

THE DEVELOPMENT OF A VIDEO
GAME THAT AIMS TO THE
PROMOTION OF THE UNDERWATER
CULTURAL HERITAGE AND THE
SUSTAINABILITY OF THE
UNDERWATER ARCHAEOLOGICAL
PARKS

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Abstract

There are video games with the adventures of explorers who travel the world and the seas in search of ancient relics and treasures, such as the hunting of the pirate treasure of Sir Francis Drake in *Uncharted 4*, and in search of answers to myths and legends of the past, such as in *Tomb Raider Anniversary*, where Lara Croft is after the lost city of Atlantis. In these games, imagination is combined with historical truths, in order to make the scenes spectacular and the adventures magnificent. I think it would be good to focus here on real historical and archaeological elements related to the seas, on which a video game could be based, so that people can approach the ancient civilizations and its remains, which constitute our cultural heritage. By giving them the opportunity to get to know the elements that formed the ancient civilizations, they will be entertained while enriching their knowledge and expanding their spiritual horizon. That way, the importance of the existence of the marine archeological museums for those who dive and of the terrestrial museums that accompany them and are addressed mainly to those who do not dive will be enhanced, benefiting the local and the national economy and raising awareness towards the importance of the submerged archaeological sites in the Mediterranean and the Atlantic ocean and their protection, so that more people can enjoy them in the future and more information on the past can be acquired after their further research, that can be accomplished only if they are preserved. That way, the sustainability of the underwater archaeological parks can be achieved.

As you set out for Ithaka
hope your road is a long one,
full of adventure, full of discovery.
Laistrygonians, Cyclops,
angry Poseidon—don't be afraid of them:
you'll never find things like that on your way
as long as you keep your thoughts raised high,
as long as a rare excitement
stirs your spirit and your body.
Laistrygonians, Cyclops,
wild Poseidon—you won't encounter them
unless you bring them along inside your soul,
unless your soul sets them up in front of you.

Hope your road is a long one.
May there be many summer mornings when,
with what pleasure, what joy,
you enter harbors you're seeing for the first time;
may you stop at Phoenician trading stations
to buy fine things,
mother of pearl and coral, amber and ebony,
sensual perfume of every kind—
as many sensual perfumes as you can;
and may you visit many Egyptian cities
to learn and go on learning from their scholars.

Keep Ithaka always in your mind.
Arriving there is what you're destined for.
But don't hurry the journey at all.
Better if it lasts for years,
so you're old by the time you reach the island,
wealthy with all you've gained on the way,
not expecting Ithaka to make you rich.

Ithaka gave you the marvelous journey.
Without her you wouldn't have set out.
She has nothing left to give you now.

And if you find her poor, Ithaka won't have fooled you.
Wise as you will have become, so full of experience,
you'll have understood by then what these Ithakas mean.

Σα βρεις στον πηγαϊμό για την Ιθάκη,
να εύχεσαι νάναι μακρύς ο δρόμος,
γεμάτος περιπέτειες, γεμάτος γνώσεις.
Τους Λαιστρυγόνας και τους Κύκλωπας,
τον θυμωμένο Ποσειδώνα μη φοβάσαι,
τέτοια στον δρόμο σου ποτέ σου δεν θα βρεις,
αν μέν' η σκέψις σου υψηλή, αν εκλεκτή
συγκίνησις το πνεύμα και το σώμα σου αγγίζει.
Τους Λαιστρυγόνας και τους Κύκλωπας,
τον άγριο Ποσειδώνα δεν θα συναντήσεις,
αν δεν τους κουβανείς μες στην ψυχή σου,
αν η ψυχή σου δεν τους στήνει εμπρός σου.

Να εύχεσαι νάναι μακρύς ο δρόμος.
Πολλά τα καλοκαιρινά πρωιά να είναι
που με τι ευχαρίστησι, με τι χαρά
θα μπαίνεις σε λιμένας πρωτοειδωμένους·
να σταματήσεις σ' εμπορεία Φοινικικά,
και τες καλές πραγμάτειες ν' αποκτήσεις,
σεντέφια και κοράλλια, κεχριμπάρια κ' έβενους,
και ηδονικά μυρωδικά κάθε λογής,
όσο μπορείς πιο άφθονα ηδονικά μυρωδικά·
σε πόλεις Αιγυπτιακές πολλές να πας,
να μάθεις και να μάθεις απ' τους σπουδασμένους.

Πάντα στον νου σου νάχεις την Ιθάκη.
Το φθάσιμον εκεί είν' ο προορισμός σου.
Αλλά μη βιάζεις το ταξείδι διόλου.
Καλλίτερα χρόνια πολλά να διαρκέσει·
και γέρος πια ν' αράξεις στο νησί,
πλούσιος με όσα κέρδισες στον δρόμο,
μη προσδοκώντας πλούτη να σε δώσει η Ιθάκη.

Η Ιθάκη σ' έδωσε τ' ωραίο ταξείδι.
Χωρίς αυτήν δεν θάβγαινες στον δρόμο.
Άλλα δεν έχει να σε δώσει πια.

Κι αν πτωχική την βρεις, η Ιθάκη δεν σε γέλασε.
Έτσι σοφός που έγινες, με τόση πείρα,
ήδη θα το κατάλαβες η Ιθάκες τι σημαίνουν.

C. P. Cavafy, *Ithaca*, 1975. From *C.P. Cavafy: Collected Poems*. Translated by Edmund Keeley and Philip Sherrard, 1992.

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Reasoning

I studied Archaeology and History of Art, completed my master’s in Maritime Archaeology at the university of Southern Denmark and worked several years as a tutor for children. I have always been interested in myths and legends of the sea and loved the adventures of archaeologists-explorers in video games and I could not find a more suitable topic for my thesis, than a combination of my studies, interests and love, that could be proven beneficial for both the sustainability of the underwater archaeological museums and the protection of the underwater cultural heritage.

Therefore, some ideas on the topics and the challenges that a video game about the underwater cultural heritage could include will be provided. The reason why

I believe that a video game would appeal to people of all ages willing to be entertained while learning, is principally because I always found that addressing to those who do not have a lot of knowledge about heritage matters can be difficult, unless you try to do so through an entertaining way. Addressing to a person who is not keen on a specific science can be a great challenge, because it is very important to do that in a simple and understandable way, so that they can understand and take position on a matter. Trying to make your points clear to a person who is not completely into a matter, means that you have to put aside your arrogance and explain things simply without trying to impress the others with thundering but empty words. This is something I learned due to my engagement with young people as a tutor, trying to teach them not only history and literature, but ethics and respect for everyone and everything as well, through the acquisition of knowledge and the promotion of culture. My hope is to contribute to making the world a better place, through the amelioration of the quality of life of all beings.

Chapter 1: Linking the Underwater Cultural Heritage with the Sustainability of the Underwater Archaeological Parks and the Video Games

What Underwater Cultural Heritage is

According to the United Nations Educational Scientific and Cultural Organization and the 2001 UNESCO Convention, Underwater Cultural Heritage is *all traces of human existence having a cultural, historical or archaeological character which have been partially or totally underwater, periodically or continuously, for at least 100 years, such as:*

(a)i. sites, structures, buildings, artefacts, and human remains, together with their archaeological and natural context.

(a)ii. vessels, aircraft, other vehicles or any part thereof, their cargo or other contents, together with their archaeological and natural context. According to UNESCO, around 3 million shipwrecks are spread across the ocean floors around the planet.

and

(a)iii. Objects of prehistoric character.¹

¹ UNESCO 2001, P. 27

Sarah Dromgoole complements in the *Underwater Cultural Heritage and International Law* that *Underwater Cultural Heritage is the material found underwater, generally lying on or embedded in the seabed, which has the potential to yield information about past human existence* (University of Cambridge, 2013).²

The 2001 UNESCO Convention on the Protection of Underwater Cultural Heritage underlined the importance of the protection of the cultural heritage via the in situ preservation and set rules for its commercial exploitation. The in situ preservation, that is the first option for the protection of heritage, is the preservation of the remains on the sea floor. Any recovery of objects shall be completed only if required. Furthermore, public access shall be promoted, unless the archaeological site has to be protected and therefore remain inaccessible.³

All that can be accomplished by the professionals in the field of underwater archaeology, that is the systematic study of past human cultures, by using the material remains that include sites and artifacts found in the underwater environment.⁴



Fig 1. Shipwrecks in the Atlantic from the era of the WWI. They might not be over 100 years old yet, but they are considered to be Cultural Heritage, since they belong in an era of historical importance and they might have consisted underwater graveyards.

² Piquer 2017, p. 18

³ UNESCO 2001, p. 28

⁴ Delgado 2002, p. 1

The Protection of the Underwater Cultural Heritage through the Sustainability of the Underwater Archaeological Parks

Sustainability is the ability of preservation of the state of something, so that both the economy, the environment and future generations are benefited.⁵ Since we have been talking in the thesis about Cultural Heritage, then we should replace the environment aforementioned with that. Therefore, we are concerned here about the protection of the Cultural Heritage and its exploitation in a way that could benefit the economy of today and the future generations.

Since the right exploitation of the underwater archaeological parks can foster sustainability, we should focus on both the diving tourism that flourishes through them and the non-diving tourism that could prove to be profitable for the State, due to the visits of the non-divers to the terrestrial museums that accompany the underwater archaeological parks.

The significance of diving tourism for sustainable development and for the protection of the natural and cultural environment is overall high. Tourism fosters economic development, since it contributes to the revenue growth of a country, and it is admittable that the diving tourism has grown rapidly over the past years, due to the fact that recreational diving is becoming more and more approachable and affordable to everyone wishing to dive and breath underwater.⁶

The positive impacts of tourism include the opening of industries, such as hotels, stores, restaurants, diving centres, providing job opportunities to the locals and promoting the blending of different societies, that enhances the social development of both foreigners and locals.⁷ By getting close to the past cultures, people can learn to recognize the differences among the past cultures and their similarity as to one thing: that they all have the potentials to thrive in the right and proliferating circumstances, and that would protect them from discrimination, so that racism is confronted.

Video Games

Video games can be regarded as innovative tools for teaching and learning. Even if the video game is set in a mythical reality, its context will be set on things that actually existed and formed our cultural heritage. Research shows that the interest in a game can encourage people to undertake learning activities, because dopamine is

⁵ Coccosis 2001, p. 20

⁶ Stathis 2019, p. 2

⁷ Shaalan 2005, p. 85-86

produced in their brain, that is connected to the learning processes through the video game. Consequently, video games can enhance learning.⁸

A video game about the adventures of diving archaeologists will enable people to experience the diving experience and the underwater exploration through virtual dives in a digitally reconstructed environment, monitoring the air content in their tanks and avoiding getting affected by the decompression sickness, while exploring wrecks, confronting mythical sea monsters and learning about past cultures, that left mysterious traces of their existence in the seas and await to be discovered.

A 3D video game about Underwater archaeology in the Mediterranean has been developed in Italy as an application for smartphones, that is called Dive in the Past. The user gets to dive in some specific spots in the Mediterranean, to explore four specific archaeological sites: The Oreste ship in Trsteno Bay, Montenegro, that was sunk in the Second World War, the wreck of Gnalić in Biograd Na Moru, Croatia, that is a famous rowing ship known as "the red Gagliana", sunk under mysterious circumstances at the end of the 16th century, the Imperial Nymphaeum of Punta dell'Epitaffio in Gulf of Pozzuoli, Italy, that forms a part the Submerged Archaeological Park of ancient Baiae, and the wreck of Peristera, off the Greek island of Peristera, that was a commercial ship, sunk in the 5th century BC and carrying a vast amount of amphorae.

It belongs to the Serious Game genre and was developed thanks to the MeDryDive project, funded by the COSME program of the European Commission for small and medium enterprises. It was developed to promote awareness among the general public on the protection and enhancement of the underwater cultural heritage. Technologies, like the multibeam sonar, have been used for digitizing archaeological finds and sites and have helped the Italian developers to create a 3D model of the underwater environment. Additionally, flora and fauna have been realistically represented. The game belongs to a novel game category, called *game tourism*.⁹ Therefore, innovative technologies combined with Sustainable Tourism development have already started being implemented.

⁸ Green 2004, p. 16

⁹ Gatto 2018, p. 2-3

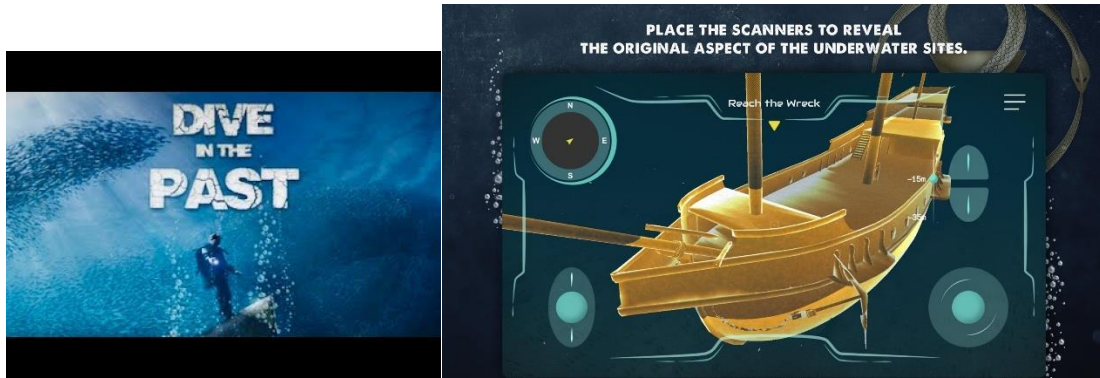


Fig 2. The *Dive in the Past* video game.

Chapter 2: Myths and Villains

It is undeniable that the aforementioned mobile app game aims to promote the marine archeological parks, but there is a slight chance that it cannot attract the interest of young people, as it has no real action, due to the omission of adding obstacles that could make achieving their goal more difficult, thus rendering the game challenging. In action/adventure games that are about adventurers looking for ancient and historical relics, the bad element is often represented by mercenaries, who eye the items and information that the adventurers collect, before reaching their final goal, that is the most important artefact. Examples are the *Tomb Raider* and *Uncharted* series video games, in which the protagonists have to deal with a multitude of mercenaries with weapons. Less violence occurs in the *Lego Indiana Jones* games, where the villains are broken into pieces once they are hit and defeated. However, it is usually not only mercenaries, but puzzles and quiz as well that make the games challenging and difficult. In the majority of the action video games that include puzzles and quiz, like in the *Uncharted* and the *Tomb Raider* series, those can be proven to be very complicated and require the concentration and dedication of the gamers in order to be resolved. And I believe that we should focus on that and try to find a way to integrate them in our game, since it is not possible to include weapons and mercenaries in a game that aims to promote the cultural heritage and highlight its importance.

Therefore, an idea could be that we combine the puzzles and the villains in order to create our obstacles and make the game challenging. That combination would attract the interest of young ages, who usually give priority to their entertainment over the acquisition of sterile knowledge. Therefore, in this chapter we will deal with sea monsters, which according to historical sources have haunted the oceans since ancient times. The reason why we focus on them and we are going to analyze them so thoroughly in this chapter is because adding obstacles in an action game, that aims to bring people of all ages into contact with elements of older cultures and therefore has to be interesting for as many age groups as possible, is quite

challenging. By combining historical knowledge on sea monsters and puzzles, people will have the opportunity to come close to the way of thinking of ancient people and their perceptions of the mysteries of the oceans, understanding the reasons why people in the past came to describe them the way they described them in books and portrayed them the way they portrayed them on maps, signifying their possible location in the world. We will talk about maps, which are archeological objects that formulate what was written in ancient texts, parts of which will be mentioned here, so that they can be used in the harmonical integration of sea monsters in the game and provide information that will be useful in the creation of puzzles.



Fig 3. From the Uncharted 4, the archaeologist and explorer Nathan Drake

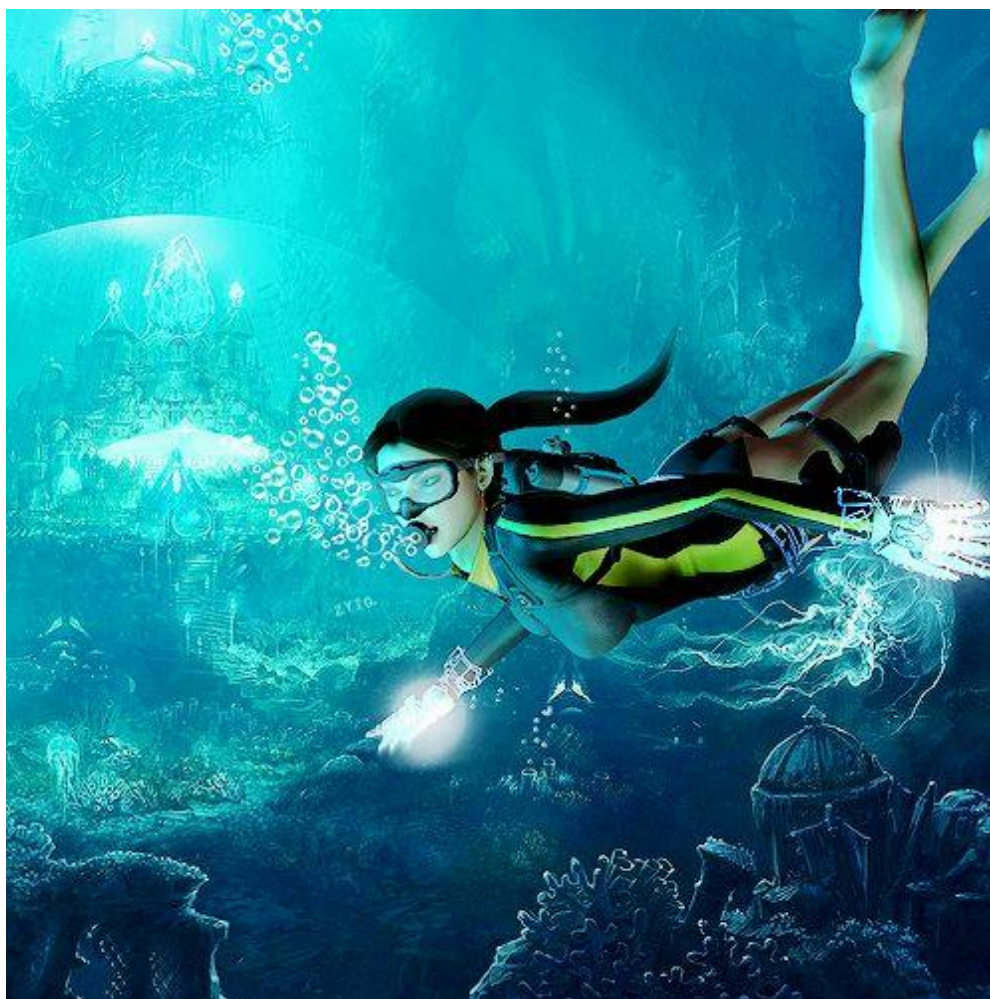


Fig 4. Lara Croft in the Tomb Raider video game.

But why sea monsters? Because the sea has always fascinated people. The immense blue could carry him to distant places and inspire him to create the most exciting and weird stories about the creatures it can nourish and the mysteries it can hide. Natural phenomena that could not be explained scientifically ended up signifying myths, and human weakness to overcome the sea urge gave birth to legendary creatures, that many believe they still swim in the abyss, waiting to be discovered. These monsters have been depicted many times on navigational charts to point out dangerous places and unfamiliar waters, usually at the edges of the known world, serving as guardians of the exotic areas that hid mysteries. Throughout the centuries and after the exploration of the distant regions, those creatures stopped guarding them, as those areas were not any more dangerous. But they continued to decorate a lot of maps, charming the people and feeding the myths about them, as the vast sea and its unexplored depths remained mysterious. Even today, stories with weird creatures continue to be created and circulate, and many are those who throw themselves into their search, believing that legends often hide a piece of truth. Is it possible that one day, any of those creatures that many people through the ages believed to have seen and depicted in manuscripts and maps, will be revealed? Maybe

not. Perhaps they are just products of the imagination. But the fact is that the sea is so deep and vast, that -even today- 70% of it remains undiscovered and, before someone makes sure that something does not exist, one can continue claiming that it does so, until the truth is revealed. So, until the sea gets explored in its 100%, it can remain in legends as the home of the sea monsters.

The Sea in Myths

Firstly, we should distinguish myths from legends. Both myths and legends are set in the past. Their difference is that myths are stories of gods or supernatural heroes that try to explain mysteries of the world then, and legends are stories of heroes or creatures that include more realism than we can find in the myths, aiming to form adventure narratives.

If we talk about myths, we could talk about the way that the sea was regarded as a passage between life and death in Greek mythology. Immersion myths talked about the transformation of life into death and the mortality into divinity. Since in ancient Greek literature the sea was considered to be a dangerous place, sailors who died at sea could not enter the underworld, because their bodies had not received the requisite funerary rituals and the sea was considered to be a passage between lands. Therefore, there are myths that allegorize the life-changing transitions into a passage from life to death through the immersion in the sea, that transforms the individuals.

Sea water in ancient Greek literature represented a source of life, fertility, vitality and purifies. In the Homeric and Hesiodic cosmogonies, gods and creatures sprang from the sea. Furthermore, the mythical Oceanus lies at the edge of the world, encircling it and providing the rivers with water, that fills the seas. The Isles of Blessed and more islands on which gods live, such as the Hesperides, are to be found beyond Oceanus, where mortals cannot go, unless they are dead. Therefore, Oceanus served as the boundary between the worlds of mortals and gods and as the passage from life to death in the world of mortals and then to eternal life in the world of gods.

An interesting adding in the sea myths of the past was the dolphin. Dolphins represented metamorphic transitions between life and symbolic death and between mortality and divinity, traveling from the world of gods to the world of mortals to save them. Theseus is guided by dolphins in his journey under the sea, representing the coming-of-age transition, an ephebe becoming an adult. Arion, who escapes from the Corinthian pirates, is saved by a dolphin,¹⁰ after he sang a hymn to Apollo and jumped in the sea.¹¹ Coeranos once purchased a dolphin that had been trapped in a fishing net, so that he could set it free. Later on, his ship sank and he was rescued by a dolphin.

¹⁰ Beaulieu 2008, p. 1-5

¹¹ Beaulieu 2008, p. 87

Once he died, a school of dolphins follow his funerary along the harbor, repaying Coeranos for his kindness. This story tells us that, according to past people, dolphins could show gratitude and respect for the funerary processes.¹²

The sea in ancient Greek literature is called *ἄλς*, *πόντος*, *Ὠκεανός* and *θάλασσα*. Pontus and Oceanus were personified as water divinities. In the work of Hesiod, *Theogony* 273-389, Pontus is the father of the sea monsters Phorcys, Thaumas, Eurybie and Keto, as well as Nereus. Therefore, Pontus represents the dangers that sailors might encounter.¹³



Fig 5. The Titan god Oceanus in the Trevi Fountain, Rome.

