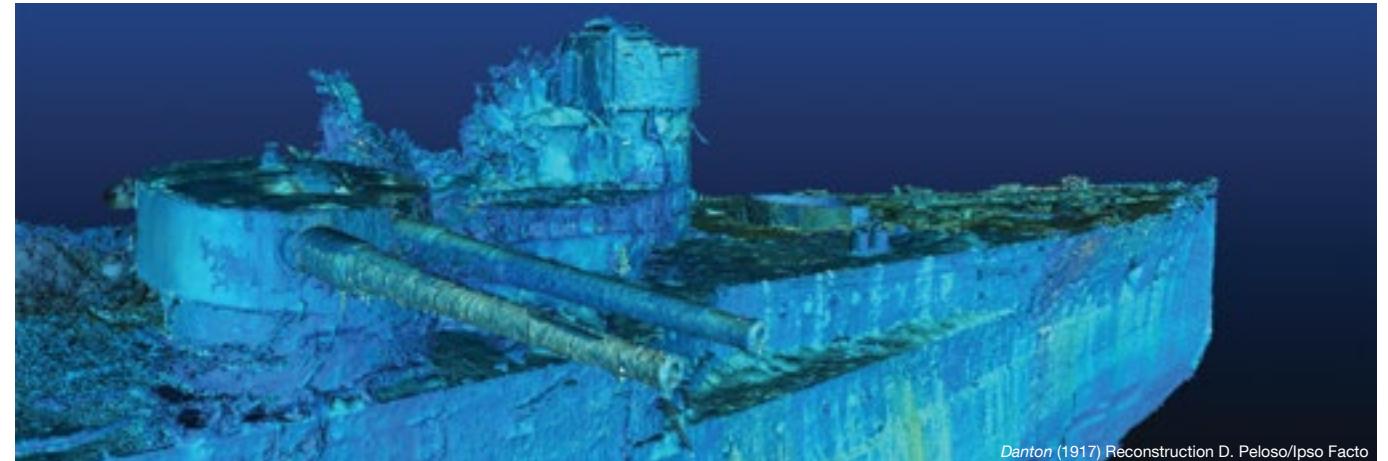
Vanikoro (1788) Photo T. Seguin/DRASSM, 2006



Danton (1917) Photo F. Osada/DRASSM, 2016

Italy: *Danton*, a deep slumber for over 100 years

In 2008 the Galsi company was conducting preliminary surveys for the laying of a gas pipeline between Algeria and Italy when it discovered the wonderfully preserved remains of the French battleship *Danton*, sunk in 1917 off Sardinia in over 1,000 metres of water. The remains of about 300 sailors, including officers and the commander of the battleship, still lie in the wreck. In 2015 and 2016, DRASSM, UNESCO and the Dassault Foundation joined forces to undertake an ambitious project on the wreck. DRASSM designed and developed special image-making equipment to capture a photogrammetric view of the entire wreck, which is 145 metres long, 25 metres wide and 23 metres high. This equipment can be deployed down to a depth of 2,000 metres. The resulting 3D model is the first of its kind for a wreck situated at such great depth.



Danton (1917) Reconstruction D. Peloso/Ipso Facto

SHARING KNOWLEDGE, PROTECTING CULTURAL HERITAGE



DRASSM RESOURCE CENTRE. KNOWLEDGE AND SKILLS AVAILABLE TO ALL

Managing cultural remains: the national archaeological map of France's maritime zone

Developing the national archaeological map is one of DRASSM's primary tasks. The map compiles and organizes, at national level, all the available archaeological data. It is a responsibility of the French state. Its objectives are multiple:

- Digitized national inventory.
- Basis for 'predictive' maps on archaeological heritage.
- Development of research programmes on various levels and themes.
- Integration of measures to protect remains concerning, in particular, the environment.