About Monsters and Maps

In the classical and medieval periods, the sea remained a dangerous and mysterious place. In this chapter, written works of classical and medieval authors are listed, along with the supply of information regarding the definition of monsters, the role of maps and the geographic location of monsters on them, so that a general acknowledge of the exotic in earlier times, from the years of Middle Ages till the 17th century, can be acquired. The reasons of their existence on charts will be studied, so that a guide for the interpretation of symbolisms on those artefacts of material culture -whose initial purpose of creation was solely the navigation of people in the seas- will be formed. Therefore, the reason why maps are going to be discussed is because they represent objects of archaeological importance that have to do with the culture

¹² Beaulieu 2008, p. 83

¹³ Beaulieu 2008, p. 12-13

heritage related to the seas and because they can provide useful information on the sea monsters.

Main research topics in this chapter will be the way sea legends in the Atlantic Ocean were perceived and the purpose of their depiction on navigation maps. What human beliefs do those maps voice? Were those monsters considered to be a real threat for human lives or was their purpose only decorative on maps? Those research questions will be the axis of this chapter, so that information about the sea monsters that can be valuable for the game will be provided and a work that will be understandable and pleasant for anyone to read will be written.

Written sources from the antiquity will be included in the research and will be interpreted, along with antique maps that will be examined, in order to provide the archaeological basis for the study. The maps that will be studied here represent some of the most well-known ones that depict sea monsters, along with others that are less popular but still consist good examples of the reflection of human beliefs on the decoration of navigating tools. Apart from that, the written sources include texts from bestiaries, encyclopedias, literature and keys accompanying the maps, that give useful information and contribute to the interpretation of human beliefs regarding the legends of the sea and their influence for the formation of medieval and later material culture related to human interaction with the sea.

Defining a monster

The definition of the word *monster* has arisen contradictions since the classical and medieval times. The philosopher Aristotle (384-322 BC) in his work *On Generation of Animals* considered monsters as *errors* of nature¹⁴ and some later authors, such as Sir John Mandeville of the 14th century, defined monsters as *creatures against nature*.¹⁵ The word *monster* though derives from the Latin *monstrum*, which is related to the verbs *monstrare* (to show or reveal) and *monere* (to warn or portend) and thus we could say that it indicates an omen.¹⁶ Cicero was the first one in 44 BCE¹⁷ (*De Divinatione* 1.42) and St Augustine after many years in the 5th century AD (*De Civitate Dei* 21.8) to use the word *monstrare*, to support their argument that monsters *show* signs or warnings from the God or gods to the people. Furthermore, St Augustine and Isidore of Seville (560-636 AD) defined it as *a part of God's plan to teach people about the dangers of sin*, although the latter consists more a function rather than a defining

¹⁴ Surekha 1992, p. 50 For more information about Aristotle's aspect of monsters, see Connell, S., 2018: *Aristotle's Explanations of Monstrous Births and Deformities in Generation of Animals* 4.4. In *Aristotle's Generation of Animals: A Critical Guide*, edited by A. Falcon and D. Lefevre, pp.207-224. Cambridge University Press, Cambridge.

¹⁵ Duzer 2012, p. 387-8

¹⁶ Weinstock 2014, p. 1-5

¹⁷ Surekha 1992, p.50

characteristic (De civitate Dei 16.8 and 21.8; and Etymologiae 11.3.1, accordingly).¹⁸ Isidore specifically traced the source of the word in "monere".¹⁹ Additionally, the word may not only reveal the will of the gods, but also the absence of a divine plan governing creation, as well as the limitations of human knowledge.²⁰ Pliny the Elder (23-79 AD) considered monsters as *wonders of nature* (Natural History 2.208)²¹ and used the word *monstrum* in his encyclopedia *Natural History* for both human and animal species that have unusual appearance and habits, that live in India and Africa. However, general Roman historical records mention the word *monstrum* to denote an omen or an unusual human or animal birth, that would show possible misfortunes to the people.²² Monstrosity was furthermore strongly tied with religion in the earliest years of Reformation and there was a swift in the beliefs of the reasons it existed. From its interpretation as signs of imponent misfortunes, monstrosity started being regarded as a sign of specific crimes that acquired divine punishment and monstrous creatures and births pointed out the actions of God. Therefore, monstrous wonders started serving propagandistic purposes.²³

Animals, such as whales, dolphins, seals, manatees and dugongs were many times perceived as monsters, either because they were mistaken as such or because there was not enough scientific knowledge around them. As a result, a lot of them triggered myths about mermaids and more sea monsters, accompanying the explorers of the New World in the Atlantic Ocean on the 16th and 17th centuries.²⁴



Fig 6. The walrus on the map of Jodocus Hondius, 1575. Houghton Library, Harvard.

We derive useful information about animals and natural history from the works of Aristotle *On Generation of Animals*, the primary zoological books of Pliny's

¹⁸ Duzer 2012, p. 387-8

¹⁹ Mittman & Kim 2015, p. 6

²⁰ Weinstock 2014, p. 1-5

²¹ Surekha 2012, p. 50

²² Friedman 2010, p. 1118

²³ Surekha 2012, p. 52-53

²⁴ Brito 2013, p. 12-20

Natural History and Thomas de Cantimpré's *Liber de Natura Rerum* from the 13th century, which consisted the source of the 13th century works *De Animalibus* of Albertus Magnus and *Speculum Naturale* of Vincent de Beauvais. Thomas de Cantimpré (1201-1272 AD) divided the animals in *Quadrupedes*, *Aves*, *Monstra manna* (*wonders of the deep*), *Pisces*, *Serpentes*, and *Vermes* (*lowly creatures*).²⁵ Later in the 15th century the *Hortus Sanitatis*, an anonymous medieval illustrated encyclopedia of plants and animals, was published in Mainz in 1491 by Jacob Meydenbach. In the chapter *De Piscibus & Natatilibus* there are a lot of descriptions and illustrations of marine creatures and monsters.²⁶ Additionally, the Swiss scholar Conrad Gessner (1516-1565 AD) provided with his work useful information about the classification of animals and the existence of sea monsters. He wrote in his *Historia Animalium* and in his later work on aquatic animals *Nomenclator Aquatilium Animantium*: [...] *quos Latini beluas marinas etiam vocarunt ab immanitate, opinor, & magna cum terrestribus beluis similitudine; nam eodem modo concipiuntur & gignuntur, & pulmones habent, renes, vesicam, testes, mentulam; foeminae vulvam, testes, mammas* (Gessner 1558, 229). ([...] *I believe that the Latin authors spoke of marine beasts because of their wildness and their similarity to terrestrial beasts, because they conceive and give birth in the same manner, and have lungs, kidneys, a bladder, testicles and a penis, and the females a womb, ovaries and teats.*)²⁷



Fig 7. Monstrous whales (*De Cetis*) in Gessner's *Nomenclator*. Zurich, 1560, pp. 176-177. *Bibliothèque du Muséum national d'histoire naturelle*, Paris. of four sea monsters that resemble those in the *Nomenclator* of Gessner. (Photo from C. M. Pyle)

²⁵ Pyle 1996, p. 272-273

²⁶ Duzer 2011, p. 117

²⁷ Hendrikx 2018, p. 126

In ancient greek literature, we read about heroes encountering monsters, such as in the wanderings of Odysseus, where he meets the Cyclopes, the Laestrygonians, Scylla and Charybdis, and the Sirens.²⁸

Olaus Magnus in his work of 1555 wrote that sea monsters and the water surrounding them were considered as wonders or marvels, because of the reactions of people towards them. He conceptualized them as such, by writing in the second book of his *Historia de gentibus septentrionalibus*, “On the Wonders of Nature in the North” (De mira natura rerum Septentrionalium): *The vast Ocean presents a wonderful spectacle [admirabile spectaculum] to every nation in its swirling waters. It exhibits its various offspring, which strike us not in their wonderful [mirabiles] size and similarity to constellations but rather through their threatening shapes, so that there appears to be nothing hidden either in the heavens, or on earth, or in earth’s bowels, or even among household tools, which is not preserved in its depths. In this broad expanse of fluid Ocean, receiving the seeds of life with fertile growth, as sublime nature ceaselessly gives birth, an abundance of sea monsters (piscibus monstrosis) is found.* He also wrote that *Many writers, and celebrated ones, have tried to reveal how many marvels [miracula] there are connected with the waters especially in the very vast Ocean toward the north of the Norwegian kingdom and its islands and explained that Such great wonders [mirabilia] (some of which I shall add below) have their position in the huge extent of Ocean that even a person with surpassing talent can hardly describe them. These will be shown below where I deal with beasts and monsters, if God is gracious.* Not all of the monsters were believed to be evil though, as someone may suggest. Based on the kind of reaction each monster created to people, they could be divided into four types. The first type was the dangerous one, threatening human lives, the second one protected people usually from other monsters too, the third one acted as signs, indicating events that were about to come, and the fourth one could be useful as commodities for humans. Olaus also created a map depicting a multitude of sea monsters, that is known as *Carta marina et descriptio septemtrionalem terrarum ac mirabilium* (*A Marine Map and Description of the Northern Lands and Their Wonders*) or simply *Carta Marina*.²⁹

As it comes to the appearance of monstrous creatures in literature and maps though, Caroline Bynum makes a good point, noting that “metamorphosis stories are popular in Antiquity but not in the early Middle Ages”³⁰ and I would add that this is the case of later ages as well. As we will see in the next chapters, sea monsters are usually defined by hybridity, appearing as a combination of body parts from different animals.

²⁸ Duzer 2012, p. 429-431

²⁹ Starkey 2017, p. 30-37

³⁰ Oswald 2010, p. 118

The maps and their role

Maps can be interpreted as a way of human communication, enabling people to tell others about the places they have been or experienced.³¹ Early maps of the universe and the terrestrial world can be traced back to the ancient Egyptian and Babylonian civilizations, with the latter even having developed ways to measure distances based on time: the unit *beru*, for example, meant *double hour* and was about ten kilometers. From around 2300 B.C. until the middle of the first millennium B.C., they drew plans of property, land, houses, and temples. The famous *Babylonian World Map* from the 7th century BCE depicts mythical places beyond the world that was known to the Babylonians. Those places are drawn as triangles beyond the circle of the ocean and were reached only by some ancient heroes. Inside the circle, there is an oblong marked as *Babylon* and smaller circles that represent cities. The map has a text accompanying it, that mentions legendary beasts that were believed to live in those regions, beyond the ocean.³²



Fig 8&9. The Babylonian world map of around 600 BC. British Museum.

Much later, in medieval Europe, the maps that were produced were divided into categories: the *mappamundi* (world maps) from the eighth century onwards, the *portolan charts* from 1300 AD onwards, the regional and local maps, and the celestial maps. The term *mappamundi* derives from the Latin *mappa*, that is *tablecloth* or *napkin* and *mundus*, that means *world*. Their purpose was philosophical and didactic, so they didn't follow a geographic plan, but served as a source of information regarding the people and their relationship to God.³³ This is the reason why the image of God is depicted on several medieval maps³⁴ and the presence of monsters and other

³¹ Harley 1987, p. 1-2

³² Millard 1987, p. 107-112

³³ Harley 1987, p. 283-287

³⁴ Pérez 2014, p. 8

marvels on them formed a ring around the known world, filling the map's edges and mirroring the Creation's divine plan.³⁵ Some of those maps, that combine both text and image, provide information about those monsters.³⁶



Fig 9&10. The Cotton Map, 1025-1050 AC and the Psalter Map, 1260-1270 AC. British Library.

The *portolan* charts were named after the word *portolano*, that is a collection of written sailing directions and it has been suggested that these charts often accompanied those texts.³⁷ Consequently, they were scale maps, showing distances and serving as navigation tools for the ships.³⁸ However, they sometimes included several mythical features. The portolan charts were usually rolled and fastened with a wooden thong and they were attached to wooden rollers.³⁹

³⁵ Mittman 2012, p. 40

³⁶ Pérez 2014, p. 8

³⁷ Campbell 1987, p. 375-383

³⁸ Harvey 1987, p. 284

³⁹ Campbell 1987, p. 372-375. The translation of the legend is from Crone, G. R., 1978: *Maps and Their Makers: An Introduction to the History of Cartography*, Archon Books, p.28.



Fig 11. The Genoese world map, 1457. Library of Congress.

No matter the type of map, artistic motifs had always been used a lot in cartography, enabling symbols, flora, fauna and monsters as part of maps, probably as a specific demand of a client to the map maker, involving a lot of times additional artists to draw them. It seems that sea monsters on maps could serve as indications of dangers of the sea and threats to sailors, following the geographic plan of the marvellous as depicted on written works, as well as simply decorations, to add vitality to the seas of the maps and prove the artistic skills of the cartographer.⁴⁰ In the 15th century, maps became widely available with the invention of printing, firstly being printed with carved wooden blocks and after the 16th century with engraved copper plates.⁴¹ Additionally, cartography developed as a science in the 16th century, due to the contribution of the Flemish cartographer Gerard Mercator and the acquisition of a deeper knowledge of the physical world.⁴² Mercator developed a cylindrical projection for navigation, at a time that the exploration of the New World contributed to the acquisition of knowledge to depict coast lines and harbors on maps, resulting in more accurate maps.⁴³ Geographic details and toponyms started filling the blank spaces of the maps, that before abounded in artistic details.⁴⁴ Therefore, the appearance of monsters on maps became declining, although literary reports continued existing till the 18th century.⁴⁵

⁴⁰ Duzer 2011, p. 116-117

⁴¹ Perocho 2004, p. 3

⁴² Pérez 2014, p. 6

⁴³ Perocho 2004, p. 3

⁴⁴ Pérez 2014, p. 6

⁴⁵ Friedman 2010, p. xxxii

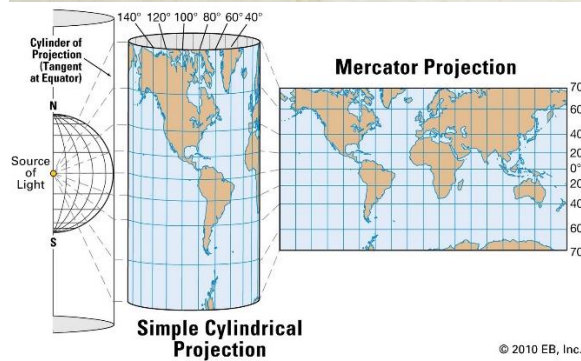
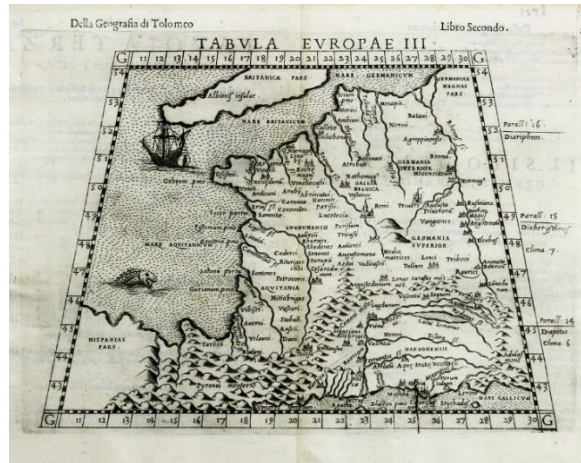


Fig 12&13. A map of Gaul by Ruscelli, in the 1561 edition of Ptolemy's *Geography* and the Mercator projection.

Nowadays, a modern map that depicts a monster can be easily interpreted as a map of a fictitious location or as one imitating the old maps to appear antique. Nevertheless, sea monsters always reflected the mysteries of the abyss and the unknown of the deep sea. Tales of those creatures, that hunted down ships and sailors and terrified mariners through the ages, inspired cartographers who incorporated them in their maps to indicate unexplored areas. Monsters attacking ships or swimming in the seas first appeared in the 10th century and continued being depicted on maps till the end of the 17th century.⁴⁶

⁴⁶ Duzer 2013, p. 15

The geographic place of monsters on a map



THE LENOX-GLOBE

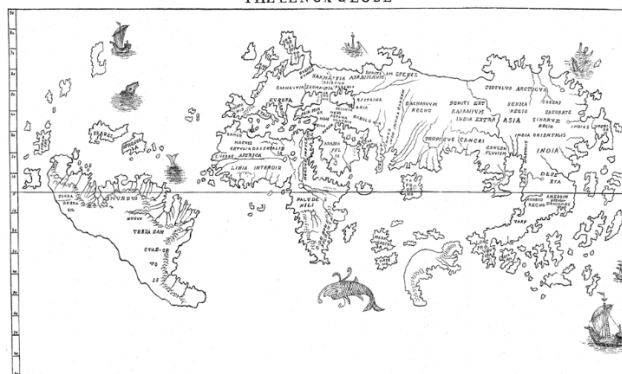


Fig 13&14. *Hic sunt Dracones*, meaning *Here are Dragons*, near the coast of south-eastern Asia, probably to notify for the existence of exotic and dangerous places. on the *Lenox Globe*, 1510. New York Public Library.

Apart from the belief that monsters were located in places with extreme climate, since the extreme conditions could contribute to the formation of extremities⁴⁷, people also believed that monsters lived at the edges of the earth as well and Pliny justified it, by writing in his *Natural History* that the uncivilized nature of the races living at the edges of the world is proportionate to the savagery of nature in those places: *It is hardly surprising that human and animal monstrosities are generated around the edges of this region, given the capacity of the creative mobility of fire to mould bodies and carve shapes. Even where water is present together with heat, the resulting fertility can be excessive. In Egypt, heat, combined with the fertile waters of the Nile, produced not only multiple births but also monstrosities which, even if they had occurred, could not have survived in less exuberant climates* (6.187).

It is also in the prologue of the *Liber Monstrorum* where we read that monsters are to be found *in the hidden parts of the world, raised throughout the deserts and the islands of the Ocean and in the recesses of the farthest mountains*, due to the growth of human population that made them move to the edges of the lands and into the sea:

⁴⁷ Duzer 2012, p. 391

... because now, when humankind has multiplied and the lands of the earth have been filled, fewer monsters are produced under the stars, and we read that in most of the corners of the world they have been utterly eradicated and overthrown by them, and now, cast out from the shores, they are thrown down to the waves, and that by the churning from the steep summit of the pole they turn from the edge of the entire circle and from every place on earth towards this vast abyss of the flood.⁴⁸ Ranulph Higden wrote in his *Polychronicon* as well that at the farthest reaches of the world often occur marvels and wonders, as though Nature plays with greater freedom secretly at the edges of the world than she does openly and nearer to the middle of it.⁴⁹ As it was mentioned above, distance could ensure that people were safe, far away from wondrous creatures, which appeared even more exotic as they were so difficult to reach, adding more charm to the mystery of their existence. The Greek historian Herodotus (484-425 BC) suggested too that *the extreme regions of the earth, which surround and shut up within themselves all other countries, produce the things which are rarest* (The Histories 3.116).⁵⁰



Fig 15. The *Hereford Mappamundi*, a T-O map from 1300 AC. The circumferential ocean divided the world in two parts: the known and the unknown one. The arrow points the place that Hercules built the pillars, so that the monsters could not enter the known world.

In medieval times, the centre of the world was believed to be Jerusalem⁵¹, a tradition that is linked to the ancient Greek one, placing Delfi as the *umbilicus mundi* (*omphalos* in Greek). As the history of the world begins in the furthestmost east, in the Garden of Eden, this is where people believed that humanity came from. In the furthestmost west, the boundaries of the known world were marked by the pillars of

⁴⁸ Duzer 2012, p.394-5

⁴⁹ Friedman 2010, p.2

⁵⁰ Duzer 2012, p. 391

⁵¹ Morawlecka 2012, p. 1

Hercules.⁵² Diodorus Siculus writes in his *Bibliotheca Historica* of the 1st century BCE that Hercules built that pillars, in order to prevent the sea monsters of the Atlantic Ocean entering the Mediterranean: *When Heracles arrived at the farthest points of the continents of Libya and Europe which lie upon the ocean, he decided to set up these pillars to commemorate his campaign. And since he wished to leave upon the ocean a monument which would be had in everlasting remembrance, he built out both the promontories, they say, to a great distance; consequently, whereas before that time a great space had stood between them, he now narrowed the passage, in order that by making it shallow and narrow he might prevent the great sea monsters from passing out of the ocean into the inner sea, and that at the same time the fame of their builder might be held in everlasting remembrance by reason of the magnitude of the structures* (4.18.4).⁵³ Pliny talks about regions *beyond the Pillars of Hercules* where *nature itself begins to fail* (Natural History 27.3).⁵⁴

Several classical authors, like Strabo, Pliny the Elder, Ptolemy and Gaius Julius Solinus talked about a series of islands in the Northern Sea and named them *Scandia* or *Scandza*, referring to the northernmost of those islands as *Thule*, *Thyle* or *Tile*. Some of the maps that were included in the early printed editions of Ptolemy's *Geography* even depicted Scandia and Thule. The frigid climate made some ancient and medieval authors believe that monsters lived there.⁵⁵ Pytheas of Massalia (350-285 BC) claimed that *wonders happen in the northern Atlantic* and Antonius Diogenes reported in his work *Wonders Beyond Thule* -that survives today as a summary by Photius- that he saw people and wonders in the far North, that no one would have ever thought.⁵⁶ Additionally, Adam of Bremen wrote in his work *Gesta Hammaburgensis ecclesiae pontificum* or *Deeds of the Bishops of the Hamburg Church* of the 11th century that *in that territory [northern Europe] live very many other kinds of monsters whom mariners say they have often seen*.⁵⁷

⁵² Morawlecka 2012, p. 1

⁵³ Duzer 2012, p.394

⁵⁴ Beagon 2007, p. 23

⁵⁵ Starkey 2017, p. 39

⁵⁶ Duzer 2012, p. 391-2

⁵⁷ Starkey 2017, p. 39. For the citation of Adam of Bremen see Tschan, F. J., 1959: *History of the Archbishops of Hamburg-Bremen*, translation, p.201. Columbia University Press.



Fig 16. The island *Tile* or *Thule*, as it appeared on Olaus Magnus's map *Carta Marina*, 1539.