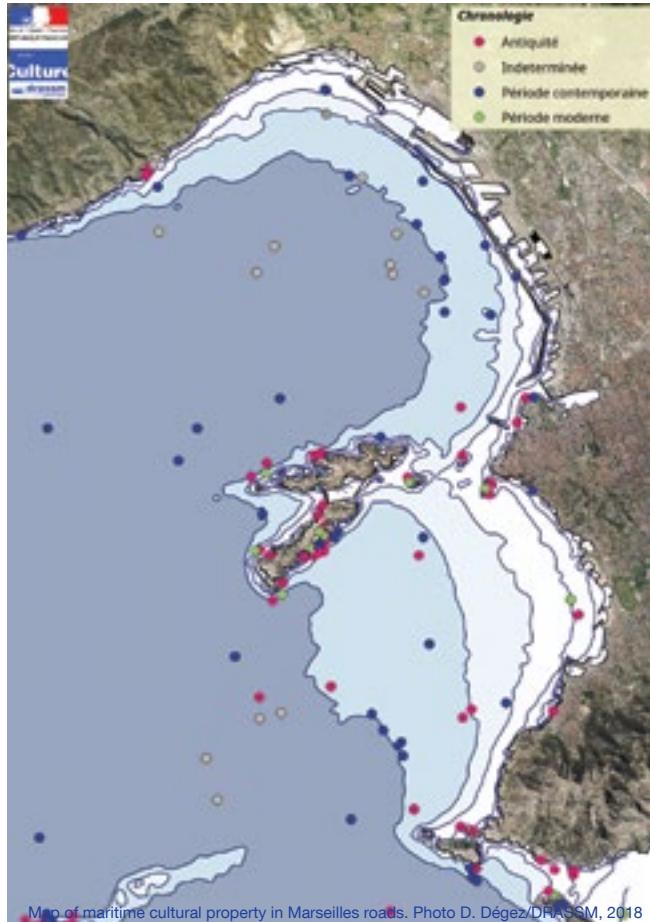
In essence, this digital inventory is a fundamental tool for managing France's maritime zones and an overview of archaeological remains. The national inventory is far from complete and many remains have yet to be discovered. Ongoing archaeological works and data digitization are continuing to expand our knowledge. By processing and displaying the data as a geo-referenced map, the latest information can be used in a variety of ways: research, administration, documentary distribution, land-use planning...



Conservation report. Photo N. Huet/DRASSM, 2016

The Archives Unit: thousands of shipwreck files

DRASSM's archives unit is responsible for centralizing all documents relating to maritime cultural remains lying in France's maritime zone, as well as the remains of French-flagged ships which foundered in foreign or international waters. The unit currently holds thousands of files on wrecks and reported wrecks, and its collection continues to grow thanks to new discoveries and archive research carried out by DRASSM archaeologists or at their request.



Map of maritime cultural property in Marseille's roads. Photo D. Dégez/DRASSM, 2018

Photo library, video library, photo studio: a collection of more than 100,000 documents

Since its founding more than fifty years ago, DRASSM has surveyed, directed the study or overseen the excavation of more than 1,600 underwater archaeological sites in Metropolitan France, its overseas departments and territories and other countries. At the same time, its documentary holdings, which cover not only history but also scientific developments and the major accomplishments of the discipline, are among the largest and most diverse in the world. The information they contain concerns shipwrecks, submerged dwelling sites, flooded decorated caves, silted-up ports, abandoned anchorages and isolated finds, and more. Themes include not only maritime history, but also economic and commercial history, the history of science and technology and the history of daily life from antiquity—and even prehistoric times—up to the present day. Similarly, the collection holds a complete range of artefact types, including amphorae and Norman stoneware, Roman swords and bronze cannon, glass vials and perfume bottles of horn, marble statues and bronze travellers' icons... Finally, the development of excavation techniques is amply illustrated in the collection, from devices such as the earliest underwater airlifts designed by Jacques-Yves Cousteau to multi-passenger submersibles, as well as magnetometers, side-scan sonars and more. The collection has been digitized and is available online from the Ministry of Culture's database *Mémoire*.



Lune (1664) Photo T. Seguin/DRASSM, 2013

The Bernard Liou Library

The Bernard Liou Library contains close to 7,500 works and more than 1,200 offprints. It also holds 201 periodicals including 112 still in publication, and almost 4,500 articles and extracts sourced from periodicals, conference minutes, films, CD-ROMs, exhibition press releases, and so on.

The holdings of this highly specialized library cover the fundamental areas of DRASSM's responsibilities: marine archaeology, archaeology of inland waters, maritime history, history of ship design and construction, ship disasters and their remains, history of diving, amphorae, metallurgy, artillery, preventive conservation... Featuring an extensive working area, the library welcomes researchers, archaeologists and students by appointment.

Since 2013 the library has been contributing to the collective online catalogue Frantiq (Federation and Resources on Antiquity): <https://www.frantiq.fr/fr/bibliotheques/DRAS>.

And lastly, the library has its own Facebook page which opened in 2017 under the name Bibliothèque Bernard Liou.



Le Grand Congloué (2 BC) Coll. DRASSM, 1952

Preventive Conservation Unit: Managing collections, training human excavators

In 2010, DRASSM set up a preventive conservation unit which is now responsible for managing the collections of archaeological artefacts discovered accidentally or during underwater surveys and excavations. The unit is consulted prior to authorizing archaeological operations in order to assess what resources need to be deployed to ensure the conservation of objects and sites. In addition to this vast remit, the unit's specialist personnel are responsible for training human excavators in the recovery and initial conservation of artefacts in the field, and for drafting a manual on preventive conservation in underwater archaeology. This multitasking unit is integral to the emergence of new avenues of research into conservation, whether they involve the preservation of wrecks displayed in museums or modern metal wrecks still in their initial resting place. It fosters strong bonds between the various partners engaged in researching and promoting maritime cultural remains, such as volunteer excavators, professional archaeologists, conservation laboratories, archaeometrists, museum conservators and collections managers.

Eighteen archaeological repositories across France

While the regional archaeological repository in Milles, near Marseilles, is by far DRASSM's largest building for storing underwater cultural heritage, it is not the only one. Seventeen additional repositories are situated across Metropolitan France and its overseas territories. The latter are managed by the Preventive Conservation Unit in cooperation with regional archaeology departments, museums and local government. The archaeological remains held in these repositories are regularly the subject of studies and analyses, and are often selected for temporary exhibitions.



Milles repository. Photo L. Reboul/DRASSM, 2010

More than 200 museums display objects discovered on underwater sites

Another role of the Preventive Conservation Unit is to maintain regular contact with museums which hold underwater cultural heritage. It ensures that proper conservation practices are adhered to, supervises exhibitions and reports on the condition of the deposited artefacts. The unit is also proactive in the lending of culture material for temporary and permanent exhibitions, or when a museum realigns its scientific or cultural programme.

And management software

Ishtar is an application designed specifically for managing the 200,000 maritime cultural items entrusted to DRASSM's safekeeping. It is used for making inventories, reconstituting collections, monitoring conservation treatments, and keeping track of objects as they move from excavation site to museum exhibition. Heads of archaeological operations, as well as museum curators and researchers, can use this management tool to ensure the smooth flow of information through the scientific community.



Natière (18th c.) Photo T. Seguin/DRASSM, 2013

DRASSM's documentary holdings are among the largest and most diverse in the world.

DRASSM AND SURVEYING

TOOLS AT THE SERVICE OF CULTURAL HERITAGE



Ocean One. Photo F. Osada, T. Seguin/DRASSM, 2016



The *André Malraux* in Brittany. Photo T. Seguin/Drassm, 2015

André Malraux. DRASSM's research vessel

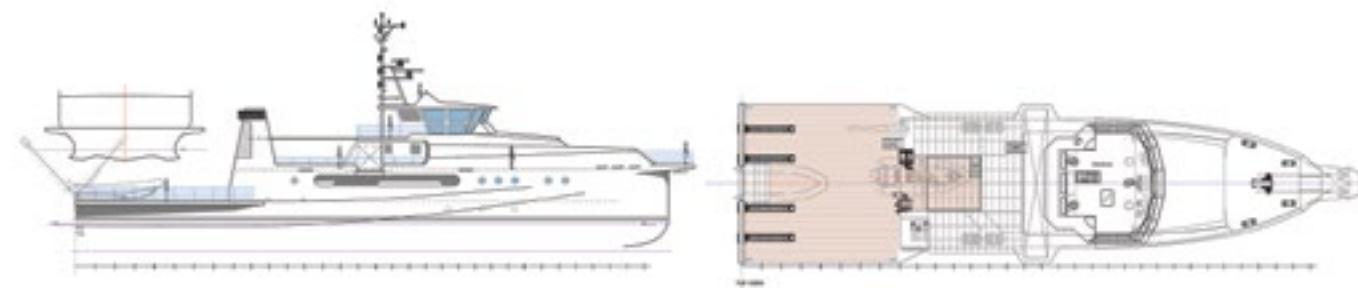
After creating DRASSM in 1966, André Malraux, then minister of cultural affairs, provided the new organization with an archaeological research vessel called the *Archéonaute*. Companion to several generations of underwater archaeologists, the *Archéonaute* spent forty years criss-crossing the Mediterranean before age rendered her incapable of standing up to the rigorous demands of DRASSM's missions. In the autumn of 2006, DRASSM archaeologists teamed up with a naval architecture firm to begin the long process of identifying the needs which would determine the design of her successor. Launched in 2012 under the name *André Malraux*, this thoroughly modern research vessel enables DRASSM to undertake all the surveys and excavations incumbent upon the Department, whether in coastal waters or offshore, from the Mediterranean and the Atlantic to the Channel and the North Sea. She is expected to remain in commission until the middle of the 2050s.



Triton off Fos sur Mer. Photo M. Serra, 2017

Triton, *Kerguelen*, *Nérée*

In recent years DRASSM has strengthened and diversified its maritime logistics. In addition to the *André Malraux*, DRASSM can call upon a number of other vessels. The *Kerguelen* is perfectly equipped for electronic surveying and designed to be shipped to anywhere in the world in her twenty-foot transport container. The aluminium barge *Nérée 2* is particularly suited to missions in inland waters. And the fifteen-metre fibreglass motor launch *Triton* is a veritable concentrate of innovative technologies.