However, a lot of monsters in Greek myths were to be found in ancient Greece and not far away from populated areas. The *Hereford Mappamundi*, for example, depicts the monsters that Odysseus encountered on his wanderings in the Mediterranean, a journey that was mapped by Abraham Ortelius in his *Parergon* of the *Theatrum Orbis Terrarum* from 1579. Pliny claimed that the Cyclopes and Laestrygonians, that Odysseus met, are indeed evidence that monsters can be found even in the middle of the world. The *Carta Marina* of Olaus Magnus depicts monsters close to inhabited areas as well.⁵⁸

Pliny believed that the sea was *the most savage part of nature* (Natural History 36.1.2)⁵⁹ and that the inventor of the ship brought great dangers to men (19.1.6). Furthermore, he commented about the ocean that it may be fertile and yielding, but it produces monsters because the waves and the winds constitute it unstable: *In mari autem tam late supino mollique ac fertili nutrimento, accipiente causas genitales e sublimi semperque pariente natura, pleraque etiam monstrifica reperiuntur perplexis et in semet aliter atque aliter nunc flatu nunc fluctu convolutis seminibus atque principiis, vera utfiat vulgi opinio quicquid nascatur in parte naturae ulla et in mari esse, praeterque multa quae nusquam alibi* (9.2). (*But in the sea, which lies spread out so widely and so yielding and productive of nourishment since it receives generative causes from above and is perpetually bringing forth progeny, a great many actual monstrosities are found, since the seeds and first principles are folded together and intertwined now in one way and now in another by wind and wave. So much so, that it is popularly believed that whatever is born in any area of nature also has a counterpart in the sea; and in addition, that a great many creatures are produced in the sea which are never found elsewhere*). According to Beagon, Pliny has probably been influenced by Aristotle, who wrote in his *Generation of Animals* that the sea has some of the characteristics of the other elements and can therefore sustain forms of life that are found on land (Gen. an. 761b10-15).⁶⁰ The Roman poet Albinovanus Pedo

⁵⁸ Papadopoulos & Ruscillo 2002, p. 207

⁵⁹ Duzer 2012, p. 417-18

⁶⁰ Beagon 2007, p. 23

associated sea monsters with the Atlantic: *And now they see day and sun long left behind; banished from the familiar limits of the world they dare to pass through forbidden shades to the bounds of things, the remotest shores of the world. Now they think Ocean, that breeds beneath its sluggish waves terrible monsters, savage sea-beasts everywhere, and dogs of the sea, is rising, taking the ships with it (the very noise increases their fears): now they think the vessels are sinking in the mud, the fleet deserted by the swift wind, themselves left by indolent fate to the sea-beasts, to be torn apart unhappily* (in *Suasoriae* 1.15).⁶¹ Lastly, we read in Psalm 103:25: *So is this great sea, which stretches wide its arms: there are creeping things without number: creatures little and great.*

The most notorious sea monsters

In this chapter, specific sea monsters will be discussed, so that the reader acquires a deeper knowledge about the context of the existence of such creatures and their significance on maps, although the sea monsters, that appear a lot of times on maps, are generic. The generic sea monsters usually have fins and heads that resemble those of terrestrial creatures, but their body is similar to that of marine animals and fish. Sometimes, they combine characteristics of monstrous creatures or represent a variation of them,⁶² as the case is with the map of Africa, *Dell’Africa a sue provincie* of Giuseppe Rosaccio of 1594 and a map of Europe by Gerard Mercator, *Europae descriptio* from 1572. On the maps, a double sea horse with a shell on its back and a bird-headed sea monster in the Atlantic Ocean appear accordingly. However, we understand that it is a sea horse, because a more accurate image of it appears again later, in Rosaccio’s *Vniversale descrizione di tvtto il monde* that was published around 1643 (fig 34) where Neptune rides a single sea horse with a shell on its back in the Atlantic Ocean. The reason why several sea monsters consist partly of body parts of terrestrial creatures, can be traced in the medieval belief that every land creature has a counterpart in the sea and Isidore of Seville expressed that in his *Etymologiae* (12.6.4-5).⁶³

⁶¹ Duzer 2012, p. 417-18

⁶² Latva & Scurnik 2016, p. 18

⁶³ Duzer 2014, p.320



Fig 17&18. The double sea horse in *Dell’Africa a sue provincie* of Rosaccio, 1594 and the bird-headed monster in *Europae descriptio* of Mercator, 1572. British Library and Herzogin Anna Amalia Bibliothek.

some monsters, the most notorious ones, were among the most famous creatures in literature and art that inspired the creation of legends since the early ages.

a) *The anthropomorphic ones*

The sea monk

There was the belief in the Middle Ages that anthropomorphic creatures lived in the Northern seas and we read about them in bestiaries, chronicles, novels and encyclopedias. Antoine de la Sale wrote: *One sees there are monstrous fishes which are very marvelous; because in the front part, there are figures of horses, the others of beef, the others of deer, the others of goats, the others of dogs, and the others of men and women of the belt in addition, and the rest of fish [...].*⁶⁴ It was believed that, apart from religious signs, anthropomorphic monsters could be the result of a semen of a drowned man.⁶⁵ One of those marvelous creatures was the *sea monk*, that is reproduced very anthropomorphically in art. The sea monk was also known as the *sea bishop*, *bishop-fish* or *monk-fish*⁶⁶ and in the Latin texts we find it as *monachus piscis*, *monachus marinus* or *episcopus marinus*, although Conrad Gessner in his *Historiae animalium* of the 16th century discriminated the latter two in two different monsters. He described them as *sea-people* (*De hominibus marinis*), suggesting that they represented religious faults and this is the reason they looked like Roman Catholic clerics: the *monachus marinus* had a bishop’s mitre on its head and the *episcopus marinus* had a tonsured head (Book IV, 519-522).⁶⁷ However, in *Otia Imperialia* of Gervais de Tilbury, the marine monks are considered to be the marine

⁶⁴ Leclercq-Marx 2018, p. 54-55 For Antoine de la Sale, see Desonay, F., 1935: *Antoine de la Sale, Œuvres completes. In La Salade, Vol.1, p. 134.*

⁶⁵ Hendrikx 2018, p. 133

⁶⁶ Honegger, p. 972

⁶⁷ Hendrikx 2018, p. 132-135.

counterparts of terrestrial animas.⁶⁸ Pierre Belon described it in his book *De Aquatilibus* of 1553, based on drawings that were sent by the Danish king Christian III to Charles V, depicting a strange fish that was caught in the town Del Elepoch (Danish Øresund) in 1546, and he also provided a picture of it. Bellon wrote that, according to reports, the fish lived for three days and moaned in despair. He mentioned that monster again in his book *Nature et diversité de poisons*. The sea monk is described in the Latin *Libri de Piscibus* of the same century and is depicted in a woodcut in a similar way, that appears again in the French translation *Histoire* of the work of Rondelet.⁶⁹ Godefroid of Viterbo from the 12th century, who served as the secretary of the Roman emperor Frederick Barbarossa, wrote in his chronicle: *Qua mare discedit saepius, atque redit. Aequoreos when boves ibi nauta capessit; Pisces ibi monachus, seu forma monastica crescit. Fertque cucullatum per maris alta caput. Calceus est illi conformis et ampla cuculla, Tam bene disposita, qua non foret aptior ulla; Et quasi vox hominis garrula lingua satis. Frons, manus et vultus, hominum moderamine fultus [...] Mergere naviculas saepius arte parat. Piscis ibi cantat quasi gallus, voce Sonora.* (Where the sea goes often enough and comes back. There a monk fish or monkfish develops, it carries through the depths of the sea a hooded head. He has an exactly matching shoe and a wide hood, so well-disposed that there would be no more suitable, and his tongue is quite talkative as much as a human voice. His forehead, hands and face (are human) [...] Quite often, he causes the sinking of small ships by his art. The monkfish then sings like a rooster with a sonorous voice.)



Fig 19. The drawings of the sea monk, the sea bishop, a triton and a sea satyr, by Gaspar Schott in his *Physica Curiosa, sive mirabilia naturae*, 1622, exact copies of the sea monsters drawn by Gessner (1558: 519, 520, 522, 1197 accordingly). Smithsonian Library.

⁶⁸ Leclercq-Marx 2018, p. 60

⁶⁹ Mackenzie 2014, p. 333-334

Thomas de Cantimpré located them in the Brittanic Sea, as we read in *Hortus Sanitatis*, liber IV: *Ex Libro de naturis rerum monachi maris dicti sunt quia caput habent in modum monachi recenter rasi, coronam desuper rasam et candidam et circulum in modum crinium super loca aurium. Faciem tamen non habet in toto similem homini, quia nasum habet pisci similem et os naso continuum. Ceterum in inferioribus habet formam piscis [...] Hoc monstrum homines super ripas itinerant husbands liberate allicit and coram eis super aquas ludit: quod if hominem admirantem propinquare emptiness, appropinquat and ipse and, if datur facultas, hominem rapit and trajici in profundum, sicque carnibus ejus satiatur* (According to the *Liber de natura rerum*, the monks of the sea are so called because they have the head of a monk who has just been shaved: on the top of the skull, they have a white tonsure and a circle that is like the hair above the ear area. The face of the monkfish, however, is not exactly like that of the man, because he has a fishy nose and an attached mouth. In the rest, in its lower parts, it looks like a fish [...]) This monster likes to attract the men who walk on the shore and he plays on the surface of the waters in front of them: and if he sees someone approaching in wonder, he too approaches and, if the opportunity is given to him, he catches him, plunges into the depths, and thus feeds on his flesh.)⁷⁰ Gessner agreed with the aspect of the sea monk being a dangerous creature and listed several reported sightings of it. That way, it seems that, although he doubted a big part of the text of Olaus Magnus *Historia de gentibus septentrionalibus* regarding some of the information included in it as unreliable, he didn't doubt about the existence of the sea monks. Gessner wrote as well: *Itaque copiosior saepe sui, ut non solum rerum cognition prodessem, sed iis etiam qui solute aut numerosa oration Graece Latineue differre aut scriber vellent, syluam vocabulorum locationumque suppeditarem [...]. (I have also often gone into great detail by providing not just knowledgeable facts, but a rich supply of words and expressions as well, for those who want to write single or multiple texts in Greek or Latin [...]).* Therefore, he declared that his work could be used as a source for both literature and scholarly work, because of the undeniable facts provided to the reader in a sophisticated way. Furthermore, he cited the opinion of Rondelet regarding the existence of the sea monk, saying that the latter is not determined whether the creature exists: *[...] vera ea sit an non, nec affirmo, nec refello [...]* (Rondelet 1554, 494). *[...] (whether this is true or not, I neither confirm nor deny) [...].* It is true that Rondelet had a scepticist attitude towards some sea monsters, but especially towards some depictions of them. In his description of the *monstrum leoninum*, he declares that he doesn't doubt about its existence, just because the physician Gijsbert Horst talked about it: *Quamobrem quum dubitare extitisset ne revera aliquando monstrum istud marinum Gilbertus Germanus, [...] affirmavit certo*

⁷⁰ Leclercq-Marx 2018, p. 57-59. For the citation in *Pantheon* of Godefroid of Viterbo, see Pistorius J. & Struve, B. G., 1726: *Gottfried von Viterbo: Pantheon*, p.29. Regensburg. For the translation of the passage in *Hortus Sanitatis*, see Jacquemard C., Gauvin B. & Lucas-Avenel M. A., 2013: *Hortus sanitatis: Livre IV, Les Poissons*, p. 327. Presses Universitaires de Caen.

*se scire, [...] captum in medio mari fuisse. Quare ex illius fide quale fuerit hoc monstrum describere non dubitavi. [...] (Rondelet 1554, 491). (Since I doubted whether it was a sea-monster, Gilbertus Germanus [...] has assured me that he knows for certain it was caught at sea [...]. It is because of my trust in such a person that I have not hesitated to describe this monster).*⁷¹ However, it is probable that the legend of the sea monk originated from sightings of seals or walrus.⁷²

Giacomo Gastaldi created a world map in the middle of the 16th century that was titled *Cosmographia universalis et exactissima iuxta postremam neotericorum traditionem* (A universal and precise cosmography according to the latest authors) and was published in Venice in 1561. It depicted several sea monsters, the most of them generic. However, in the western edge of the map, north of the equator, there is a sea monk with a crown, a creature that looks like a merman but with aquatic forelegs (it's not for sure that he has a tail hidden by the waves but it is probably a copy from Gessner's book) and a sea bishop. It's more than probable that Gastaldi used the latest scientific publications of Belon's *De aquatilibus libri duo* from 1553, Rondelet's *Libri de piscibus marinis* from 1555, and of *Historiae animalium liber III* of Gessner as sources for those monsters.⁷³



Fig 20&21. The *Cosmographia universalis et exactissima iuxta postremam neotericorum traditionem* of Gastaldi, 1561 and the anthropomorphic monsters. British Library.

⁷¹ Hendrikx 2018, p. 132-135

⁷² Honegger, p. 972

⁷³ Duzer 2013, p. 100

The sea knight, the sea unicorn and the Zytiron

Alexandre Neckham, referring to the *sea-knight*, mentioned in his encyclopedia of the 13th century that *there is, as reported, in the waters of the sea, an armed fish in the manner of a soldier* ([...] *piscis armatus in modum militis*). Additionally, Gervais de Tilbury wrote in *Otia Imperialia*: *fully armed knight rides the back of a dolphin, who people think he is of the race of knights*, but he cited it as the marine counterpart of a terrestrial animal and not a man.⁷⁴ In the novel *Perceforest* of the 14th century the *sea knight* is located on an island in Britain.



Fig 22&23. The *Equus Neptuni* or sea horse by Pierre Belon, 1553 and the *Zytiron* in Hortus Sanitatis, 1491. British Library and *Bibliothèque Royale de Belgique* accordingly.

Another creature, whose appearance resembles in a way the depictions of the sea knight, is the *sea unicorn*. It is usually depicted as half fish and half unicorn. Vincent de Beauvais of the 17th century claimed that its name derived from its horn,

⁷⁴ Leclercq-Marx 2018, p. 54. For Neckham, see Wright, T., 1863: *Alexandri Neckam De naturis rerum*, p.144. Longman, Roberts & Green, London. For Gervais de Tilbury, see Duchesne, A., 1992: *Gervais de Tilbury: Le livre des Merveilles. Divertissement pour un empereur (Troisième partie)*, p. 75. Les Belles Lettres, Paris.

with which it could hit the ships and sink them. However, ships could easily avoid that, once they could see the creature from distance, because it was very slow. Its speed was the only thing that differentiated it from the swordfish. In a copy of *De Natura Rerum* of Thomas de Cantimpré it appears as a swordfish, having a big horn in its forehead and wings. He resembles his nostrum with a sword, influenced by the Greek words *xiphias* (that is the swordfish) and *xiphos* (that is the sword). In the *Latin Book of the Treasury*, the creature has a sword on its muzzle and in an English bestiary of the 13th century it has a shield as well to protect itself. That way, the sea unicorn that resembles sometimes the swordfish, it shares some characteristics with the sea knight, which can be confused with the *Zytiron* as well. Thomas de Cantimpré said about it: *Zytiron monstrum est marinum, quod vulgus vocat maris militem, sicut dicit Liber rerum, et est ingens ac fortissimum. Huiusmodi dispositionem habere dicitur: in parte anteriori quasi formam armati militis prefert et caput quasi casside galeatum ex cute rugosa ac dura et firma nimis. A collo eius dependet scutum longum et latum et magnum et cavum interius, ut in eo possit monstrum contra ictus pugnantium more defendi. [...] Est autem ipsum scutum forma triangulare, duritia ac firmitate tam validum, ut vix unquam possit iaculo penetrari. Brachia habet fortia nimis et loco manus quasi manum bisulcam, cum qua ita validissime percutit [...]. In mari Britannico hec monstra habentur. (The Zytiron is a sea monster that is commonly called a seafarer, as the Book of Nature says, and he is huge and very strong. It is said that his members are arranged in the following way: in its front part, it presents the appearance of an armed soldier, with his head wearing a helmet that seems of metal, but is very hard, solid and rough. At his neck hangs a long, broad and large shield, hollow inside, with which the monster can protect himself from hits, like a fighter. [...]. The shield is triangular in shape, so strong in its hardness and strength that a weapon can barely penetrate it. He also has very strong arms, but instead of hands, he has a kind of forked member with which he assaults very violently [...]. We meet these monsters in the British Sea).*⁷⁵ A hybrid zoomorphic creature, that resembled the sea-unicorn, was the *sea horse* or *Equus Neptuni*, which Gessner believed that was fiction and does not mention any contemporary reports about it in his work (Gessner 1558, 433).⁷⁶

⁷⁵ Leclercq-Marx 2018, p. 55-57. For Thomas de Cantimpré see Boese, H., 1973: *Thomas Cantimpratensis, Liber de natura rerum*, p. 249.

⁷⁶ Hendrikx 2018, p. 135



Fig 24&25. A swordfish in the Atlantic, on the map *Geografia tavole modern di geografia* by Antione Lafrey, 1575 and a monster that resembles it on the map *Islandia* (Fig -) in Ortelius's *Theatrum Orbis Terrarum*, 1587. According to the map key, that monster is *Nahval* and it has a tooth on its face. Library of Congress and British Library accordingly.



Fig 26&27. The sea unicorn on *Quiuirae Regnu Cum Alijs Versus Borea* by Cornelis de Jode, 1593 and the detail of a terrestrial unicorn on the 1546 world map of Desceliers (?), as -according to the medieval belief- every terrestrial animal had its counterpart in the sea. The University of Manchester Library.

The Sirens

In ancient times, the *sirens* were imagined as women-birds of vicious character, something that is reflected in *Odyssey*.⁷⁷ In the *Physiologus* the siren is described as a bird-woman and figured as a woman-fish.⁷⁸ Indeed, Gessner pointed out in *Historia Animalium* that sirens were initially birdlike creatures, but more recently were thought to be half fish, and he included a report of sighting of a such creature: *Olim a Selando quodam accepi, in patria sua ad oram Germaniae, monstrum marinum quoddam vernacula voce nominari ein Füne, facie virginea, inferiore corpore piscis, magnitudine ovis* (Gessner 1558, 1056). (*Once I heard from a certain person from Sealand, that in his fatherland at the fringes of Germany, a certain sea-monster is in the vernacular called a fairy, with the face of a girl, the lower body of a fish, and the size of a sheep*).⁷⁹ Additionally, we read about them in the much earlier *Liber Monstrorum* that: *Sirenae sunt marinae puellae, quae nauigantes pulcherrima forma and cantu dulcedinis decipiunt, and a capite us umbilicum sunt corpore uirginali and humano generi simillimae, squamosas tamen piscium caudas habent, quibus semper in gurgite latent.* (*The sirens are young girls of the seas which deceive the navigators by their beauty and by their very soft songs: from the head to the umbilicus, they have a body of young-girl, they do however have tails of fish covered with scales with which they remain in the waters*).⁸⁰ Therefore, this description of the sirens reminds us of the more modern depictions of the mermaids.

The mermaids in the beginning were depicted in the literature as benevolent and caring creatures, before their demonization by the Church. Then they became monsters living in the seas, resulting in their mix up with the ornithomorphic sirens. Saint Bernard of Clairvaux believed that the mermaids warned the sailors about upcoming storms, a behavior that was attributed to dolphins. St. Servians of Tongeren in his work *Gesture* of the 11th century wrote that sirens were compassionate towards the misfortunes of people: *Quid, quod sepe fertur, semihominesque pisces semipisquesque homines Syrenas tempestatem nautis precinuisse, quantumque humane habuerant form, undis ultro enudasse mortuosque passim fluitantes uiros ulnis subleuatos ad conspectum nauigantium sustentasse celumque pontumque dulcis querele altisonis uocibus personuisse ?* (*What good is it to say, since it is often done, that fishes half-wives and women half-fish, the sirens, had predicted the storm to the sailors, how much they had human form; what good was it to say that they had spontaneously stripped [the sailors] into the waves, which they had brought to the sight of those who sailed the dead men, tossed on all sides and supported by the arms, and that they had made sound the sky and the sea with their softly plaintive voices,*

⁷⁷ Verner 2005, p. 112

⁷⁸ Leclercq-Marx 2018, p. 62

⁷⁹ Hendrikx 2018, p. 132

⁸⁰ Verner 2005, p. 112. For the translation of the *Liber Monstrorum* see Orchard, A., 1995: *Pride and Prodigies: Studies in the Monsters of the Beowulf Manuscript*. Cambridge.

which resound loudly?).⁸¹ But the most of the legends linked sirens or mermaids to the seductive female creatures, willing to lure the sailors and drown them. It was also the comparison of sirens to harbor-side prostitutes, made by Isidore of Seville, that strengthened the image of them as females trying to seduce and trick men.⁸² Christopher Columbus reported having seen three *female forms* off the coast of Hispaniola that rose high out of the sea, but were not as beautiful as they are represented, a description that we find in *Hortus Sanitatis* as well, where we read that *syrenas* were considered *deadly animals that have the figure of a woman with a hideous face*. The half human-half fish creatures that resembled the female mermaids were the *mermen* or *tritons*, their male counterpart.⁸³ A very early representation of mermen is found on the Assyrian Frieze of the transportation of timber from the palace of king Sargon II in Khorsabad, northern Iraq.⁸⁴

On the world map of 1550 of Desceliers, there is a siren south of the southern tip of Africa looking her image in a mirror, as a gesture of vanity, and a ship passes by close to her. The mirroring as a symbol of vanity may relate to the classical ages and the ancient Greek myth of *Narkissus*, a young man who used to mirror himself on the waters of a lake and admired his beauty, until his death; there a flower grew and was named after him.⁸⁵



Fig 28&29. The world map of 1550 of Desceliers and the detail with the siren. The British Library.

Ambroise Paré in his treaty on monsters and marvels from the 16th century included mermaids and more humanoid sea creatures,⁸⁶ a practice that Gessner followed as well in his work, by including descriptions of the *sea-satyr* (*satyrus*

⁸¹ Leclercq-Marx 2018, p. 62. For Saint Bernard de Clairvaux see Wilhelm, F., 1910: *Sanct Servatius, oder wie das erste Reis in deutscher Zunge geimpft wurde. Ein Beitrag zur Kenntnis des religiösen und literarischen Lebens in Deutschland im 11 und 12 Jahrhundert*, p.125. Beck, Munich.

⁸² Hendrikx 2018, p. 132

⁸³ Brito 2013, p. 14

⁸⁴ Duzer 2013, p. 13

⁸⁵ Duzer 2013, p. 94-97

⁸⁶ Brito 2013, p. 14

marinus) and the tritons.⁸⁷ Damião de Góis in his *Urbis Olisiponis Descriptio* of the 16th century refers to sirens, nereids and tritons as (...) *a kind of people that the locals start calling marine men because they have the skin surface with scales scattered almost over the entire body/ (...) such people owed their origin to marine men or tritons (...)/ The Tritons jumped to the shore and, once in a while, had the custom to come to the beach (...)*. Furthermore, Cavazzi in his *Relação dos três reinos do Congo*, published in 1687, also gives a very detailed description of the fish-woman: *There is one [fish] that Europeans call fish-woman and local name is Ngulu-maza [literally, Kikongo or pig water], beautiful name, but so horrendous. Has the muzzle gaping but small in comparison with another that appears to be a male. I think this is the famous triton from fables of mythology, the female may be considered the naiad of the old*. Interesting is the case of the double tailed mermaids too, that are mentioned by the Dutch scholar Adriaen Coenen in his books of the 16th century.⁸⁸ Traditionally, sirens were located in the Indian ocean⁸⁹ and there are several maps placing them there.

On Gastaldi's *Cosmographia universalis et exactissima iuxta postremam neotericorum traditionem* of 1561, southwest of the southern tip of Africa, Poseidon or Neptune rides a chariot pulled by two horses -probably sea horses- representing the Triumph of Neptune as seen in Roman mosaics, and reflecting the influence of classic antiquity in Renaissance art. A two-tailed siren holds a laurel wreath, probably for him.⁹⁰ There is a similar drawing of Neptune, incorporated in an edition of Gastaldi's *Cosmographia* published in Venice in 1569, where Neptune is placed in the lower margin of the map, on the left corner. The scene of the Triumph of Neptune is found in more Renaissance maps, such as the *Vniversale descrizione di tutto il monde* of Giuseppe Rosaccio published in around 1643, where he rides a sea horse with a shell as saddle in the southern Atlantic Ocean.

⁸⁷ Hendrikx 2018, p. 132

⁸⁸ Brito 2013, p. 15-18

⁸⁹ Duzer 2013, p. 80

⁹⁰ Duzer 2013, p. 101



Fig 30&31. Gastaldi's *Cosmographia* published in 1569 and the *Vniversale descrizione di tutto il monde* of Rosaccio, 1643. Houghton Library, Harvard University and Library of Congress accordingly.

Close to the siren on Gastaldi's *Cosmographia* 1561, there is a humanoid monster with long hair and long arms with long branching fingers. The monster reappears in the Atlantic Ocean, off the northern coast of South America, on the 1587 multi-sheet manuscript world map of the Milanese cartographer Urbano Monte. The geographical treatise that Monte published, says that: *...in the ocean here, there often appear some fish in human form of such strangeness, that raising themselves above the water they surpass the highest masts of ships, so that, screaming horribly and making some valleys in the water, they move themselves with their arms which they have in the shape of great tree trunks twenty five palms long, and there is no boatswain's mate so brave that he would not be terrified by their monstrosity.*⁹¹ I would suggest that this creature, resembling an old man in the depictions, may relate to the ancient Greek deity of water, Nereus, who was also called Old man of the sea. Although Monte's description of the creature's behavior doesn't resemble that of

⁹¹ Duzer 2013, p. 112

Nereus according to mythology, it is probable that the myth of the humanoid creature haunting the Atlantic derived from the one of Nereus.

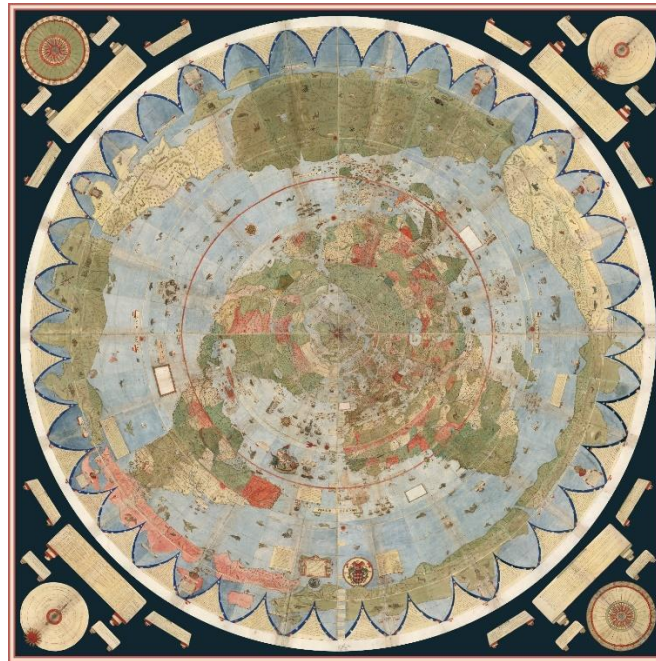


Fig 32/33. The 60 pages manuscript world map published in 1587 by Urbano Monte. The map is a planisphere with the 60 sheets joined digitally together by Brandon Ramsey. Detail of the humanoid monster off the coast of South America in the Atlantic Ocean.

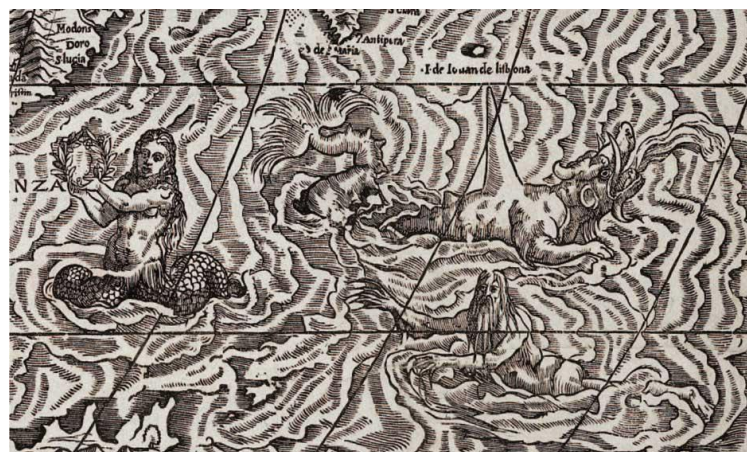


Fig 34. A double tailed siren next to a hybrid and the humanoid monster in the Cosmographia of 1561 of Gastaldi. British Library.

(Personal note 1: According to the Greek mythology, the Nereids were female deities of the sea, daughters of Nereus, who was the son of Pontus and Gaia and was also called Old Man of the sea. They lived in the sea and accompanied the god of sea, Poseidon. The Naiads were female deities of the fresh water, who accompanied-together with the satyrs-the god of wine Dionysos. Triton was a male deity with the torso of a man and the tail of a fish, son of the god Poseidon and the sea goddess Amphitrite, living in the sea. He had a seashell, which he used to blow and calm the sea.

Personal note 2: According to the medieval Greek mythology, Mermaid was a woman and the sister of Alexander the Great. In the first version of the legend, she drank the water of immortality that Alexander had acquired for himself and became a mermaid. In the second one, she spilled the water accidentally. She was so sad, that she begged the gods to make her live forever, to make sure that her brother would be well, even without possessing the water of immortality. The gods transformed her into a mermaid and after that moment she began living in the sea, asking the sailors of the passing by ships whether her brother was still alive. Every time that the sailors would say that he was dead, she would be so angry that she would create storms, but every time they would say that he was still alive, she would calm the water, allowing them to sail in safety.)

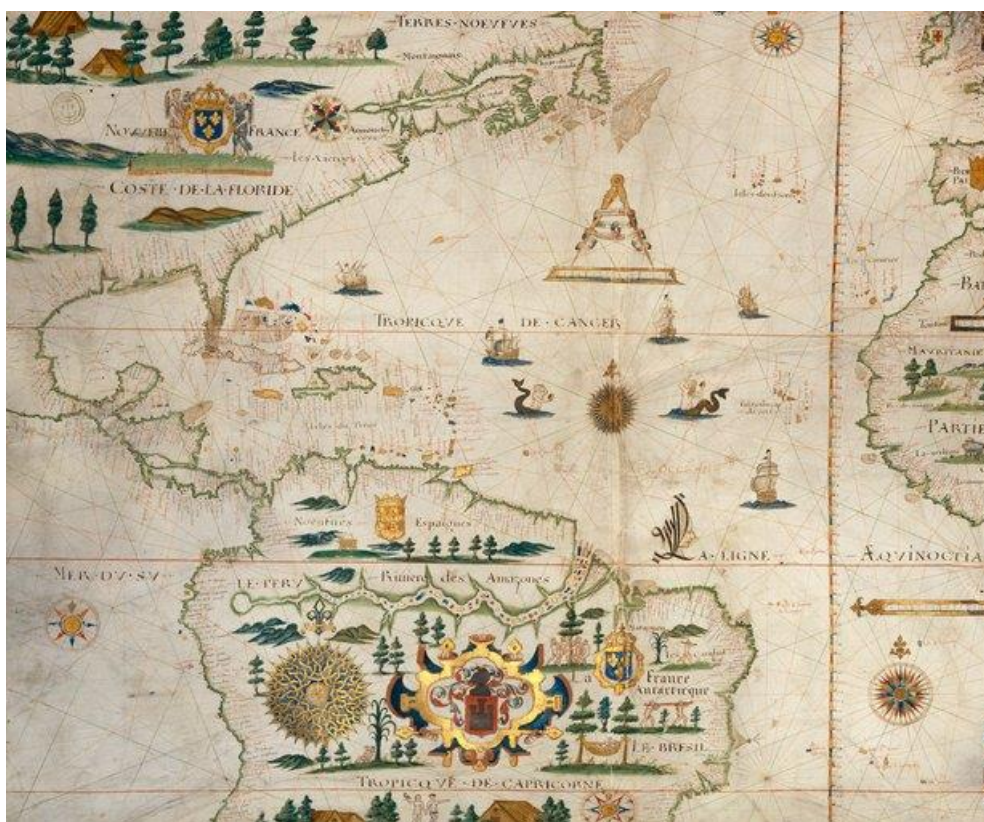


Fig 35. Two sirens looking themselves in the mirror on a map of the Atlantic Ocean by Pierre de Vaulx, 1613. National library of France.

b) The zoomorphic monsters

Jasconius

The story of the Irish monk Brendan was written by a scribe in the 8th century. According to it, Brendan and fourteen fellow monks were traveling in a coracle, a light wooden boat, covered with animal hide, to find the Land of Promise of the Saints. They experienced a lot of marvels on their way, such as Judas Iscariot imprisoned in eternity, birds singing hymns. The monks landed on a rocky island, with hardly any sand on the beach and a few trees, but Brendan stayed on board, because he knew where they had landed. When they started preparing the food and the food began to boil in the cauldron, the island started moving. The monks ran to the boat, seeing the island disappearing across the sea. Brendan talks to the monks: "Have no fear, my sons. Last night God revealed to me the meaning of this wonder in a vision. It was no island that we landed on, but that animal which is the greatest of all creatures that swim in the sea. It is called *Jasconius*." Every year *they found Jasconius in the usual place (on Easter eve), climbed out onto his back, and sang to the Lord the whole night, and said their masses the next morning.*⁹² The creature even brought back to them every year their lost cauldron.⁹³ On their journey, they found more monsters: a huge creature, shooting out spray from its nostrils, tried once to hit them. But after Brendan prayed to the God "Lord, deliver your servants now, as of old you delivered David out of the hand of the giant, Goliath. Deliver us, O Lord, as you rescued Jonah from the belly of a great whale.", a second sea monster appeared and attacked the first. It killed it and swam back the way it had come.⁹⁴

The geographer and cartographer Pîrî Reis created a portolan chart in 1513 depicting the whole known world by his time, but only a fragment of it survives till today. He named it *Carte de l'Atlantique*,⁹⁵ focusing on the exploration of the New World. It displays cities and rulers, rivers, mountains and animals.⁹⁶ In the North Central Atlantic Ocean, there is a carrack next to a large fish resembling a whale with two men on it, lighting a fire. It is drawn upside-down, with the south at the top, following the Arabian maps' iconographic structure. The depiction of the whale is upside-down, because -as stated by McIntosh (2000)- some medieval mappamundi followed the concept of the Arabian maps, that were oriented with the south at the top. According to the inscription of Pîrî Reis: "It is said that in ancient times a priest called Sanvolrandan travelled through the Seven Seas. He is said to have come across

⁹² Swenson 2017, p. 25-28. For the legend of St. Brendan see the translation of Webb, J. F., 2004: *The Voyage of Saint Brendan. In the Age of Bede*, p.241 and 266. Penguin Books.

⁹³ Mittman 2017, p. 47

⁹⁴ Swenson 2017, p. 28-29 For the legend of St. Brendan see the translation of Webb, J. F., 2004: *The Voyage of Saint Brendan. In the Age of Bede*, p.253. Penguin Books.

⁹⁵ Masseti & Veracini 2016, p. 41

⁹⁶ Masseti & Veracini 2016, p. 52

this fish, to have landed on it, thought it was dry land, and lit a fire on this fish. When the back of the fish began to burn, it plunged under the water. The people fled in the boat and came to the ship. These things are not reported by the Portuguese infidels. It is taken from ancient mappamundi". The drawing refers to the St. Brendan's legend and the fish resembles the fish from which Jonah emerges, in a Persian manuscript from Vienna.⁹⁷

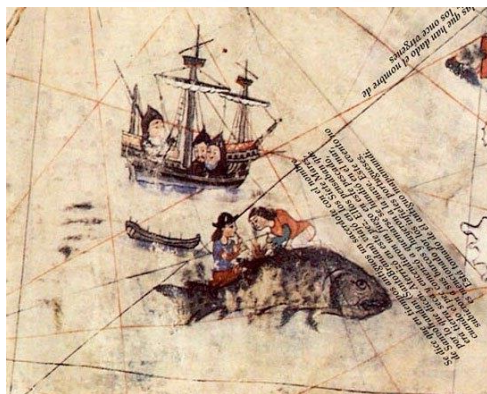


Fig 36/37. The Carte de l'Atlantique of Pîrî Reis and detail with Jasconius, 1513. Library of Topkapi Palace Museum.

Coenen in his *Walvisboeck (Whale Book)* of the 16th century wrote that people often mistook a big creature for an island and moored their ships upon it. He called it *Aspidochelon*.⁹⁸ Gessner, likewise, referred to the monstrous whale, on whose back sailors gather around a cooking fire in Olaus Magnus's work, as *Aspidochelon* (Gessner 1558, 138). The word *Aspidochelon* though derives from the Greek words *ασπίδα* (*aspidha*) and *χελώνα* (*chelona*), that is *shield* and *turtle* accordingly. Therefore, the creature could be described as a turtle and not only as a whale in legends of the Middle

⁹⁷ Masseti & Veracini 2016, p. 44-45

⁹⁸ Swenson 2017, p. 23-25

Ages, sometimes considered to have evil intentions by trying to trick sailors and drown them. The creature was also described in the *Physiologus* of the 2nd century ACE.⁹⁹



Fig 38&39. The flying turtle on the map of northern Europe published by Tramezini in 1558 and on *Tabulae Geographicae C. Ptolemei* by Mercator in 1578. British Library.

The sea-serpent, sea-dragon and the Leviathan

The *sea-serpent* and the *sea-dragon* in both literature and art seem to relate to each other, along with their counterparts on land, the snake and the dragon accordingly. Thomas de Cantimpré wrote in the introduction to the liber VI: *De monstribus et beluis marinis* of the *Liber de Natura Rerum* that: *Vix enim terra animal quadrupes habet, quod non in parte simile mare habet.* (cf. fn. 5, 232) (*The earth scarcely has a four-footed animal, which is not found in some likeness in the sea*) and he added about the sea-dragon: *Draco maris monstrum est crudelitate horridum. Instar draconis terrestris in longitudinem extenditur, sed alis caret. Caudam tortuosam habet, caput secundum magnitudinem corporis parvum, sed hyatum oris horridum. Squamas et cutem duram habet. [...] Pinnas habet pro alis, quibus utitur in natando.* (cf. fn. 5, here pp. 237) (*The sea-dragon is an exceedingly cruel monster. It exceeds the terrestrial dragon in length, but lacks wings. It has a coiled tail and a head that is, in relation to the size of the body, small; yet its maw is terrible. Its scales and skin are hard. [...] Instead of wings it has fins, which it uses for swimming.*)¹⁰⁰ But what a dragon is?

We read in the *Etymologiae* of Isidore of Seville: *The dragon is the largest of all the snakes, or of all the animals on earth. The Greeks call it δράκων, whence the term is borrowed into Latin so that we say draco. It is often drawn out of caves and soars aloft, and disturbs the air. It is crested, and has a small mouth and narrow pipes through which it draws breath and sticks out its tongue. It has its strength not in its teeth but in its tail, and it causes injury more by its lashing tail than with its jaws...Also, it does not harm with poison; poison is not needed for this animal to kill, because it kills whatever it wraps itself around. Even the elephant with his huge body is not safe*

⁹⁹ Hendrikx 2018, p. 132

¹⁰⁰ Honegger, p. 5-6

from the dragon, for it lurks around the paths along which the elephants are accustomed to walk, and wraps around their legs in coils and kills them by suffocating them. It is born in Ethiopia and India in the fiery intensity of perpetual heat. (Etymologiae 12.4.4).¹⁰¹ In ancient Greek, the word δράκων (drakon) originated from the verb δέρκεσθαι (derkesthai), that meant to see clearly. Therefore, *dragon* is the creature that can see clearly or watches carefully, and probably that was the reason why the dragon originally associated to myths with gold, as guardians of treasures. The myths of the dragon Ladon, that protected the golden apples of the Garden of Hesperides, and the one of the dragon protecting the Golden Fleece that Jason obtained, might strengthen this view.¹⁰² Some works from the Old Norse and Anglo-Saxon literature, such as *The Elder Edda*, *Skaldskaparmal* of *The Prose Edda*, the *Volsunga Saga* and *Norna-Gests þattr* and *Beowulf*, connect the dragon with materiality, that is linked to greed, and therefore with the moral death, something that is reflected in the Christian ideology as well.¹⁰³ Sagas additionally talk about the *draugar*, that is the revenant or haunting after a corrupted person's death, so the greed is also connected to physical death.¹⁰⁴

Although the *draco marinus* is first mentioned by Pliny in his *Natural History: rursus draco marinus, captus atque inmissus in harenam, cavernam sibi rostro mira celeritate excavat* (9.82.27) (*again, the sea-dragon, when he is captured and thrown onto the sand, digs for himself wonderfully quickly a cave with his snout*) it's more than probable that this creature is the *Trachinus draco*, the greater weever fish, and not an "actual" dragon. *Beowulf* of the 1st century ACE is the first text to mention the sea-dragon: *The water was infested with all kinds of reptiles. There were writhing sea-dragons and monsters slouching on slopes by the cliff, serpents and wild things such as those that often surface at dawn to roam the sail-road and doom the voyage. The sea-dragons here, together with the nicras, smaller sea-monsters, pose some obstacles to the hero on his way.*¹⁰⁵

The 1497 edition of the *Hortus Sanitatis*, the illustrated encyclopedia of plants and animals that derived information about sea monsters from the *Etymologies* of Isidore of Seville and the *De natura rerum* of Thomas of Cantimpré,¹⁰⁶ used that description to talk about the sea-dragon, but the depiction of it on the illustration provided was very different than the text. The fins of the dragon, that run parallel to the spinal ridge, can be recognized as such, due to their similarity to the ones of a

¹⁰¹ Bell, p. 4. For the translated passage of Isidore of Seville, see Barney, S. A., Lewis W. J., Beach, J. A. & Berghof O., 2006: *The Etymologies of Isidore of Seville*, p.255. Cambridge University Press.

¹⁰² Sherlock 2014, p. 5

¹⁰³ Sherlock 2014, p. 8-10

¹⁰⁴ Sherlock 2014, p. 29-30

¹⁰⁵ Honegger, p. 3-4. For the translation of the *Beowulf*, see Heaney, S., 2007: *Beowulf*, p.99. London.

¹⁰⁶ Duzer 2013, p. 18

canus marinus that is depicted in the encyclopedia.¹⁰⁷ A dragon that resembles the description of Thomas de Cantimpré is the one drawn in the Descelier's world map of 1546, where the dragon is located off the west coast of Java Minor and it has a small head, a long neck, a long tail and fins.

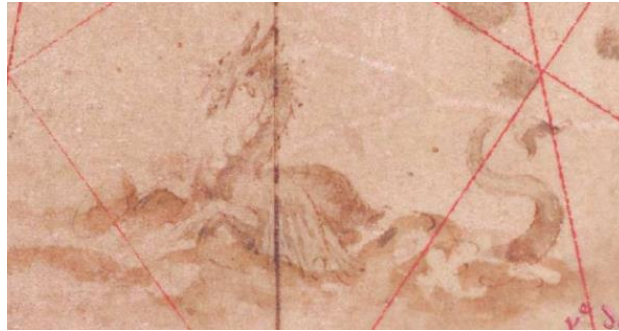


Fig 40. The sea dragon on the world map that is attributed to Desceliers, 1546. The University of Manchester Library.

Adding to that, Edward Topsell wrote in his 17th century *History of Four-footed Beasts and Serpents* that *there be some dragons which have wings and no feet, some again have both feet and wings, and some neither feet nor wings, but are only distinguished from the common sort of Serpents by the combe growing upon their heads, and the beard under their cheeks and he provided a picture of those three dragons, but doesn't mention the sea-dragon.* (1658, 705). We do find a picture of one though in a late 13th century French manuscript, having no fins.¹⁰⁸ Another monster, the *simia marina*, was depicted and described as a serpent by the scholar Girolamo Cardano in his work. However, Gessner, who included the image in his book, described it as an animal with the tail of an aquatic animal and the head of an ape and he added that *he would not have included it, if it hadn't been the work of the specific man* (Gessner 1558, 1054). He describes the *simia marina*: *Non pisceo tegmine reliquum corpus, sed illiusmodi circumvestitur, cuiusmodi testudinis involucrem est. [...] Color ei viridis tot corpore; sed in dorso magis fuscus, ad latera pallidus. Dentes lati et continui* (Gessner 1558, 1053-1054). *(The rest of the body is not covered in skin like a fish's, but is a covering like a turtle's. [...] Its colour is green all over the body, but on the back it is darker, and the sides are pale. Its teeth are broad and continuous).*¹⁰⁹

¹⁰⁷ Honegger, p. 13

¹⁰⁸ Honegger, p. 6-7. For Topsell, see Edward Topsell, 1658: *The History of the Four-footed Beasts and Serpents*, p.705. London.

¹⁰⁹ Hendricx 2018, p. 136



Fig 41&42. Drawings of dragons by Topsell in the *History of Four-footed Beasts and Serpents*, 1568 and the *simia marina* by Ulisse Aldovandi in his *Historia Naturalis*, 1599. Biblioteca Universitaria di Bologna.