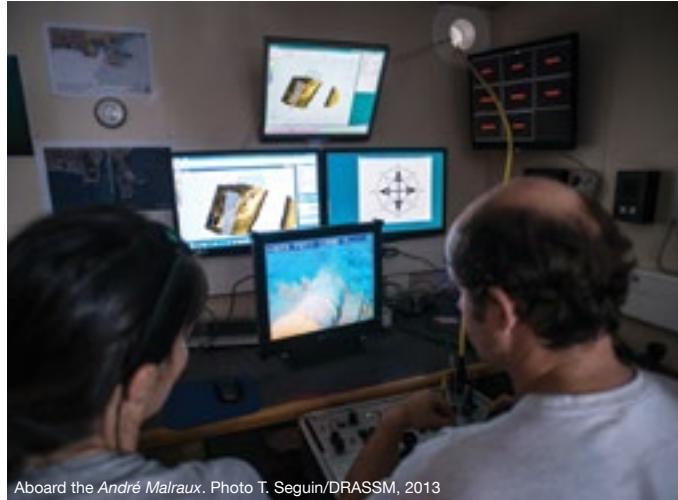
Malraux II. Design firm Mauric, 2016

And Malraux II

Since 2015, DRASSM has been working on a project to build another major research vessel. Bigger than the *André Malraux*, the ship will undertake more complex missions offshore. She will even have the capacity to transport scientists and the technical equipment required for managing underwater heritage directly to sites in France's overseas territories. This new ship is expected to enter service at the beginning of 2021.

Detecting equipment: a range of effective tools for research

Today, most diachronic or thematic survey projects use specialist detection equipment, such as side-scan sonars, multibeam echo-sounders, magnetometers and sediment penetrators. These tools often furnish results that are decisive in locating and identifying anomalies that might turn out to be maritime cultural remains. They can cover extensive areas, and the inspection of deep zones—even in poor visibility—is not a major obstacle for them. Such tools ensure the accurate positioning of identified targets. Using these instruments requires a certain expertise and interpretive finesse, and often the contribution of supplementary analyses. These detection devices have gradually imposed themselves to become an integral part of DRASSM's arsenal of tools to inventory, manage and study the cultural heritage of maritime zones.



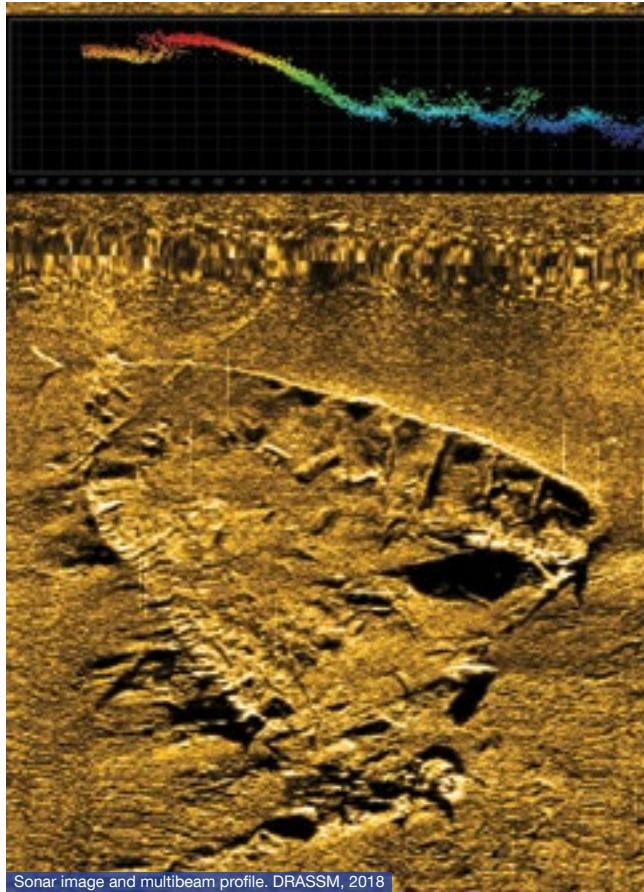
Aboard the *André Malraux*. Photo T. Seguin/DRASSM, 2013

Deep-water archaeology: a priority for underwater heritage

Whatever the circumstances of the catastrophe, whether a storm, a battle or an overloaded hold, ships lost in deep water are by far the best preserved. Once the chaos of the sinking has passed, the sheer depth of her resting place keeps a ship out of the reach of human hands. It also saves her from the daily onslaught of the swell, the oxidation generated by backwash and tides, and the voracious appetite of the wood-eating mollusc *teredo navalis* or naval shipworm.

These wrecks, whose great depth has for so long kept them away from human activity, are today under direct threat from technological progress in offshore exploration, advances in SCUBA technology, the arrival of 'treasure hunters', and the dwindling of fish stocks which is pushing fishing fleets into waters they once ignored. As a result, the looting, destruction and exploitation for financial gain of deep-water wrecks have in the last decade become so common as to threaten irremediably this vast source of heritage.

In 2007 the urgency of the situation obliged DRASSM to look into ways of developing logistical solutions and special methods that would enable archaeologists to survey and subsequently excavate wrecks lying beyond the limits of scientific diving. Drawing on the experience accumulated in the 1980s during several planned explorations on wrecks situated at depths of between 300 and 750 metres, DRASSM launched a very ambitious programme to build robots that are specially adapted to the demands of underwater archaeological research. The site of the *Lune* is the ideal candidate for developing the underwater archaeology of the coming century, a testing ground for new logistical methods that will allow humankind to protect and promote the most inaccessible corners of the world's seas.



Sonar image and multibeam profile. DRASSM, 2018

The *Lune* Project, a twenty-first century laboratory for underwater archaeology.



Speedy and *Leonard* on the *Lune*. Photo F. Osada, T. Seguin/DRASSM, 2015

Lune. proof of progress in excavation techniques

Discovered in the spring of 1993 by IFREMER's submarine *Nautilie*, the wreck of the *Lune* has been lying in 90 metres of water off Toulon since 1664. It sank in minutes, carrying to the bottom of the sea nearly a thousand military personnel, all its bronze and iron artillery pieces and every bit of its equipment. Immediately after discovery, the wreck of this royal French vessel was surveyed by DRASSM, with the support of IFREMER. It was then decided to mothball the wreck until new excavation techniques and the necessary logistical capability were available to ensure a successful study. By 2008 the discipline had sufficiently evolved and DRASSM has been working ever since to make the project a reality. Being undoubtedly one of the most important and best preserved wrecks in the world, the *Lune* is now an experimental laboratory for the development and testing of excavation methods that will be indispensable for the emerging discipline of deep-water archaeology. Several operations featuring robots have been undertaken on the site, in 2012–2013, 2014 and 2016.

Since these initial operations were carried out numerous wrecks on the west coast of Corsica, lying at depths of 150 to 600 metres, have been thoroughly surveyed. These wrecks constitute a complementary testing ground for the development of deep-water archaeology.



Speedy. Photo F. Osada, T. Seguin/DRASSM, 2014

R&D projects and industrial solutions: the *Corsaire Concept* programme

As early as 2012 numerous partners in France and overseas, including roboticists, 3D imaging specialists, engineers, researchers, small and medium enterprises and industrialists, joined forces with DRASSM to develop disruptive technology that can facilitate the study of wrecks lying at very great depths. Named *Corsaire Concept*, the programme was set up by DRASSM and aims to integrate, year in year out, new skills and innovations. The goal is to produce a complex robotic system that is perfectly adapted to the archaeology of deep-water sites.

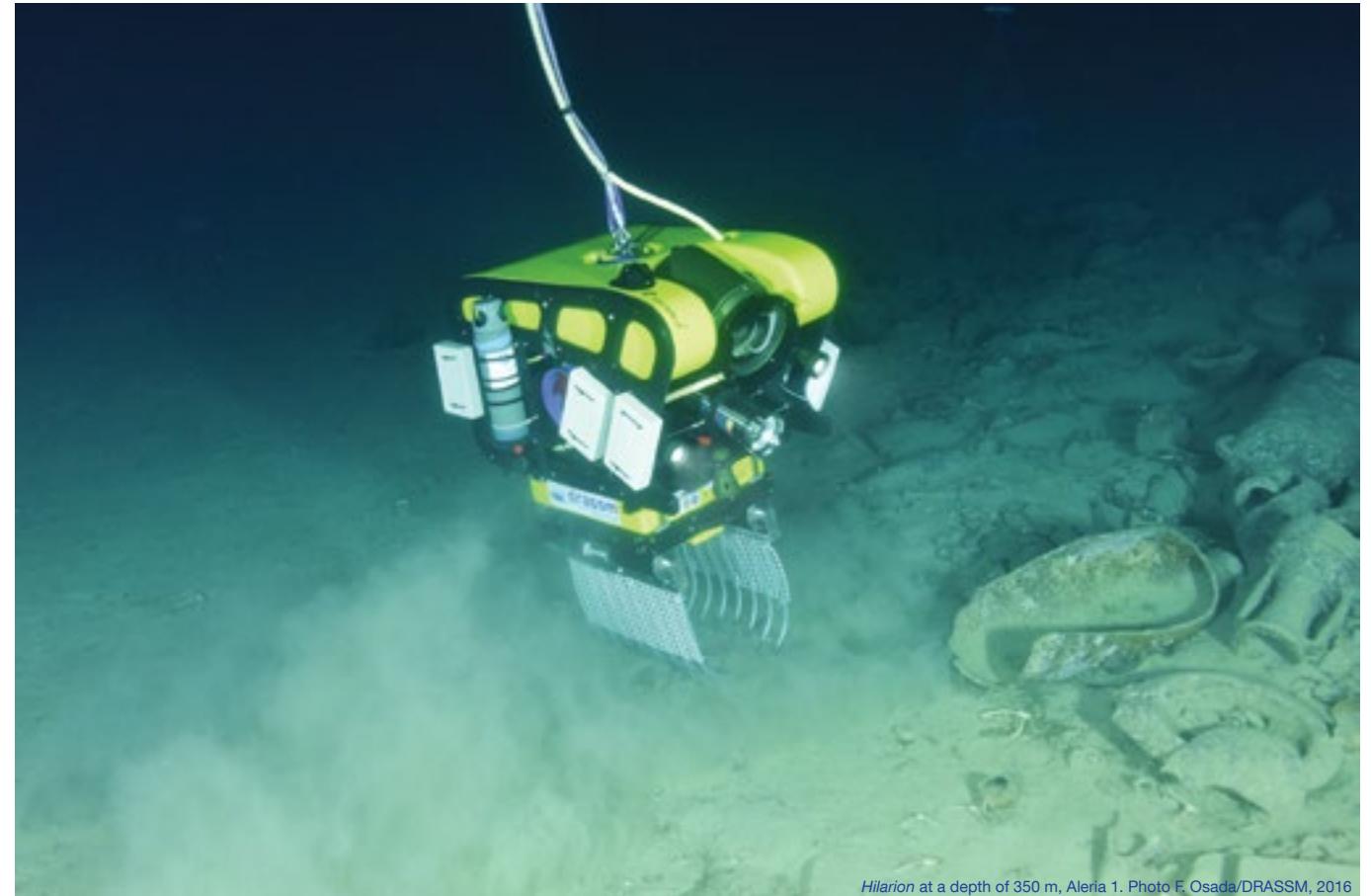
The programme has given rise to innovative robots which are entirely suited to carrying out tasks that are usually the preserve of humans. Deployed directly by archaeologists themselves, these machines will soon be sufficiently advanced as to enable excavations at very great depths with the same precision and rigour that we currently require for operations carried out by human divers on underwater archaeological sites.