As we saw, the dragon may appear sometimes in medieval texts and pictures as a serpent. A repetitive motif in depictions of serpents in the Middle Ages is the serpent or dragon with its tale in its mouth, shaping a ring and symbolizing the eternity and unity of matter.¹¹⁰ That serpent is also called *ouroboros*, that means *tail-eater* in Greek.¹¹¹ The ring-shaped dragon was used by the alchemists to represent the never-ending cycle of the elements and it is mentioned in the anonymous text on alchemy *The poem of the Philosopher Theophrastus upon the sacred Art* from the 8th or 9th century: *Devours his tail till naught thereof remains. This dragon, whom they Ouroboros call, Is white in looks and spotted in his skin, And has a form and shape most strange to see [...] A monster scorching all the earth with fire, With all his might and panoply displayed, He swims and comes unto a place within The currents of the Nile; his gleaming skin [...]*.¹¹² Olaus Magnus in a passage of his book describes a sea creature, whose gluttony leads it to consume itself: *The most prevalent of these monsters [that are caught along the Norwegian coast for their fat] is one circular in shape, known in the Norwegian tongue as swamfisk, and called by Albertus, in Book 24 of his work On Animals, hahanc or ahunus. It is more gluttonous than all other marine beasts, and can hardly be satisfied even by preying continuously, for it is reckoned to possess no separate stomach [stomachus]. Consequently everything it eats turns into the grossness of its own body, where nothing else can be seen but a single conglomerate mass of fat. After it has stretched itself to excess till it can expand no more, it easily vomits forth the fish it has swallowed, since, like other fish, it has no throat. Its stomach [venter] is a direct continuation of its mouth. This creature is so fat that, when danger is imminent, then, like the hedgehog, it folds flesh, fat, and skin together over its head, which it conceals by rolling itself up tight. Yet this is not performed without disadvantage, for its fear of hostile animals forbids it to open out when it is assailed by hunger. It therefore sustains itself by feeding upon its own flesh, preferring to be consumed in part than to be gobbled up entire by ravening monsters.*

¹¹⁰ Pennick 2014, p. 204

¹¹¹ Duzer 2012, p. 419

¹¹² Browne 1920, p. 204

However, once the danger is removed, it seeks for safety (1555, 767). He calls it *swamfysk*, but due to the non existence of any such Norwegian word, there is no match of this creature with any known one. Olaus provides a woodcut as well depicting it, among with other sea monsters. Although the *swamfysk* doesn't seem to devour itself, its shape looks like a ring, as it is curled up to defend itself from two monsters that attack it. In the woodcut, we also see a sea-cow suckling its baby.¹¹³ Additionally, a *mappamundi* in a manuscript of the 11th century in Munich (Bayerische Staatsbibliothek, CLM 7785, fol. 2v) depicts a giant serpent devouring its tail and encircling the earth. Beyond the serpent, there is an ocean with four hybrid sea monsters, half human and half fish, reflecting the medieval belief of monsters to be found in the edges of the world.¹¹⁴



Fig 43&44. The ring-shaped serpent in Olaus Magnus's *Historia de gentibus Septentrionalibus* 1557 and on a *mappamundi* of 1180. Bayerische Staatsbibliothek.

Seemingly, the dragon resembles *Leviathan*, a mythological sea serpent or dragon and the symbol of evil in Judeo-Christian literature.¹¹⁵ Gessner, referring to its description according to the book of Job, wrote: *Loquens enim in spiritu de diabolo, sub Leviathan typo, ita dicit propheta* (1558, 240). (*Speaking in spirit of the devil, in the form of the Leviathan, the prophet says the following*).¹¹⁶ The monster appears in Ugaritic texts battling with *Baal* or *Anat*, and in the Old Testament and later Jewish literature, representing the divine wrath. According to Job 41:19–21 and Psalms 104:25–26, *it breathes out fire and smoke*¹¹⁷, living in a distant place: *Yonder is the sea, great and wide, which teems with things innumerable, living things both small and great. There go the ships, and Leviathan which thou didst form to sport in it.*¹¹⁸ A creature that is relevant to Leviathan in the Old Testament is the sea monster *Rahab*, that means the

¹¹³ Lewis 2018, p. 76-81

¹¹⁴ Duzer 2012, p. 419

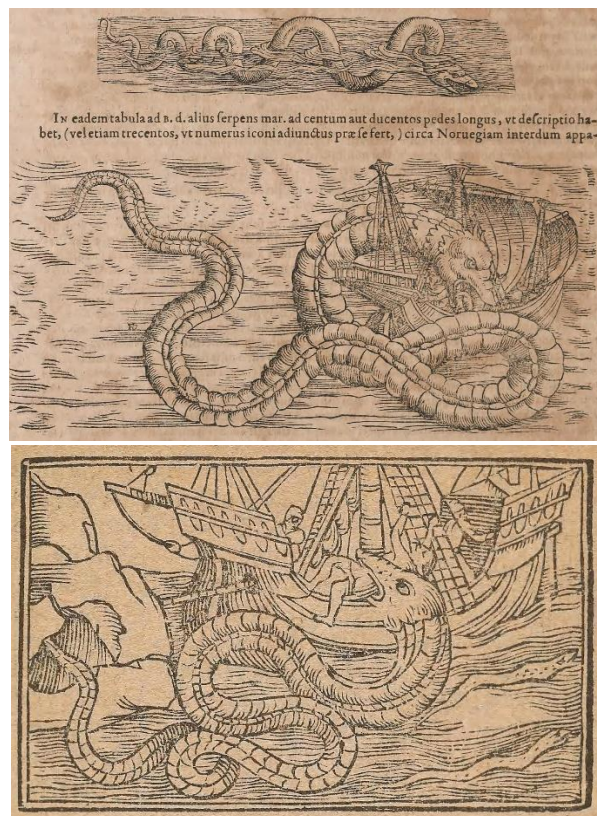
¹¹⁵ Papadopoulos & Ruscillo 2002, p. 199

¹¹⁶ Hendrikx 2018, p. 132

¹¹⁷ Papadopoulos & Ruscillo 2002, p. 142-145

¹¹⁸ Papadopoulos & Ruscillo 2002, p. 200

boisterous one, which was defeated at the time of creation and was also used metaphorically as a name for Egypt. Another sea monster of the Bible was *Tannim*, often translated as dragon or serpent, as the case is in Isaiah 27:1: *In that day the Lord with his hard and great and strong sword will punish Leviathan the fleeing serpent, Leviathan the twisting serpent, and he will slay the dragon that is in the sea.*¹¹⁹ Several centuries later, Meydenbach published the *Hortus Sanitatis* in the 15th century and included a description of Leviathan: *Leviathan Hebraice dicitur draco. Fertur autem quod draco et in terra serpit et in aquis natat et in aere volat. Unde in Asia tribus nominibus appellatur, scilicet serpens et cetus et leviathan. Leviathan, in Hebrew, means dragon. It is said that the dragon crawls on land, swims in the water and flies in the air. That is why it has three names in Asia, namely serpens, cetus and leviathan* (1497, 467).¹²⁰ Therefore, both Leviathan and the sea-dragon have a lot of shapes in medieval art and can not be recognized effectively, as the case appears to be in their depiction on maps as well. Till today, however, several reports of people claiming to have seen the sea-serpent have been reported, with authors-such as Ellis (2004) and Lee (1883)- attributing those beliefs to encounters with giant squids of the genus *Architeuthis*.¹²¹



¹¹⁹ Papadopoulos & Ruscillo 2002, p. 146-148

¹²⁰ Honegger, p. 18

¹²¹ Salvador & Tomotani 2014, p. 982

Fig 45&46. The sea serpent and the sea worm in the 2nd edition of *Historia Animalium* of Gessner, 1604 and the sea serpent in Olaus Magnus's *Historia de gentibus septentrionalibus*, 1557. Olaus separated the sea serpent from the sea worm, in the matter that the sea worm was thinner.

The Kraken

Till today, the legend of the *Kraken* still survives in folklore and literature, although it is believed that its sightings were based on the sightings of big squids, that have been studied extensively and placed under the genus *Architeuthis*. Aristotle in his work *The History of Animals* distinguished the common squid *teuthis* from the larger one *teuthus* or *teuthos*, which could reach 2.3m in length. Pliny in his *Natural History* described a giant squid, that had a body "as large as a barrel" and its tentacles were 9.1m of length. Both Aristotle and Pliny believed that the giant squid was a common animal and didn't consider it as legendary, but it was probably its size¹²² and the need of people to justify the loss of their ships, along with mistaken sightings that made it as such. The Kraken became part of the Nordic mythology, after the king Sverre of Norway wrote in a manuscript in the 12th century that *the Kraken was one of the many sea monsters, colossal in size, as large as an island, and capable of sinking ships; it haunted the seas between Norway and Iceland, and between Iceland and Greenland*. In the *Saga of Örvar-Oddr*, written by an anonymous author in the 13th century, two other sea monsters appeared that looked like the Kraken: the *Hafgufa* (meaning *sea-mist*) and *Lyngbakr* (*heather-back*). Those monsters were described as well in the Norwegian encyclopedia *Konungs Skuggsjá* from the same century as big as an island or mountain, attacking ships. Olaus Magnus referred to a giant squid in his *Historia de gentibus septentrionalibus* as one of the monstrous fishes. In general though, Kraken can be found in a variety of forms in art and literature, sometimes being presented as a huge cephalopod or as a serpent, as the case was in Gessner's *Historiae Animalium* of the 16th century, and its name can appear slightly different, as *Krake*, *Krabben*, *Kraxen* or *Skykraken*.¹²³ Pliny talked about a giant octopus that used to go ashore at Carteia in Spain, to eat the fish that had been left to salt, until it was killed by dogs and armed men with tridents (9.48.92-93)¹²⁴ and legends, as well as depictions of octopuses on maps, will be discussed above. The most interesting thing is that the legend about the creature survived through the ages. Pontoppidan wrote in the 20th century *that it could create a maelstrom by submerging and the ships would be pulled in the depth*, while there was the belief that the amber that could be found on the beaches of the North Sea was its excrement. According to folklore, the monster could also benefit the fishermen, by attracting fish due to its aroma that it produced. The fishermen who would approach it, would make a big catch.¹²⁵

¹²² Salvador & Tomotani 2014, p. 971-974

¹²³ Salvador & Tomotani 2014, p. 972-973

¹²⁴ Duzer 2014, p. 313

¹²⁵ Salvador & Tomotani 2014, p. 974

The monstrous whale

A lot of maps from the Medieval and later times depict whales as monstrous creatures swimming in the ocean, probably because their enormous size terrified the sailors over the centuries. According to Procopius, *Porphyrios* was a whale terrifying the city of Byzantium for more than 50 years, disappearing occasionally and coming back again. One day, however, he came very close to the land hunting some dolphins and the people killed him. His body was about 15 m long and was a sperm whale (7.29.9–16). Procopius used the Greek word *κήτος* (*ketos*), that refers to any sea monster or big fish to describe the creature. Homer was the first to use the word *κήτος* much earlier in his *Iliad* and *Odyssey*, for example to describe *Skylla* as a big sea monster and Hesiod mentioned in *Theogony* that *Keto* was the ancestor of a lot of monsters, such as the Gorgons, Kerberos, Hydra, Pegasos, Chimaira and Sphinx (*Theogony* 235). Oppian used the word as well in his *Halieutica* of the 3rd century ACE to indicate any big sea creature (eg 1.360-1.408)¹²⁶. Centuries later, Gessner discussed about the words *κήτος* and *cetus* used by Greek and Roman authors to refer to whales and sea monsters and Olaus Magnus talked about the cetaceans in his *Historia de gentibus septentrionalibus* and draw several monstrous whales on his *Carta Marina*.¹²⁷

Thomas de Cantimpré in his *Liber de natura rerum* located the *ketos* in the Atlantic Ocean (6.6-7)¹²⁸, and that is related to the claim of Pliny that, according to reports, an enormous sea monster was stranded on the Atlantic coast of Spain. The latter also wrote in his *Natural History* that the skeleton of the sea monster in Andromeda's legend was found in the far eastern end of the Mediterranean, in Jaffa. The beast (*belua*) had a length of 40 ft. and a spine of 1,5 ft. thick (9.4.11).¹²⁹ According to the ancient Greek myth, Poseidon sent *Ketos* to punish queen Cassiopeia, because she dared to say that she was more beautiful than the Nereids.¹³⁰ In ancient Greek art, the *ketos* is usually depicted with Perseus, Andromeda, Hercules, Thetis, Nereids or the Poseidon, Amphitrite, Triton, *Skylla*. On the Caeretan hydria from 520-510 BC there is probably a representation of Perseus fighting the *ketos*. Its body lacks scales and resembles the one of a whale.¹³¹ Furthermore, according to the Old Testament, Jaffa was the place where Jonah boarded on a ship, disobeying the command of God to go to Nineveh. He was on the sea *and the Lord appointed a great fish to swallow up Jonah; and Jonah was in the belly of the fish three days and three nights* (Jonah 1:17). In the Hebrew text we read *dag gadol* and the great fish mentioned there could mean

¹²⁶ Papadopoulos & Ruscillo 2002, p. 206-207. For the translation of Hesiod, see West, M.L., 1966: *Hesiod, Theogony: Edited with Prolegomena and Commentary*. Oxford.

¹²⁷ Hendrikx 2018, p. 126

¹²⁸ Clesse 2018, p. 90

¹²⁹ Papadopoulos & Ruscillo 2002, p. 210

¹³⁰ Nigg 2013, p. 19

¹³¹ Papadopoulos & Ruscillo 2002, p. 216-219

a whale.¹³² However, in the *Stuttgart Psalter* of the 9th century, the creature swallowing the prophet is depicted as a sea-dragon, so it's not for sure how the monster was perceived.¹³³



Fig 47. An ancient Corinthian vase with Andromeda, Perseus and the ketos. Altes Museum.

Fig 48. The creature that swallowed Jonah is usually depicted as a cetacean, but in the *Stuttgart Psalter* of the 9th century it is depicted as a sea-dragon. *Württembergische Landesbibliothek*.

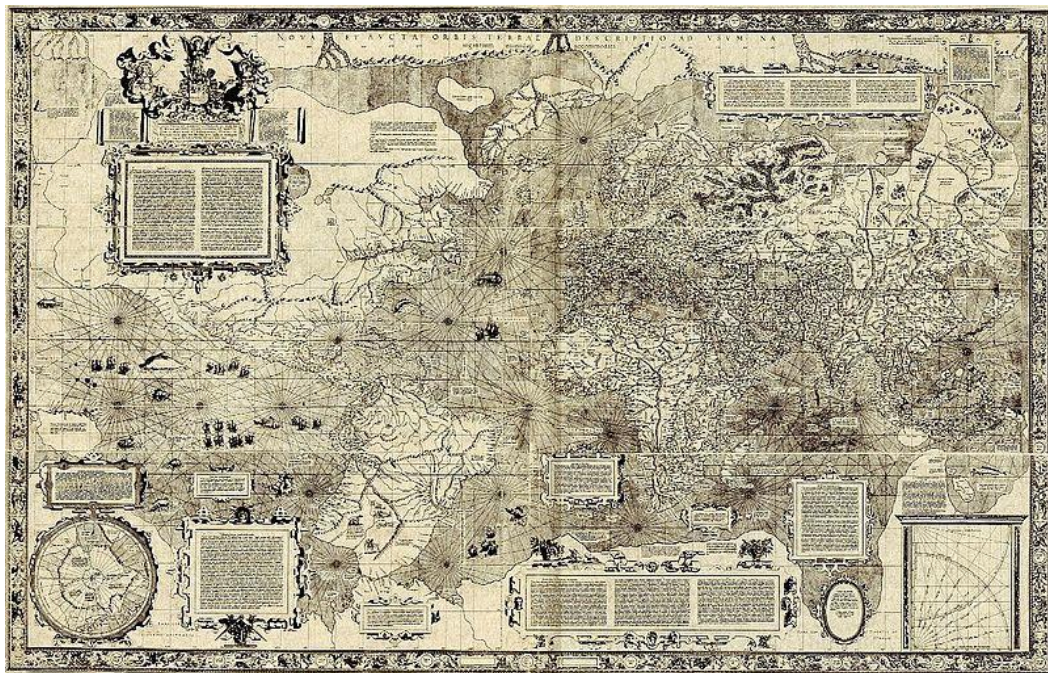


Fig 49. Mercator's world map of 1569. Maritiem Museum Rotterdam.

¹³² Papadopoulos & Ruscillo 2002, p. 213

¹³³ Honegger, p. 10

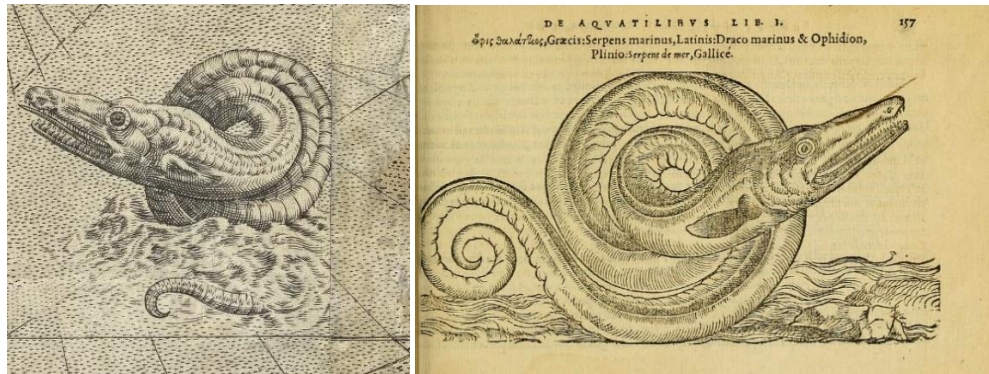


Fig 50&51. Detail of the sea serpent in the Atlantic Ocean on the world map of Mercator and the one in Belon's book of 1553, *De Aqualitibus*.

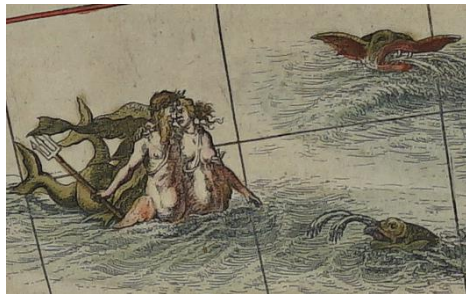
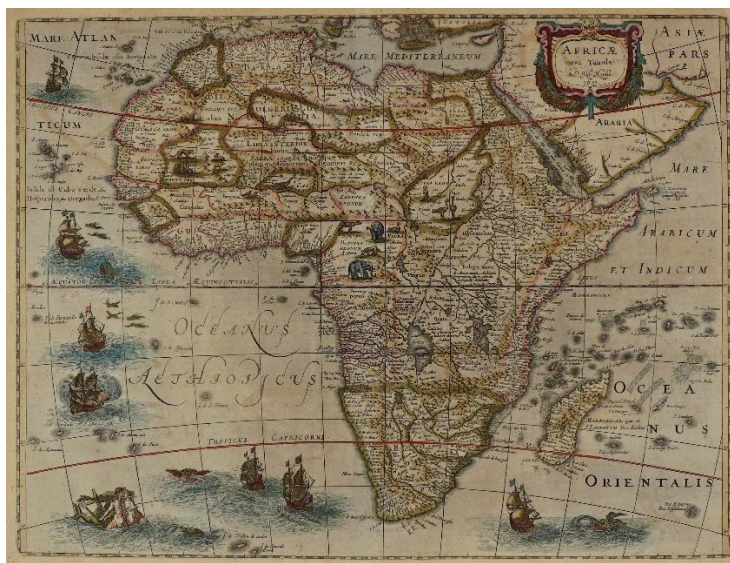


Fig 52&53. The *Africa Nova Tabula* by Hondius in the Mercator-Hondius atlas, published in 1613. In the detail of the map, Poseidon with Amphitrite appear, drawn after the Renaissance iconographic style and proving the decorative purpose of its depiction.

The importance and influence of the discoveries in the New World

The German cartographer Martin Waldseemüller created a world map in 1507, that was the first map to apply the name America. It does not have any sea monsters, but it has six legends about them in the Indian Ocean, providing information that derived from *Hortus Sanitatis*. According to one of those legends: *hic cernitur leuiaton*

draco marinus qui frequenter contra cetum pugnat (here is seen the Leviathan or sea-dragon that frequently fights against the whale), an idea that appears in some medieval texts, such as Vincent of Beauvais's *Speculum Naturale* of the 13th century. Johannes Schöner created a globe in 1515 and placed monsters where Waldseemüller placed the legends, adopting the images of the creatures that are included in the *Hortus Sanitatis*.¹³⁴



Fig 54&55. The Leviathan on the globe of Schöner of 1515, located where Waldseemüller placed a legend about it on his world map of 1507. The creature is to be found in the *Hortus Sanitatis*, 1491. Frankfurt am Mein, Historisches Museum and British Library accordingly.

Waldseemüller published the *Carta Marina* in 1516, printed on twelve sheets that were intended to be assembled into a wall map.¹³⁵ On the lower part of the map, there is King Manuel of Portugal riding a sea monster off the southeastern tip of Africa. After the successful return of Vasco da Gama from India sailing around Africa, King Manuel became the "Lord of the conquest, and navigation, and commerce of Ethiopia, Arabia, Persia and India". Waldseemüller depicted him on a sea monster, showing that he has under his control the sea and the dangers of it, being dominant over the oceans. The monster is designed with a naturalistic tone in his teeth and skin, tree-dimensionally and in motion, according to the influence of the Renaissance.¹³⁶ A second map that depicts a king on a map and indeed in the Atlantic Ocean, is the *Americae Sive Quartae Orbis Partis Nova Et Exactissima Descriptio* published in 1562 by Diego Gutierrez. The king Philip II is depicted crossing the waves to arrive in the New World on a chariot pulled by sea-horses and leaded by Neptune in the Atlantic Ocean. Southern on the ocean, a man on a beast wearing a headcloth with feathers - resembling the native Americans' type of headcloth- holds the royal coat of arms and a triton in front of him blows the seashell to calm the sea, so that the king crosses the ocean in safety. Gutierrez was commissioned to create the map by the Spanish King Philip II, in order to establish his dominance over the Atlantic.¹³⁷ A second map that has a scene similar to the one of the king on a chariot is the *Nova et Acurata Totius*

¹³⁴ Duzer 2013, p. 71-72

¹³⁵ Duzer 2012, p. 14

¹³⁶ Duzer 2013, p. 18

¹³⁷ Clark 2016

Americae Tabula by Willem Blaeu from 1608. So we see that monsters on the maps could also serve propagandistic purposes in favor of royal dominance over the sea.