An underwater archaeological robot: when science fiction becomes reality

At first glance, the idea of developing a robot underwater archaeologist might seem a bit of a fantasy. It is nonetheless the challenge DRASSM set for itself back in 2012. After several years of reflection and consultations, which saw DRASSM team up with the Montpellier Laboratory of Computer Science, Robotics, and Microelectronics (LIRMM), the project finally led to a partnership in 2014 with the team of Professor Oussama Khatib at the Stanford Robotics Lab in California.

The veritable avatar of a human underwater archaeologist, humanoid robot *Ocean One* carried out its first excavation mission in April 2016 on the wreck site of the *Lune*. Despite never having left its test tank at Stanford University in California, *Ocean One* was capable of working at a depth of 91 metres, collecting fragile seventeenth-century Catalan pottery from the wreck and putting it in a basket which had been placed nearby by another robot designed and built for DRASSM by the LIRMM.

The acquisition and the subsequent in-house development and construction of complex robotic systems has led to fundamental changes in how DRASSM archaeologists go about their daily work. Specialist personnel have integrated the department for the purpose of deploying a new generation of robots (the ROVs *Hilarion*, *Griffouble*, *Speedy*, *Leonard*, etc.). They also contribute to research programmes on robotics that will have a huge influence of the future of the discipline (*Ocean One* humanoid, SeaHand programme, etc.).



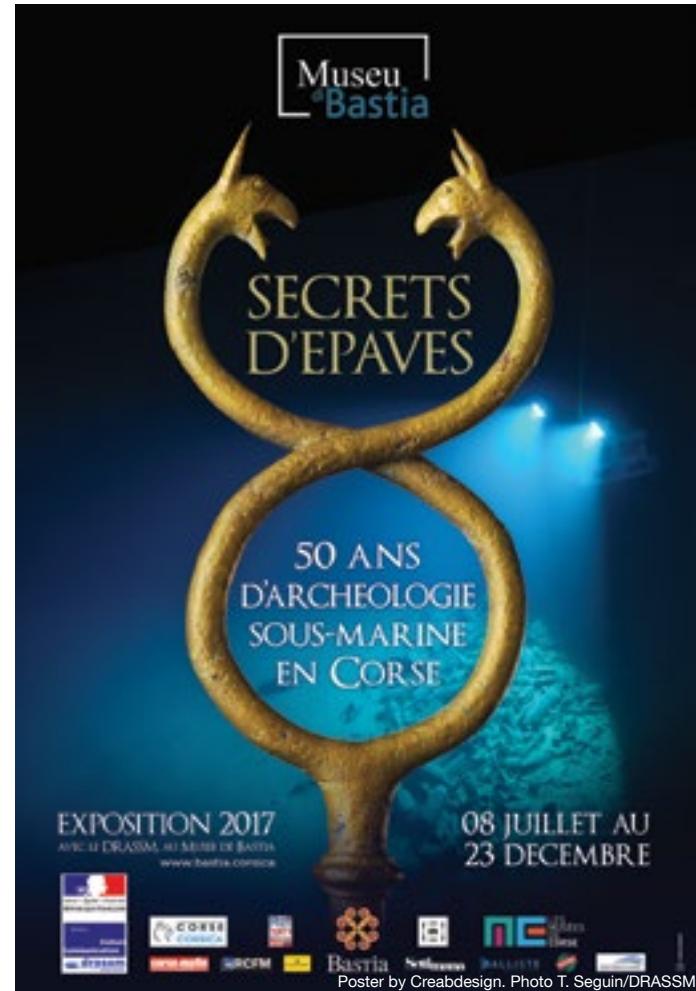
Hilarion at a depth of 350 m, Aleria 1. Photo F. Osada/DRASSM, 2016

DRASSM EVENTS

MAJOR EXHIBITIONS AND CULTURAL SITES



48 Exhibition *Mémoire à la mer* (2016) Photo T. Seguin/DRASSM



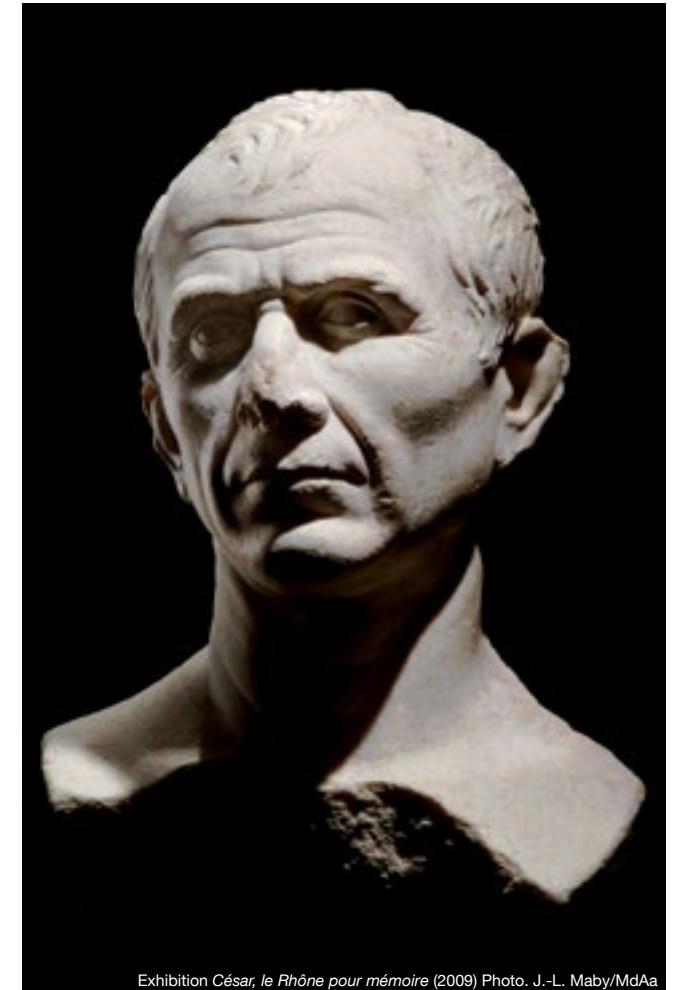
The fiftieth anniversary exhibitions

Celebrating fifty years since the creation of DRASSM by André Malraux on 30 September 1966, the exhibition *Mémoires à la Mer ! Plongée au cœur de l'archéologie sous-marine* opened for a year in April 2016 at Marseille's History Museum. It included 424 objects from across the country, creating an original and immersive experience.

In 2017 the abundance and diversity of Corsican heritage were presented to the public in an exhibition at Bastia Museum entitled *Secrets d'épaves, 50 ans d'archéologie sous-marine en Corse*.

César. le Rhône pour mémoire : twenty years of excavations in the river Rhône at Arles

The Rhône has served as a major artery to inland territories since earliest antiquity, uniting the sea and the waterways irrigating the heart of Europe. Ships from distant shores progressively enriched the city of Arles, which eventually achieved the status of Roman colony. Organized in 2009 and 2010 by DRASSM and the Museum of Ancient Arles, the exhibition recounted twenty years of DRASSM surveys and excavations in the river and its estuary. Recognized by the Ministry of Culture as an event of national interest, the exhibition drew nearly 400,000 visitors.