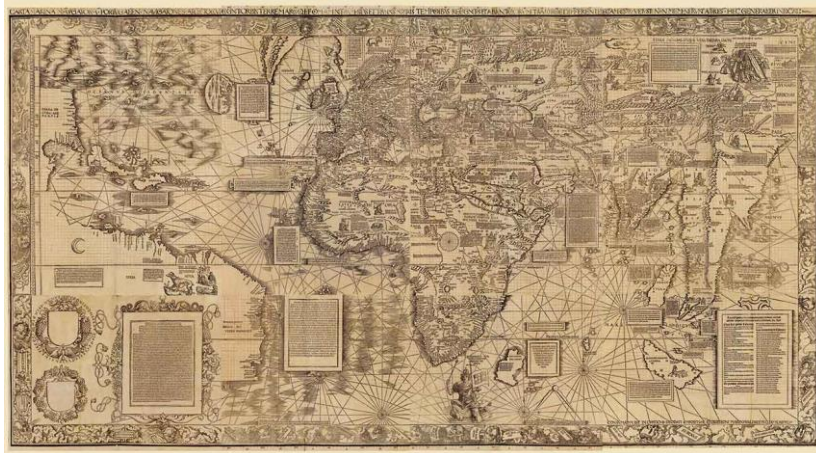


Fig 56&57. King Manuel on the back of a monster on the world map of Waldseemüller, 1516. Library of Congress.





Fig 58, 59 & 60. The map of America by Gutierrez and details with the King Philip II crossing the Ocean and a triton calming the sea in the sight of the royal coat of arms, 1562. Library of Congress.



Fig 61. The *Nova et Acurata Totius Americae Tabula* by Willem Blaeu, 1608. We can see that there are decorative motifs all over the map, leaving no blank spaces and proving the existence of the idea of *horror vacui*. National Maritime Museum of Greenwich.

Today

All in all, sea monsters were always believed to have been living in the seas, terrorizing the sailors and sinking their ships. Stories about the sightings of enormous creatures, having tentacles or resembling serpents, became legends and accompanied people in their journeys in the sea, which is still believed by some to hide those beings in its depths. Scientists have been trying to explore the oceans and the forms of life it nourishes since a long time ago and that even gave birth to “Cryptozoology”, a branch of zoology that is generally considered a pseudoscience, as it tries to study animal species whose existence is not supported by scientific evidence. The existence of those

animals is based on hypotheses, deriving from oral traditions, eyewitness records and indirect information provided in legends.¹³⁸ Although several methods trying to capture them have been established, the unfruitful attempts have led some people believing whether those creatures can simply avoid getting captured somehow.¹³⁹ A lot of books have been written and documentaries have been produced, claiming that those creatures do exist and encourage people to always be aware of their appearance, serving sometimes only commercial purposes and lacking the adventurous aspect of it. However, those mysterious creatures that have been reported by people supporting to have seen them, in their majority are not hybrid and do not look like their ancestors on antique maps; they resemble more giant squids or sea serpents; or even the *plesiosaurs*, the marine reptiles with long necks that lived at the time of dinosaurs. What is more than sure is that the maps that are published today -and attempt to be accurate- do not depict wondrous creatures, and -even if they do so- their purpose is mostly decorative; until the scientific research towards those beasts reveals something more.



Fig 62. On a map of Jodocus Hondius from 1609 included in the Mercator-Hondius atlas there is a creature in the Pacific Ocean that looks like a plesiosaur, although people back then didn't know about its existence through archaeological records. However, it can simply be a generic creature.

¹³⁸ Rossi 2016, p. 573

¹³⁹ Salvador & Tomotani 2014, p. 983

Conclusions

To conclude, cartographers of the Middle ages and later on depicted monsters on their maps to reflect beliefs about the wondrous and this is the reason they originally placed them in the edges of the known world, in Asia, Africa, the Atlantic and Indian Ocean, and later in the Pacific as well. They associated them with the extremities in the climate and they believed that they were the counterparts of terrestrial animals. Sometimes, big classified animals, such as the whales, were considered monsters, because of their big size and strength, being frightful for the sailors who encountered them, but also often mistook them for unknown creatures. Furthermore, as people did not know a lot about animals and wanted to explain a lot of things happening, classical and medieval authors were free to create and their works influenced later the cartographers. The mappamundi represented the unknown of the regions and the mystery, mixed with religious beliefs. Specifically, in the years after the establishment of Christianity and more specifically after the Reformation, a lot of monsters were born as signs from God. But even after the Age of Exploration, that the unknown world became known, and after the Reformation, when authors and cyclopedists gave up the idea of monsters representing religious beliefs and returned to the scientific methods of Aristotle's classification of animals, the cartographers continued incorporating sea monsters on their maps, mostly as decorative motifs or still propagandistic somehow, to show the control of some kings over the seas and its dangers. It was also the idea of the *horror vacui*, the concept of leaving no empty spaces on the maps, that acted as an extra reason of keeping those creatures alive. This is the reason the monsters appear a lot of times in places of the maps that are empty and not covered by toponyms, and most specifically in the seas and the oceans, that the spaces would remain blank if the cartographers didn't incorporate sea monsters on them. A map with decorative motifs could seem more artistic and be more appealing to the customers. Apart from that, the monsters on maps in the Age of Exploration, often combined with figures of kings and royal symbols, could also serve propagandistic purposes to ensure the royal dominance over the Ocean. However, the survival of some legends and myths about that creatures through the centuries may indicate something more; that people remained always interested in the mysteries of the sea.

A very interesting case is the one of the explorer and cartographer Sebastian Cabot, who created a world map after two important voyages to the New world. He depicted several land creatures on it, but only one sea monster, the *remora*. The *remora* was also known as *suckerfish* and Cabot wrote on the legend accompanying the monster that *Pliny writes in his ninth book, chapter twenty-five, of a fish called Nichio, which he describes as being round, and that attaching itself to a ship it holds it*

even though it be under sail. And Petrarch, in the preface to the second book of *Prosperous and Adverse fortune*, says that the *echenis* or *remorea*, a fish of half a foot in length, stops a ship, though it be very large, and winds and waves and oars and sails aid its course; it alone overpowers the power of the elements and of man, with no other agency save attaching itself to the planks of the ship, and with no other force than its own nature; which fish is like mud or mire, and taking it out of the water it loses its power. The aforesaid is found in very distinguished writings, that are not quoted here lest it take too much space. The image of the remora cannot be traced in any book, neither Pliny's or Petrarch's, or a map. Probably it was the only monster he depicted, because he faced lawsuits for some problems and a delay he had on his journeys and therefore wanted to justify it. The Italian historian Peter Martyr d'Angheira of the 15th century who knew Cabot very well, he wrote that: *Cabot calls these lands Terra de Bacallaos, because the neighbouring waters swarm with fish similar to tuna, which the natives call by its name. These fish are so numerous that sometimes they interfere with the progress of ships.*¹⁴⁰

The appearance of sea monsters on maps inclined after the end of the 17th century. There were a lot of cases that, even before that time, cartographers didn't choose to depict wondrous creatures and the reasons could reflect their own beliefs regarding the lack of existence of such creatures or because they had probably already gained reputation and did not care about decorating their maps.¹⁴¹ Another reason could be that some clients who ordered maps did not ask the cartographers to decorate them. Regarding the beliefs of cartographers, there were a lot of cases that they expressed doubts about their existence. Fra Mauro wrote in a legend on his detailed world map of 1450 that *because there are many cartographers and most learned men who write that in this Africa-and above all in the Mauritanias- there are human and animal monsters, I believe it is necessary to give my opinion.... In all of these kingdoms of the negroes I have never found anyone who could give me information on what those men have written. Thus, not knowing anything, I cannot bear witness to anything; and I leave research in the matter to those who are curious about such things.* A similar belief was reflected on the *Genoese map* of 1457, where the cartographer, although he drew several monsters in the Indian Ocean, he placed a legend in the Atlantic Ocean saying *frivolis narrationibus rejectis*, meaning that he rejects the fiction narratives and, therefore, he does not believe that there were monsters there.¹⁴²

So, even if the purpose of the depiction of sea monsters was to reflect the dangers of unknown regions and explain the mysteries of the sea, or it was just decorative, some of the legends that influenced the creativity of the cartographers

¹⁴⁰ Duzer 2013, p. 89-91

¹⁴¹ Duzer 2013, p. 106

¹⁴² Duzer 2013, p. 55-57

still survive and represent a part of the folklore of each culture and the willing of individuals to believe in the wondrous. And when it comes to monsters, I will conclude by citing a very interesting quote by Jeffrey Weinstock, saying that the Shrek films and Monsters, Inc. teach the lesson that it is moral values and behavior, not physical appearance, that define monstrosity.¹⁴³ Sea monsters though will continue to be charming, no matter how many years and centuries have passed or the way we perceive those things today.



Chapter 3: On Ships and Wrecks

In this chapter, useful information about ships that later on formed wrecks will be provided, so that the people using the video game can acquire some basic knowledge on the way they could identify the date and the origin of a wreck on their time exploring the Mediterranean sea and the Atlantic ocean.

Ship Building

The building sequence of a ship can be a date indicator. In the shell-first construction technique, the majority of the hull strength is provided by the shell of outer planking with rigid edge joinery, consisted of mortises and tenons. It was an

¹⁴³ Weinstock 2012, p. 279

unplanned building method. The wooden pieces were made one at a time to suit those already in place. This resulted in asymmetrical ship shapes, ex Uluburun, Kyrenia.¹⁴⁴

The Uluburun was of the Late Bronze age 14th century BC and the first shipwreck to be excavated by diving archaeologists in the 1960s, setting the milestone for the development of maritime archaeology as a discipline.¹⁴⁵ The cargo was probably of Syrian origin¹⁴⁶ and the MT joints were similar to Graeco-Roman ships.¹⁴⁷ It carried copper and tin ingots, that consisted the bronze, Canaanite jars, glass beads, glass ingots of blue turquoise, ivory, hippopotamus teeth, tortoise shells, gold and silver jewelry, weapons, as daggers and swords.¹⁴⁸

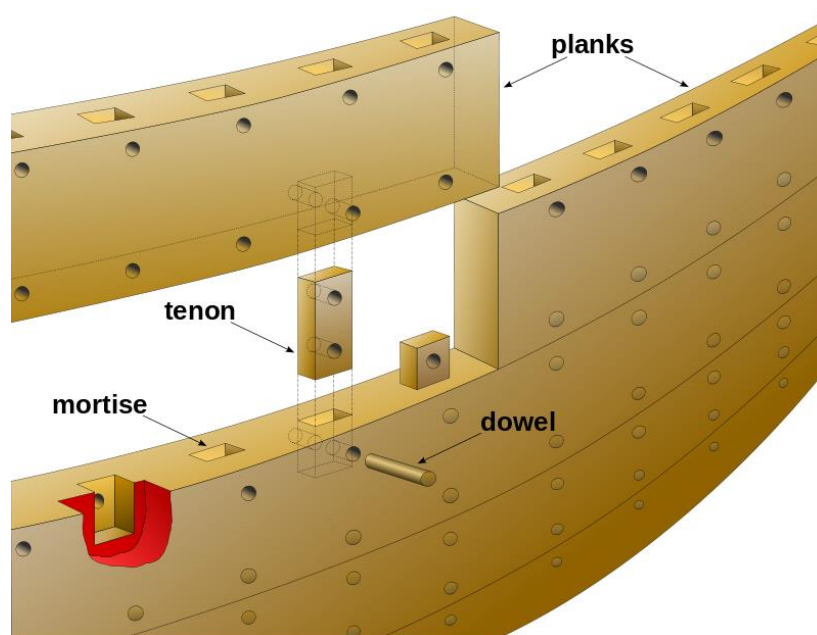


Fig 64. The mortise and tenon joint method of hull construction in ancient vessels.

The wood samples from the keel and planking indicated that the hull was made of cedar, that was the preferred timber for building ships in the Bronze age, since it has mechanical strength, can be easily worked, can be seasoned without significant distortion of shrinkage and is more resistant to salt water than most woods.

¹⁴⁴ Pomey 2012, p. 236

¹⁴⁵ Pulak 1998, p. 188

¹⁴⁶ Pulak 1998, p.215

¹⁴⁷ Pulak 1998, p. 210

¹⁴⁸ Pulak 1998, p. 193-208

No frames and frame fastenings were found in the preserved hull, probably because the frames were attached to the planking higher on the hull that has not been preserved or bulkheads were located at the unpreserved extremities of the ship.¹⁴⁹

The mortise-and-tenon joints were longer and more widely spaced than those found in Greek and Roman hull of the same size of ships. After the Bronze age, the Mediterranean shipbuilders relied more on a tougher framework to maintain the lateral and transverse rigidity of the hull and they did not need to use long tenons and thick planks.¹⁵⁰



Fig 65. The Uluburun wreck.

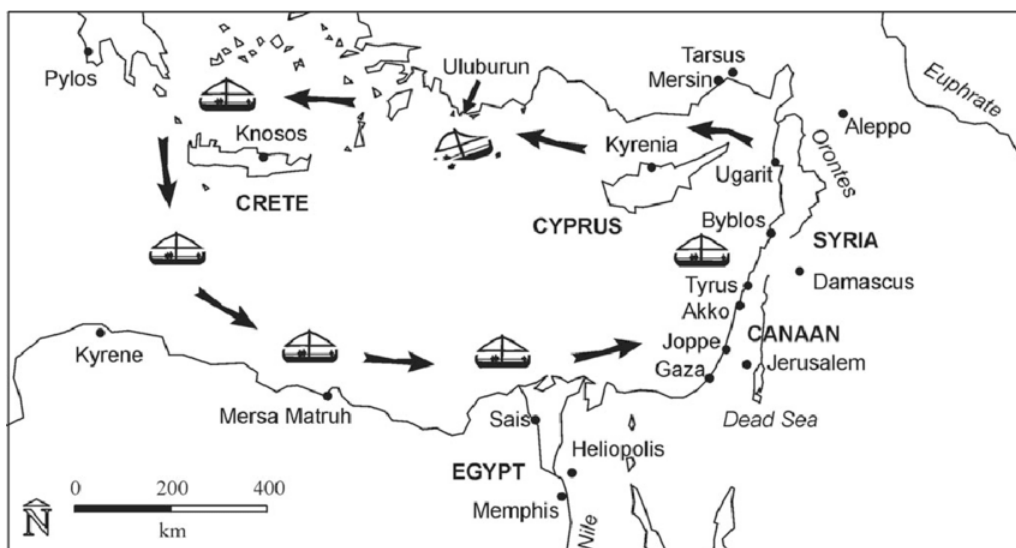


Fig 65. The eastern Mediterranean in the Late Bronze Age 14th to 12th BC. The arrows indicate the possible route of the Uluburun.

¹⁴⁹ Pulak 1999, p. 616

¹⁵⁰ Pulak 1999, p. 626



Fig 66&67. Egyptian jewelry and amphorae from the Uluburun wreck, Bodrum museum 2017

In the transition phase we have a decline in quantity and robustness of mortise and tenon joints and increase in framing, ex. Yassi Ada, that has smaller and fewer mortise and tenon joints, but is supported by increased skeletal structure. Technically was still shell-first, but hull strength now resulted in larger part from the skeleton and internal planking. Mortise and tenon joints were small, loosely fitted and very widely spaced and they appear to intend to support the planks only until frames could be inserted.¹⁵¹

In the frame-first or skeleton first, there was a predetermined ship design, since the planks were attached to a pre-erected framing that provided strength and the hull was flexible with larger capacity.¹⁵²

¹⁵¹ Pomey 2012, p. 266-268

¹⁵² Pomey 2012, p. 298

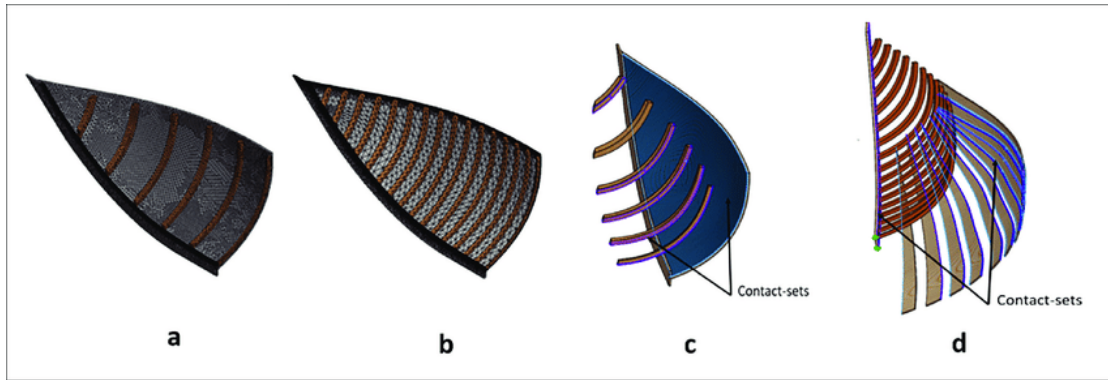


Fig 68. The frames and the hull.



Fig 69&70. Amphoras being loaded into a lift basket to be transported to the surface and divers diving from the barge in 1961. Yassiada wreck.



Fig 71. The ROV Asherah at the Yassiada wreck site.

Apart from the building sequence, we have the shell-building techniques: a. the *clinker ships* or the *plank-laying with ledges*. It is about laid planks with overlapping-lapstraked planks, so that the sides of the boats have step-like ledges. b. *the carvel ships* or *plank-laying with smooth sides*. The planks are joined edge to edge, so that the sides of the boats are smooth. They are fastened together with fishtail shaped supports set into the surface. There are no bands or ribs but at the gunwales there are thwarts set into the planks that act as midship supports.

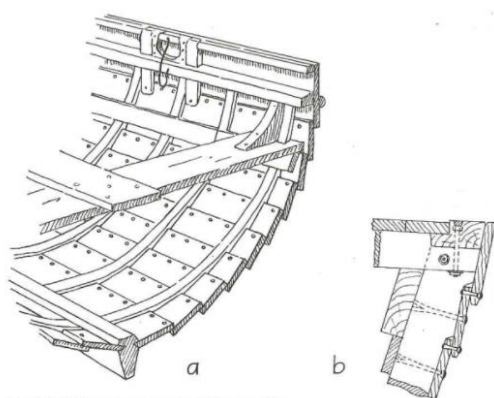


Fig. 17. Shell-construction with clinker-planking.

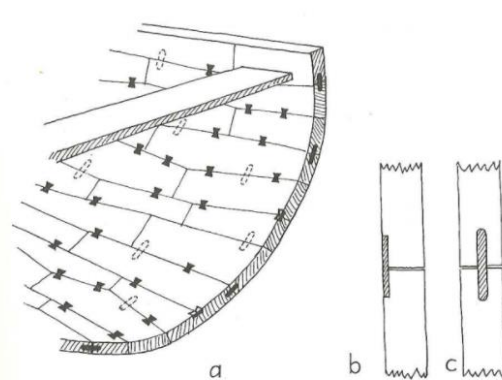


Fig. 18. Shell-construction with smooth planking.

Fig 72. The clinker and the carvel shell-building techniques.

The clinker ships, like the Viking ships, were of a skeleton-first construction with split timbers tightly fit together. The planking had significant overlap connected with clinker-nails. They were waterproofed with animal hair sealing, but mostly due to the tight fitting of structure. The clinker built could have been inspired by Romans, ex. the Nydam ship.



Fig 73. The Oseberg Viking Ship, fine woodcraft, 820 AD, Viking ship museum, Oslo.

In the clinker transition to carvel building, we have the bottom built construction, where the flat carvel bottom planks are attached directly to timbers and clinker sides are built up or attached from there. The design concept is around the shape of the bottom of the hull.¹⁵³ Carvel building was advantageous, because it economized materials and labor, as the ships were easier to repair and faster to build.¹⁵⁴

Determining the Origin and the Route of a Ship

Pottery

We study maritime pots because they can indicate the origin of a ship that is found sunk, its stops under way, the cargo, the origin of the cargo and the date of the wreck. The dating of a wreck can be accomplished through dendrodating and dating the youngest ceramics on board.

¹⁵³ McGrail 1995, p. 139-141

¹⁵⁴ Hasslof 1972, p. 42-55

Main types of Greek and Roman fine ware:

Mycenean wares 1500-900

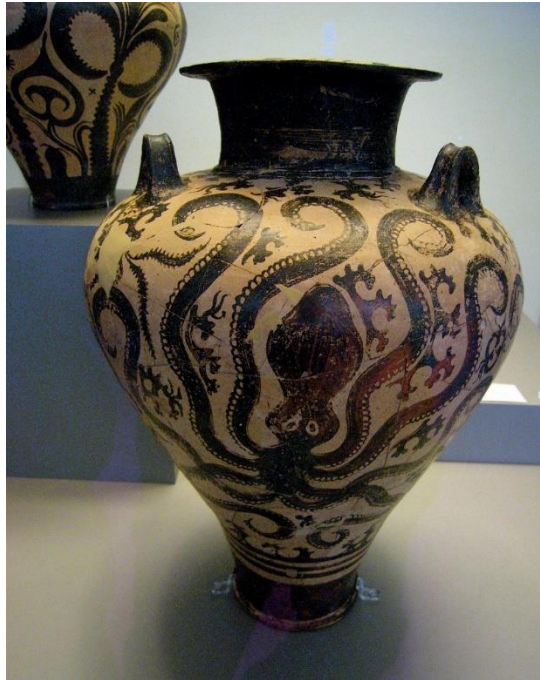


Fig 74. Vase from the Greek archaeological museum, Athens.

Protogeometric 100-900



Fig 75. Amphora with the popular plain black horizontal bands and the circle design as decorative motif, that was achieved by using multiple fixed brushes attached to a compass. British Museum, London.

Geometric 900-700



Fig 76. Amphora. The art of that time focuses on funerary rituals and the heroic world of warriors. The armed warrior, the chariot, and the horse are the most popular symbols of the Geometric period. The snakes that are added in clay were associated with death, because they can burrow under the ground and shed their skin, a sign of renewal. The Metropolitan Museum of Art, New York.

Archaic 700-500

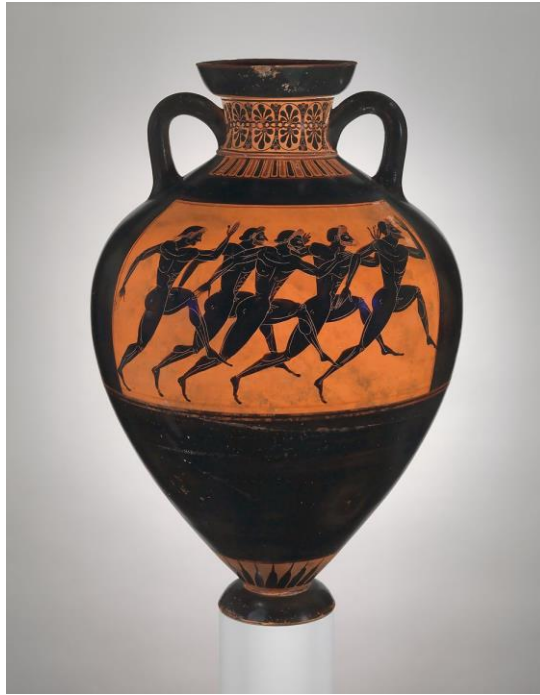


Fig 77. Terracotta vase in the black-figure technique, depicting the footrace of the Panathenaic games.