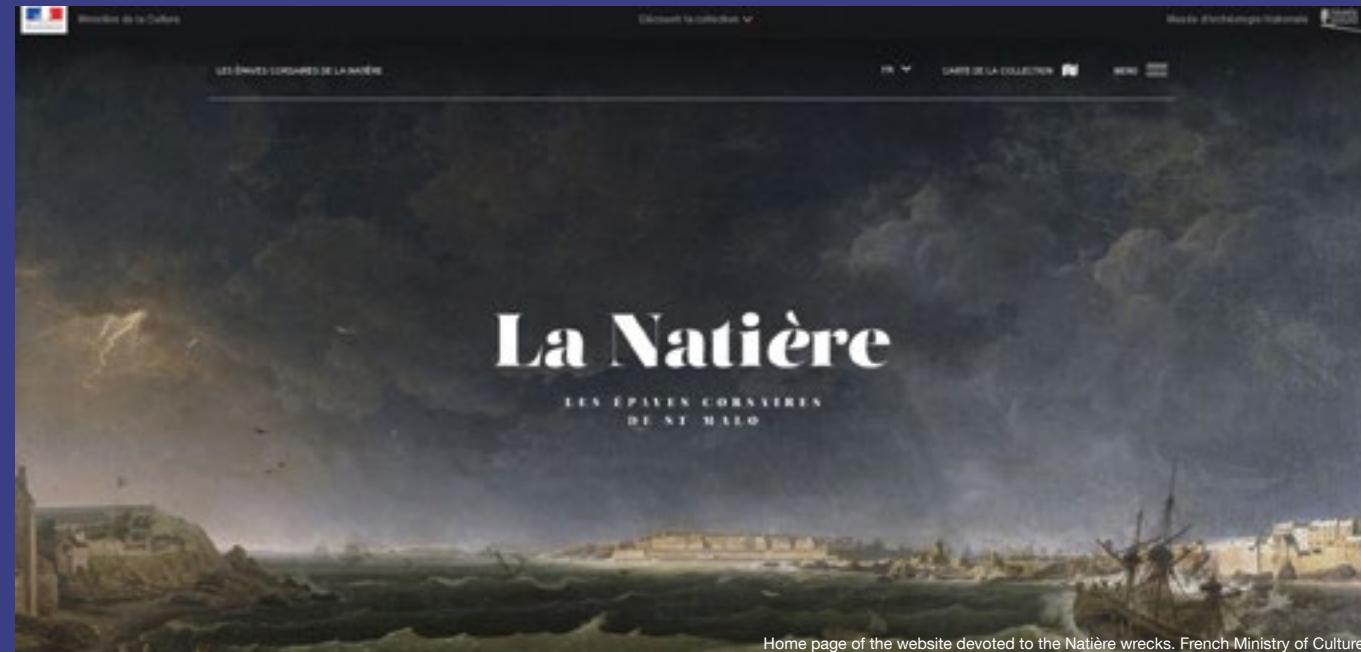
Exhibition *César, le Rhône pour mémoire* (2009) Photo. J.-L. Maby/MdAa



Exhibition *La Mer pour mémoire* (2007) Photo T. Séguin/DRASSM

La Mer pour mémoire : the underwater archaeology of Atlantic shipwrecks

Symbolizing both horrific catastrophe and a source of enrichment (or just survival), shipwrecks gradually became a key cultural feature among coastal folk. They excited the collective imagination and, as a result, attracted the interest of adventurers, lawyers, inventors and industrialists. Brutally frozen in time, shipwrecks are the submerged witnesses of history that today's archaeologists endeavour to study. The brainchild of DRASSM, which was also the organizer, the exhibition *La Mer pour mémoire* appeared in eight museums in the west of France from 2005 to 2009. Over 250,000 visitors viewed the most extensive synthesis ever made on the forty years of underwater archaeological research along the Channel and Atlantic coasts. Inter-regional and touring, the exhibition was recognized by France's Ministry of Culture as an event of national importance.



Home page of the website devoted to the Natière wrecks. French Ministry of Culture.

In the collection *Archeologie.culture.fr*

After producing *Les Hommes des Lacs* (Lakefolk, the first farmers), *Les Fouilles de Colletière* (Colletière excavations, farmer-knights of the year 1000) and *L'Archéologie sous les Mers* (Archaeology under the sea), DRASSM and its partners at the Ministry of Culture completed their overview of underwater archaeology's contribution to historical knowledge with a website dedicated to DRASSM's excavations of the Natière wrecks which lie off Saint Malo: <http://archeologie.culture.fr/epaves-corsaires/fr>

These extraordinary sites shed light on the lives of sailors, privateers and merchants who created Saint Malo's wealth in the seventeenth and eighteenth centuries and, while they did it, wrote one of the most magnificent pages in French maritime history. In 2018, DRASSM and the Heritage Department published a new website dedicated to underwater archaeology. The website provides a comprehensive overview of the underwater archaeological research directed by DRASSM since its creation fifty years ago: <http://archeologie.culture.fr/archeo-sous-marine/fr>



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Translation: Graham macLachlan

The Underwater Archaeology Research Department of France

Founded by André Malraux, a pioneering institution raising awareness of our submerged history