Red figure pottery 520-300



Fig 78. A crater depicting the ascension of Persephone from the Underworld, with the gods Hermes and Demeter.

Hellenistic wares 300-150



Fig 79. Lagynos was a wine jar typical of the period. Orange-brown slip on a white ground with motifs such as olive bows, baskets, and lagynoi.

Terra Sigillata 1st BC-7th AD



Fig 80. A Bowl of Terra Sigillata. Ancient Roman museum Bedaium.

Terra Sigillata was a Roman fine ware that was made in Italy and later in the provinces. It is also known as Arretine ware and Samian ware and it was a glossy red tableware that came in standardized forms. It was a copy from Hellenistic black-glazed wares but in red color, because that was the popular color for tableware.¹⁵⁵

¹⁵⁵ Greene 1987, p. 157-158



Fig 81. Post medieval redwares- red in N. Europe and white in S. Europe. They were lead-glazed, made on a wheel and fired in a kiln. They were made of lead powder and very thin clay.

Rates of Circulation

The rate of circulation is the rate at which the objects wear, break and are replaced. Objects that are replaced at the start of the voyage are at high rate of circulation and could indicate the beginning of a specific journey and the stops of the ship on the way of that journey. However, objects that were sturdier and would be seldomly replaced are at low rate of circulation and of a higher importance to determine the origin of the wreck.

The equipment of the ship was at high rate of circulation. It was subject to heavy wear and tear and had to be replaced every few voyages or even at every voyage. It might be difficult to determine the origin, but for example we know that Dutch ships frequently used yellow bricks as ballast. The documents and stationary that were at high rate included official documents and printed books. The language would be the national or official language of the crew that would board on the ship at the start of the journey or at a stop on its way. However, past language areas cannot correspond to today's language areas and documents were difficult to be preserved. Additionally, the navigational equipment was considered to be of high rate as well. It was valuable equipment often taken off the ship for safe-keeping after each voyage. The East India Company obliged the captains to hand in part of the navigational equipment after the voyages, so that secrecy could be maintained. Furthermore, the origin of the crew that boarded the ship at the beginning of the journey could potentially be traced through the types of measurement used.

The personal belongings of the crew can be included in the high rate of circulation. It should be mentioned that the crew may not have always been of the same origin, especially in the case of big shipping companies that would make long trips outside their place of origin. Additionally, the cargo may have been loaded in at any port on the way of the ship and is not that likely to indicate the origin of the ship.

At moderate rate of circulation, we have the working equipment that was used in unloading, loading and storing of the cargo and it could last several. Furthermore, the tools that were used were similar throughout the countries and often they did not bear the mark of the maker. Furthermore, they were sturdy. Additionally, we have the galley utensils, that include ceramics, wooden and metal artefacts, from which the origin can be determined through their characteristics. The eating and drinking equipment, the furniture and the barrels and rest of preservation and packaging material like bottles can be considered of moderate rate.

At low rate, we have the military equipment. It is sturdy and expensive and the origin can be easily identified. The objects at low rate refer to an earlier point of origin, that could even be the origin of the construction place of the ship.¹⁵⁶

A Way to Track the Route

The moss that is used for caulking can indicate the region where a ship was built and repaired, due to the botanical macroremains, that is the pollen, of vascular plants trapped in the mosses. Caulking is for watertightening the seams between planks. In Uluburun we have the remains of intrusive and unintentionally transported animals.

Mosses act as a pollen trap, since they capture the pollen at the site they grow. However, it is important to know whether a caulking sample comes from an original seam or a re-caulked seam.¹⁵⁷

Pirates

An idea would be that pirates are included in the game, since the pirate treasure hunting has always been popular among the treasure hunters and damaging for the underwater cultural heritage, something that will be discussed in the next chapter. Therefore, providing a summary of the background of two of the most

¹⁵⁶ Klej 1997, p. 181-184

¹⁵⁷ Deforce 2014, p. 299-300

notorious pirates of all time, that are included in the aforementioned *Uncharted* game series as well, is important, so that the gamers see beyond the pirate treasure hunting.

Pirates today are described as rebels, adventurers, murderers, thieves and skilled sailors. However, the social and political context of piracy is more complex than that.¹⁵⁸

It was mostly the political ideology that determined the possibility to cooperate with pirates. Sir Francis Drake was not considered as a pirate in England. He was considered as a pirate by Spanish after he captured two of their treasure galleons, since King Philip II offered an enormous reward for his capture. However, Queen Elizabeth I regarded him as one of the privateers that consisted part of the English naval force. None of the successors of Queen Elizabeth granted privateering commissions and privateers became pirates, following the criminal way instead of the acceptable one to earn money. The era called the Golden Age of Piracy of the 17th and 18th century was marked by several conflicts between privateers and France, Netherlands and Spain.¹⁵⁹

Therefore, it is admittable that in the ages of Queen Elizabeth and Sir Francis Drake of the late 17th century, pirates were considered essential for foreign policy and even regarded heroic. However, from 18th century onwards, pirates were characterized in written sources as enemies of mankind and the Latin phrase *hostis humani generis* was used in legal documents, framing pirates as savage beasts disconnected from humanity, especially after they were deprived of their right for a trial. Six dictionaries from 1623 to 1979 defined pirates as robbers by the sea. 9 Buccaneers that were regarded in the 17th century as legitimate defenders, were associated with the term pirate.

¹⁵⁸ Mares 2015, p. 6

¹⁵⁹ Mares 2015, p. 10-16



Fig 82. Treasure recovered from the pirate ship Whydah Gally that sank off Cape Cod in 1717, the only pirate ship that has ever been found.

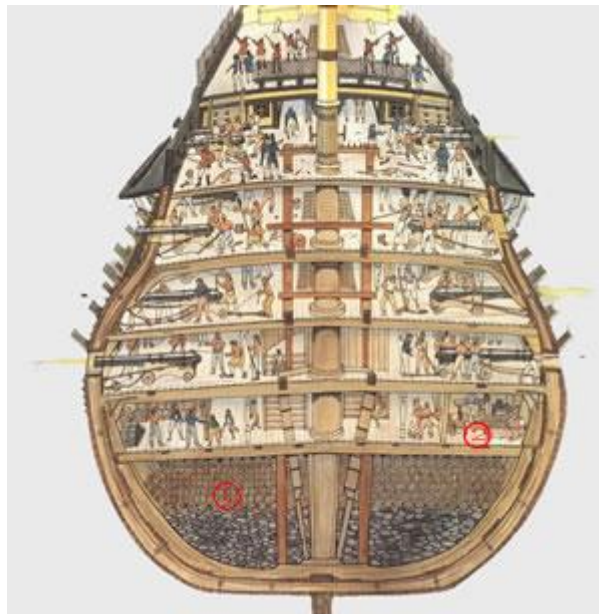


Fig 83. Section through the First Rate HMS Victory of the Royal British naval of the 18th century.

Henry Avery was one of the most notorious pirates of the late seventeenth and early eighteenth centuries. He is the most written about English pirate, appearing in ballads, theaters, movies, video games and novels.¹⁶⁰

In May 1693 Avery was on board of an English merchant-ship that anchored near Corunna, Spain. He incited the crew to mutiny, leaving the captain on shore and sailing for the East Indies. In 1695 he captured the *Gunsway*, a vessel that belonged to the Great Mogul, who seized the property of several English merchants in India after

¹⁶⁰ Frohock 2019, p. 1-2

that and placed them in prison. The East India Company issued a proclamation with which a reward would be offered for the capture of Every. 1 He disappeared in the West Indies and never appeared again. There have been some speculations that he eventually travelled back to Britain, but no one saw him again.¹⁶¹



Fig 84. Illustration of Henry Avery from the work *The history and lives of all the most notorious pirate, and their crews, from Capt. Avery, who first settled at Madagascar, to Capt. John Gow.* 1729. The British Library.

An Interview about the Discovery of a Pirate's Ship

Something I found interesting is the involvement of a friend of mine in a series of discussion about the discovery of what was assumed to be the famous pirate Blackbeard's ship, the *Queen Anne's Revenge*. According to Karl Stoker, a maritime archeologist, I learned the following: *Archaeologists and people who study history have to be careful what we identify is something, so we should not go quickly, cause we may be wrong. What happened was that they found a wreck and the two guys who found it were not archaeologists or historians, these were local enthusiasts. Before they even come back to their boat, they were sure that that was the Queen Anne's Revenge. It became such a popular idea that we eventually found the Blackbeard's*

¹⁶¹ Rollins 2013, p. 234

ship, that many archaeologists just went along with it, regardless any information that was found from an actual excavation. I am of the mentality that this is not the Queen Anne's Revenge. So that is a problem that we have in archaeology: in a lot of publications they are claiming this is, with a zero evidence. It is just the popular idea, so that people are selling books about it or that they gain reputation. I was part of some conversations about the artefacts and some of the preservation stuff. My two professors were directly involved and they had us directly involved in class talking about it and discussing ideas of what could this evidence point to, so we helped them determine their ideology about the ship. The State hired the University to do the excavation and the University was in charge of this. So here is the thing: one of my professors claims that we do not have enough evidence to claim that is yet. For starters, there is zero treasure or even artefacts that would hint that this could be a pirate ship. Pirate ships tend to have very little cargo on them, because they were pillaging and had to bring on board the stuff that they take and this ship did not have many weapons for ammunition, so a pirate ship without a means to attack is kind of weird. It also had a full load of slave equipment, so this could be a slave ship. Blackbeard did not deal with slaves, that was not his trade. Additionally, two cannons had a makers mark that they were created after the ship sunk. So, there is a lot of evidence that points that it is not his ship. But the problem with that is that the locals in North Carolina want to believe that is, because it is good for their economy, it brings tourists. My professor tried to give a light talk meeting in the town hall about this and people threw their shoes on him, because they did not want the truth to get out, that this is not the ship. Therefore, this has to do about ethics in Archaeology.

Stoker therefore, apart from talking about the discovery of a famous ship, also mentions the issue that arises from the debates of archeologists around great discoveries.

Chapter 4: Organizing the Research Methods and Preservation

As aforementioned, the preservation of underwater cultural heritage can promote sustainability. The proper management of underwater cultural heritage can balance the protection of the sites with financial development of the areas surrounding them and cultural development of the humankind through its study.

Appropriate management and promotion of the cultural heritage can be achieved in the form of underwater archaeological preserves or museums and shipwreck parks. Government support can make the monitoring of underwater antiquities possible.¹⁶²

¹⁶² Georgopoulos 2013, p. 191

In this chapter, the threats and the methods for survey and preservation of an underwater site of archaeological importance will be discussed, so that it can be integrated in the game as part of the adventures of scientists-archaeologists.

Threats

Treasure Hunting

Underwater Cultural Heritage is affected by the pillaging and looting of artefacts by a wide range of looters, from sport divers to treasure hunting companies, who are interested in the sellable artifacts they find and disregard the scientific value of them.¹⁶³ We should mention here that the illicit trade of cultural property ranks third after weapons and drugs.¹⁶⁴

Nuestra Senora de las Mercedes sank in October 1804 in the battle of Santa Maria cape between Spain and United Kingdom. It carried 595,000 silver and gold coins. 30 A robot named *Zeus* discovered the coins scattered in a depth of 1,100 meters, 100 miles west of Gibraltar, in international waters. The robot was run from the operating room of the *Explorer*, that is owned by the company *Odyssey Marine Exploration* based in Florida, specialized in the recovery of wrecks. It was named *Black Swan* to signify a surprising discovery.¹⁶⁵ However, Odyssey was interested in the market value of the shipwreck and not the scientific research, lacking ethical approach.¹⁶⁶ The State of Spain claimed that Odyssey had no claim to the artifacts and, after a five-years court battle, the coins were delivered to Spain.¹⁶⁷

¹⁶³ UNESCO 2016, p. 4/8

¹⁶⁴ Delgado 2002, p. 4

¹⁶⁵ Piquer 2017, p. 28/31

¹⁶⁶ Piquer 2017, p. 50

¹⁶⁷ UNESCO 2016, p. 4



Fig 85. Gold coins scattered in the wreck of Nuestra Señora de las Mercedes.



Fig 86. The return of the treasure to the Spanish government.

The Indonesian Belitung wreck was a 9th century dhow that was commercially exploited in 1998, since it was sold to a private entity for 32 million USD and the share provided to Indonesia was only 5 million USD. That wreck could have provided scientific information and a maritime museum close to it could have attracted tourists and generated local employment, fostering sustainable development.

Similar to that is the case of the Florida Key wrecks. The policy of Florida towards its underwater antiquities has cost the State a lot of money for the leases to salvors in order to take the artefacts in its possession. However, if Florida had invested

in creating two great museums, the State would be half a billion dollars richer each year.

The Vasa Swedish warship sank in 1628 in the harbour of Stockholm and was recovered in 1961 and exhibited in the Vasa museum since then. It is the most visited museum in the country, profiting the country with a lot of millions due to the spendings of tourists in Stockholm.¹⁶⁸



Fig 87. The Vasa wreck at the Vasa museum. Stockholm.

The UNESCO Convention on the Protection of the Underwater Cultural Heritage that took place in 2001 and was mentioned in chapter 1 of the thesis, was adopted to confront the pillaging of this heritage in all waters and increase the protection of sites in situ. It set out basic principles for the protection, the treatment and research of underwater cultural heritage, aiming to raise public awareness on the importance and significance of underwater cultural heritage.

Unfortunately, it is admittable that the advances in diving technology have made the underwater archaeological sites vastly accessible to looters. However, looters are not the only threat against cultural heritage.

¹⁶⁸ UNESCO 2016, p. 17

General Threats

Some of the factors that threaten the underwater archaeological sites are:

-Natural erosion, specifically abrasion and scouring

-Accidentally or intentionally destruction of the archaeological evidence through sports diving. Diving may result to the disturbance of the marine growth that protects the wreck. Furthermore, the exhaled air bubbles create currents that can detach layers of the marine growth and increase the oxygen disposition, causing further corrosion.¹⁶⁹

-Bacteriological attack, as the chemical composition and physical properties of the water are alternated due to the pollution

-Overgrowth of sea organisms

-Augmented degradation rate due to the warm temperature of the water.¹⁷⁰ Climate change can cause higher water temperature that leads to coral bleaching, sediment movement that leads to mechanical abrasion, alteration of the PH and salinity, alteration of depth.¹⁷¹

-Anchoring damages the timbers of submerged ships.¹⁷² Human activities that can harm the underwater cultural heritage include dredging and harbor clearing, trawling and more fishing activities.¹⁷³

If we talk more precisely about the way some materials corrode, the following information could be provided.

Wood underwater becomes a nutrition source for marine borers, that are divided into mollusks and crustaceans. Apart from marine borers, we also have marine fungi that makes the surface of the wood soft and bacteria.¹⁷⁴

Biodeterioration of stone is the result of two processes: a. Biofouling, that is the accumulation of micro and macroorganisms on the surface of submerged materials. b. Bioerosion, that is the removal of stone particles due to mechanical or chemical actions of micro and macroorganisms. Biodeterioration is determined by the

¹⁶⁹ Oikonomopoulou 2018, p. 19

¹⁷⁰ Manders 2012, p. 6-12

¹⁷¹ Oikonomopoulou 2018, p. 20

¹⁷² UNESCO 2016, p. 19

¹⁷³ Delgado 2002, p. 4

¹⁷⁴ Oikonomopoulou 2018, p. 11-12

chemical composition of water and sediments, the light, water movement, depth and the mineralogical composition of the materials.¹⁷⁵

Metal corrosion is related to oxygenated seawater and depth, water movement and depth, salinity, temperature and the characteristics of the metal. In warm tropical seas, wrecks are covered by encrusting organisms, such as coralline algae. The concretion layer protects the iron from the oxygenated water. If removed, it increases corrosion.¹⁷⁶ Recent research on the RMS Titanic has revealed that a metal-eating species of bacteria threatens the submerged iron and steel shipwrecks.¹⁷⁷

Organizing an Excavation or a Survey of a Site of Archaeological Importance

The users of the game may find organizing an underwater excavation or survey interesting. Therefore, information about that will be provided, so that it can be integrated in the game. The gamer will have to organize a survey and start exploring the sea in a scientific way.

A Type of Survey

[Personal notes]

A light survey to evaluate a site is a non-intrusive method that should be completed prior to any excavation to establish the character and the importance of a site. That kind of survey includes further geological investigation, light cleaning, probing and spot sampling, without bulk removal of soil. This survey constitutes a cost-effective method to evaluate the site without destructing it and is conducted prior to the introduction of any intrusive method that is more expensive. Therefore, the purpose of the evaluation is not to completely excavate or detail the archaeological resource, but to assess the remains if found and to determine their significance. Additionally, estimating the chronology of the site can contribute to a more targeted approach, which would be cost and time effective if further research is to be derived.

For the recognition of the site as such of an archaeological importance, an observation of the site has to be performed by archaeologist divers prior to any work in the seabed, so that the site is outlined and its limits are designated. A light site cleaning can be delivered with dredges and/or crane. In that way, organic materials

¹⁷⁵ Oikonomopoulou 2018, p. 15

¹⁷⁶ Oikonomopoulou 2018, p. 18

¹⁷⁷ Delgado 2002, p. 4

like algae, sand and sediment will be removed so that the recognition of the artefacts is possible. After that step, a buoy will be placed in the central position of the site and will be geo-referenced from the surface. The artefacts are not to be removed in a light survey, but the archaeologists will assess the importance to recover any artefact to be preserved. That is because the primary interest of the archaeological investigation is to extract information about the site in a non-invasive way and with the minimum of time and cost. A documentation has to be made at each step of the survey for the reassurance that the goals are achieved and the project is delivered on time.

Planning

A meeting with all the members of the team of the project is required to be arranged several days prior to the commencement of a survey, so that the tasks are contributed and the equipment is ordered. It should be noted that the equipment has to be tested in advance, so that the risks of getting out of schedule are eliminated in case an amelioration or alteration of it has to be made. Being in schedule contributes to the preservation of the budget and is significant for the project.



Fig 88. Divers archaeologists cleaning with Dredgers the Antikythera shipwreck, 2012.



Fig 89. Diver archaeologist measuring and drawing at the Antikythera wreck.

Vessel

The vessel for the transportation of the team members is required to be equipped with the means for survey. It has to be long enough to transport the equipment and the crew. People are about to work 8 hours both on board and underwater, so that the vessel remains at the port the rest hours which are estimated from 15.00 o'clock at the afternoon till 8.00 at the morning. In case of bad weather, the vessel is expected to remain at the port but this is not so probable due to the time period that is chosen for the survey. However, in such cases the crew is not able to work and there might be a little delay in the schedule, but the archaeologist divers could do paperwork on that day and surface tasks.

It is necessary that an archaeologist diver or an engineer of the crew has undergone vessel-handling training, so that there will be no need for hiring an extra person to drive the vessel. The communication from and to the vessel via a sat phone has to be ensured so that all safety precautions are considered. Additionally, the vessel should be equipped with a compression chamber for the treatment of decompression

illness of a diver and with oxygen. Sufficient gas by a mask should be provided in case that an injured diver has to be transferred to a hospital. The vessel should have a ladder that must be securely fastened to the diving platform and must extend to at least 1.5 metres below the surface of the sea. Also, there should be an arrangement whereby the diving team can rescue a diver safely and fast out of the water and onto the diving platform. The arrangement can be a small crane which is approved for lifting persons.

AIR EMBOLISM

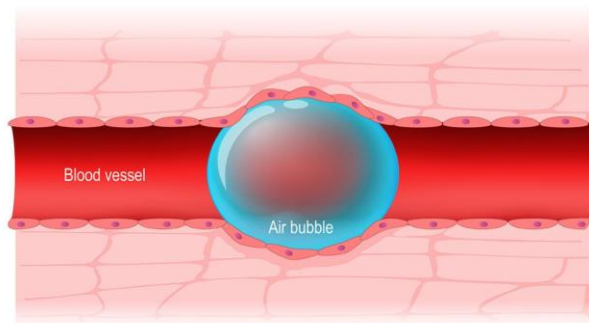


Fig 90. Air embolism is the divers sickness, resulted from the obstruction of blood vessels. Oxygen cannot be transported in the body.



Fig 91. The decompression chamber on board of a ship.

Divers

The diving scientists have to be divers who have received archaeological and scuba diving training. The diver contractor organises the diving operations and

assesses the safety working conditions, so there are no risks and the project is delivered on time. Also, he/she will prepare the Diving Project Plan (DPP) and the Risk Assessment (RA) prior to the project for defining the operations and eliminating the risks.

The prerequisite for the divers is the experience in working underwater. The equipment that is provided for each diver should include an adequate exposure protection that will be a dry suit, a breathing gas cylinder, a demand regulator, a mouthpiece assembly and a mask, fins, a pressure gauge, a submersible depth gauge and timing device, a buoyancy control device and an underwater compass. Furthermore, the divers have to be equipped with a communication device and a light device, along with cameras, pencils and boards, because a structured record of field observations should be on the plans. To reconstruct the site in a 2d representation, the archaeologists should perform scale drawings of the objects and take photographs with improved photo cameras.

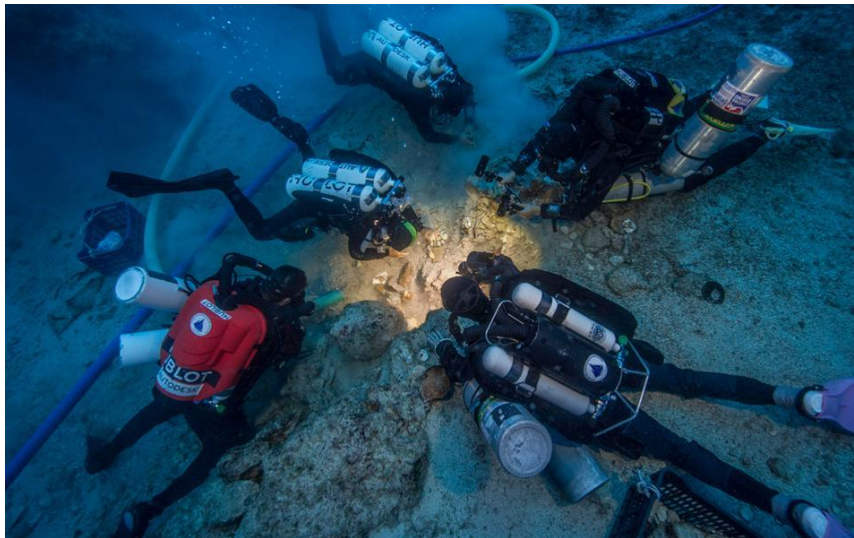


Fig 92. Underwater research in the Antikythera shipwreck.

Geological Survey

As aforementioned, a pre-disturbance survey must be undertaken before the removal of any cultural material. This survey can be combined with a geological survey. That means that for the evaluation of the site as such of a wreck site, technology has to be implied and guided by engineers. A gradiometer, a magnetometer, a sub-bottom profiler and a side-scan sonar will determine the presence of a wreck before the archaeologist divers outline the site.

ROVs, that are the Remote Operated Vehicles, or remote sensing equipment, that includes side scan sonars, magnetometers, metal detectors and sub-bottom

profilers, can be used to explore the deep waters, so that they detect unusual formations in the seabed and collect samples. ROVs can additionally carry manipulating devices for excavation or recovery of artifacts and samples to be examined.¹⁷⁸

As the gradiometer determines the gravity gradient, the magnetometer detects iron and steel objects and describes their magnetic fields, so it can locate a possible shipwreck. The side-scan sonar that transmits sound waves produces a graphic image of surface features of the seafloor and the sub-bottom profiler is used to emit sound pulses that bounce back from features and objects buried beneath the seafloor.¹⁷⁹

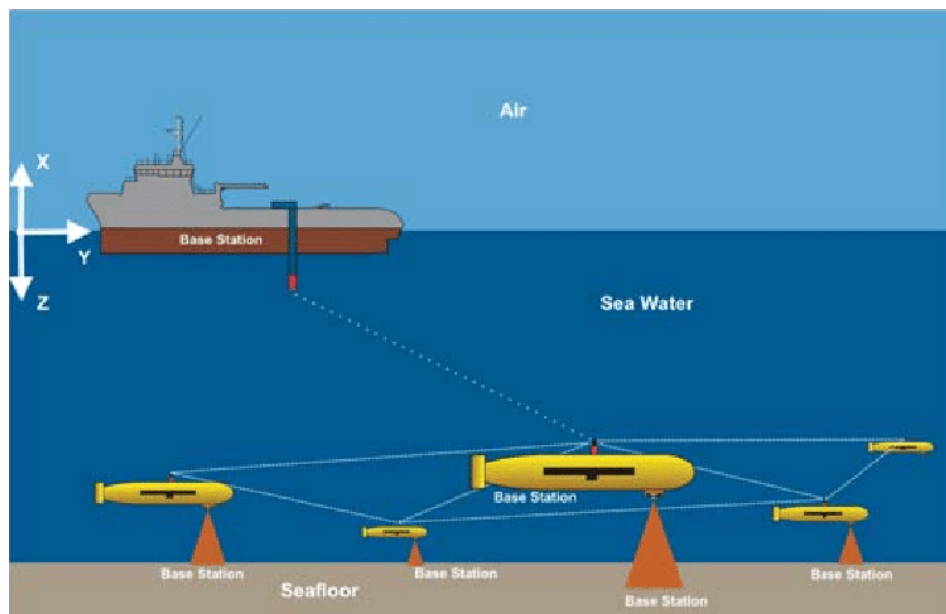


Fig 93. Localization of multiple underwater objects by gradiometer base stations.

¹⁷⁸ Delgado 2002, p. 5-6

¹⁷⁹ Plets 2013, p. 8

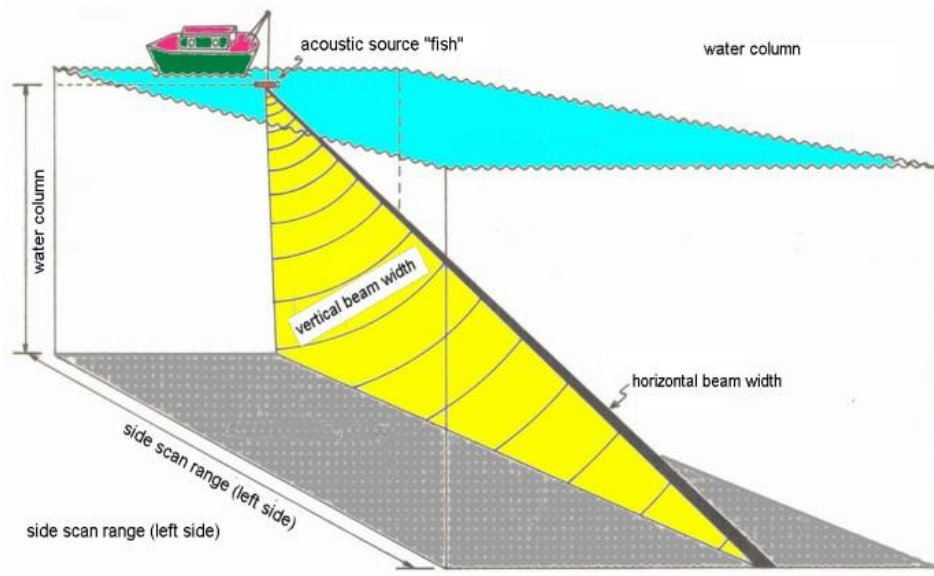


Fig 94. The side-scan sonar.

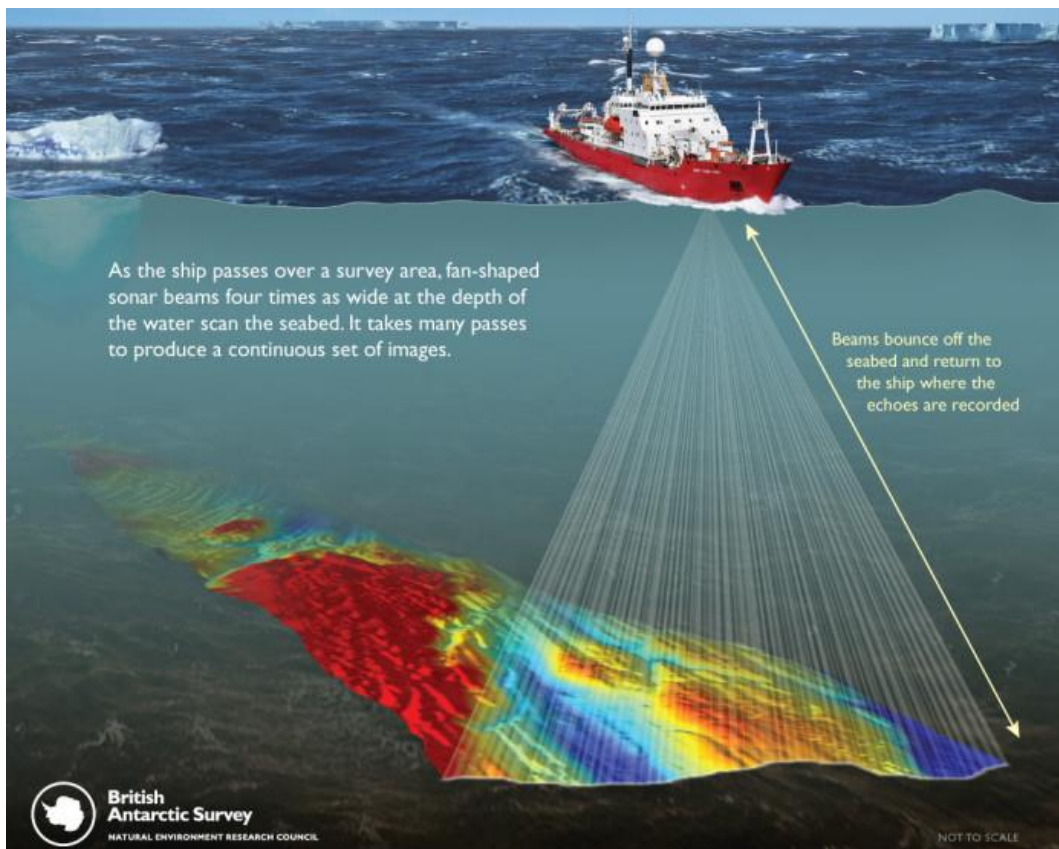


Fig 95. The multibeam sonar.

Site positioning

Positioning a referencing system on the sea-bottom is essential for reconstructing it later. The archaeologists should establish a referential system by

positioning an origin point to geo-reference it and two axes. The referential system can be a grid that defines the area in squares, so that the labelling of the artefacts will be possible. The latitude, longitude and depth of the reference point are obtained to position the site.

Preservation

After having found and excavated or surveyed an underwater archaeological site, the gamer will have to preserve it effectively, so that they further research it. Any cultural material removed from underwater is usually waterlogged and saturated with chloride ions, depending on the type of water it was found. The rate of deterioration may slow after a period of time in anaerobic conditions or if buried under sediment.¹⁸⁰

Here we will talk about the ways of protecting an underwater site against natural factors.

1. Covering or enclosing the site: a. Sediment deposition with the use of geotextiles, shade cloth or rubber matting, sediment encapsulation and use of barriers, sediment trapping using geotextiles, shade cloth, debris net or artificial seagrass. b. A metal framework can enclose the site. Metal panels are added on the frame, they are moveable so that the site can be researched. Suitable for long-term protection. A metal construction can also be built in a cage form attached to the seabed. There are lock openings on top. The netting has a protective coat of zinc to protect it from corrosion. c. Metal netting from galvanized iron fastened to the sea bottom with spikes or weighed down with concrete blocks, but the netting can be susceptible to corrosion or can be cut with tools.

2. In situ restoration: In the Underwater Archaeological park of Baiae tools such as axes, hammers, chisels and spatulas are used for the mechanical removal of biodeteriogens from walls and floors.

¹⁸⁰ Delgado 2002, p. 4



Fig 96. The Nymphaeum at the archaeological site of Baiae.

3. The site can be excavated and reburied, wrapped in a type of plastic fabric or deposited directly. Geotextile could ensure stability in the long term and prevent erosion of the sediment.¹⁸¹

In Situ Preservation

In situ preservation of the wreck following non-destructive techniques and sampling should be encouraged, so that the site is protected from erosion and remains an archaeological site that can be investigated further in the future. Records from the site can be useful when further evidence comes in light that will contribute to the better understanding of the technological advancements through the centuries.

Apart from research, the protection of the site ensures future enjoyment of the site as a diving destination and it can be inherited to the future generations. A complementary reason for preserving the wreck is the safety issue. As the wreck decays, it could pose a threat to divers' life.

The in situ preservation permits the protection and the further scientific research of the archaeological sites. Isolated artifacts can be stolen if found in the seabed and their recovery is required after their discovery. However, recovering an

¹⁸¹ Oikonomopoulou 2018, p. 21-25

entire wreck is not that simple. Its recovery, preservation and exhibition can be very costly and it is more preferable that its cargo is recovered and the hull stays in the seabed, so it can be studied and preserved there.

If artefacts or part of a wreck are to be transported to a terrestrial museum, then that museum needs to have a big capacity and its humidity, temperature and light has to be controlled in the entire place. If the hull is left underwater, those factors do not need to be controlled, but the place still has to be safeguarded from swimmers, divers and ships, so that it is not damaged. If the cargo has already been recovered, then the dangers related to the activity of treasure hunters can be limited.

Sacks of sand and wire netting is used for the protection of ancient wrecks in Italy, an economical method and simple to implement that can prevent their erosion from marine agents and potential raiders. However, periodic monitoring and renewal is required. ex. the Santa Caterina in Puglia, that is a cargo ship of the 2nd century AD , the Secca dei Mattoni off the island of Ponza in Lazio, that is a cargo ship of the 1st century AD and the cargo ship of the 3rd century AD at Giglio Porto. The Superintendence of Tuscany has adopted the surveillance method of a closed-circuit television camera on the seabed. That way the wreck can be monitored from the guards in the harbour office, but it can also be viewed by the clients of a local hotel in a screen in its lobby.



Fig 97. The Secca dei Mattoni wreck and the wire netting.

Buoys with flashing lights and alarms are used in the lake of Viverone to mark and prevent the degradation of a lake settlement. The Superintendence for Southern Etruria introduced a type of protection for the wreck of a 2nd century BC cargo ship that is consisted of modular galvanized sheet iron panels covered in glass fibre. Each of the panels had a steel welded rod that was covered in glass fibre as well and all those panels were connected together with thick chain links, forming the shape of a

tortoise shell. A gel coating of the same colour of the mud on the lake bottom covered the glass fibre and completed the camouflage. That covering shield was anchored to the sea floor, but can be removed upon deciding to excavate and study further the wreck.

Sometimes, covering a wreck to protect it from treasure hunters can attract them even more.¹⁸²

Working techniques for the In Situ Preservation

As aforementioned, parameters in the benthic zone such as temperature, salinity, oxygen, light and PH affect the presence of microflofra and microfauna that can harm ancients remains. Biodiversity that is the symbiosis between species can be affected by pollution. Hydrographic changes caused by river estuaries, rainfalls and tides affects the preservation condition of an archaeological site. Here, the ways due to which the in situ preservation can have the best of the results will be mentioned.

-Monitoring of the water movement that may cause movement of the sand waves over the wreck and destroy the material by exposing it or protect it by burrying it deeper. The sand waves can be monitored by using a side-scan sonar and the tide and currents that may lead to the movement of sand waves can be measured by sensors.

-Investigating the purity of water around the wreck with a datalogger to determine the temperature, salinity, conductivity and the dissolved oxygen.

a) The salinity of the water has a pronounced effect on the stability of metal objects and the biological growth of bacteria and fungi that cause the deterioration of wood.

b) The water temperature determines the rate of marine growth, the corrosion of metal objects and the biodeterioration of organic materials. The degradation rate is investigated by measuring the O₂ consumption, the CO₂ production and heat production at different temperatures and water contents, but it is more sensitive to increasing temperatures.

c) In an aerobic, oxygenated aqueous environment, the increasing acidity results in the oxidation and corrosion of metals. The oxidation rate of the iron is further increased by the presence of chloride.

The datalogger can also measure the Redox and the PH of the water and the sediment that is linked to the analysis of corrosion potentials of metal objects.

-Testing soil samples to determine the rate of preservation of the buried parts of the wreck through analyzing the microorganism's presence and the soil's

¹⁸² Davidde 2002, p. 83-84

properties. The hydrology, acidity and alkalinity consist some soil properties that affect the corrosion of metals and the oxidative degradation of organic materials, e.g. the wood. Furthermore, solute types and concentrations form protective coatings on metals and dissolved organic matter in the soil solution protects organic materials. Depending on the solutes present, the initial corrosion processes may create a protective layer that includes phosphates and slows corrosion. Biological activity encourages the formation of sulphides that slow corrosion. However, the oxidation of the sulphides results in strongly acidic soils in which corrosion of metals is rapid.

-Investigating the corrosion products and marine concretions that create a protective coating and prevent the damage of artifacts. Analysing the corrosion products and the marine concretions contributes to the better understanding of the degradation rate and the measures that can be taken to preserve the wreck.

-Testing whether the reaction of Galvanic corrosion can be encouraged to prevent further metal corrosion. By putting into contact in an electrolyte two or more dissimilar metals with different electrode potentials, the one metal act as anode and the other as cathode. If the electrolyte contains only metal ions that are not easily reduced, then the cathode reacts, resulting to the corrosion of the metal that acts as an anode and the inhibition of the metal that acts as a cathode.

-Monitoring the site by systematically visiting it and recording it.¹⁸³

Underwater Archaeological Parks as a way of In Situ Preservation

The Marine Protected Areas, also known as Marine Parks, are protected marine areas, that aim to the sustainable management of fishing resources and marine biodiversity.

The Diving Parks are created for recreational diving. Scientific research may be conducted. They are sustainable and preserved through the revenues of the tickets and the payments.¹⁸⁴ In those cases, the marine environment and the cultural heritage can usually be protected and economic development can be achieved through the constant ongoing monitoring.

The difference between of Marine Protected Areas and diving parks lies in that the diving parks are smaller in size, they focus on economic growth, monitored more effectively, the contribution of private sector is obvious, by funding them in order to generate revenue.¹⁸⁵

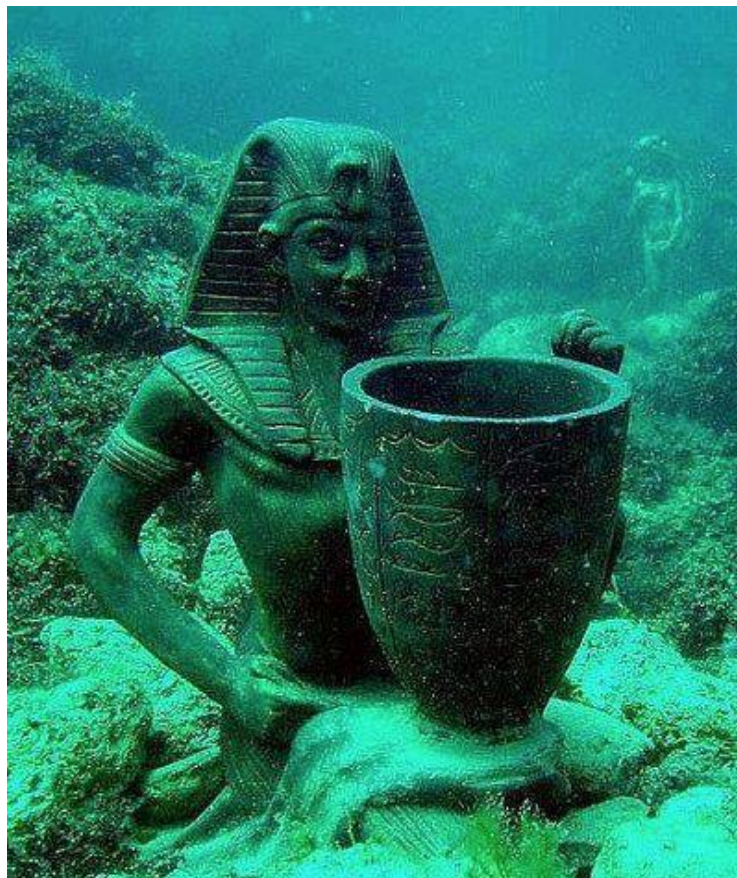
¹⁸³ Manders 2012, p. 14-19

¹⁸⁴ Oikonomopoulou 2018, p. 8-9

¹⁸⁵ Stathis 2019, p. 3

The Underwater Archaeological Parks can be: a. Underwater archaeological sites, that are open to the public by underwater visits and glass-bottomed boats. They have already been excavated and their access to public does not consist a danger for their conservation. This category includes seaside settlements and lake villages and shipwrecks with heavy cargo. b. Underwater archaeological reserves, that are not open to public, but they serve research purposes. c. Underwater eco-archaeological or underwater nature-archaeological parks and reserves, that are areas of important geology or morphology that include archaeological sites. Underwater visits are allowed. d. Untouched underwater archaeological reserves, that are sites of archaeological importance, where excavation and research has not been planned for the near future. Boats, fishing and diving are restricted or even prohibited, so that they are protected.¹⁸⁶

Therefore, the Underwater archaeological parks constitute a combination of diving parks and marine protected sites and diving there, if allowed, should be accompanied by professional divers who are responsible for the protection of those sites.¹⁸⁷



¹⁸⁶ Davide 2002, p. 84

¹⁸⁷ Stathis 2019, p. 3

Fig 98. From the lost Egyptian city of Herakleion, that was submerged beneath the Mediterranean 1,200 years ago and was considered to be a legend, before it was discovered.

Underwater archaeological parks promote the fundamental right of public access, bring attention to the protection of archaeological sites and they bring profit to the State and the local enterprises through guided tours, restaurants, etc. Furthermore, they create professional openings for underwater archaeologists and marine biologists and conservators.¹⁸⁸ However, their operation should not put underwater archaeological heritage in danger, since that would contradict the actual purpose of conservation.¹⁸⁹ It is essential that the states create a catalogue for their underwater cultural heritage including their state of conservation and the risks and the ways for their mitigation.¹⁹⁰

An example of an underwater archaeological museum is the underwater archaeological park of Baiae, a few kilometers North of Naples, that belongs to the volcanic complex of Campi Flegrei. Today Baiae is a small village with archaeological remains.

The Ministry of Culture and the ministry of Environment established in 2002 the underwater archaeological site of Baiae as an Underwater Archaeological Park. It includes walkways, gardens known as viridaria, thermae, fish ponds, pools, statues and mosaics that as the decoration of structures. The ancient remains are subjected to erosion, human activities and the colonization by biological agents and therefore has high maintenance costs.¹⁹¹

¹⁸⁸ Davidde 2002, p. 87

¹⁸⁹ Oikonomopoulou 2018, p. 35-37

¹⁹⁰ Davidde 2002, p. 87

¹⁹¹ Bruno 2015, p. 41-42



Fig 99. Mosaic from the underwater archaeological park of Baiae.



Fig 100. Statue from the underwater archaeological park of Baiae.

Buoys bound the park that includes the ruins of a villa of the Early Imperial Age that later became property of the emperors, the remains of the nymphaeum-triclinium of the Claudian palace, baths, mosaic floors and wine shops. Divers are accompanied by the local diving school, that has been authorized by the

Superintendence. Informative panels. The park of Baia can serve as a training ground for in situ conservation, due to the mosaics and the wall paintings and methods to track the rate of deterioration. The State is examining the possibility of creating resin replicas of the statues and more finds that have been recovered and are now kept at the terrestrial museum.¹⁹² However, duplication may eradicate the unique non-replaceable character of the original artefacts and the replicas might degrade the authenticity of the site.¹⁹³

In the archaeological underwater site of Punta Gavazzi in Sicily there are signs for directions and underwater colored lines that indicate the archaeological artefacts, that are anchors, pottery and amphoras. There are panels for the function, date and place of origin of them. Additionally, there are panels as well describing the navigation in general in antiquity, the types of amphoras, maps and regulations with which the visitors have to comply. Visitors are consisted of divers and non divers, that arrive at the site on a boat with a transparent bottom. What is more, there is a school at Ustica where summer courses in underwater archeology take place, due to the public interest and the tourism. Theory of ancient trade and navigation and practical lessons of surveying and photography are taught there.

Licensed guides should accompany the recreational divers. The site has to be monitored and surveyed, for example by sonar scanning, to check the condition of the site. Violation of legislation should lead to fines and imprisonment. In the Liberty wreck site in Tulamben village, Bali, Indonesia there are some customary laws called Awig-awig. Those laws include prohibition about fishing within 1000 meters of the shipwreck, removing the remains of the wreck. If someone violates those rules they are ostracized from society and are not allowed to follow religious rituals. If someone understands the importance of something they can protect it and it can bring benefits economical and humanitarian by preserving the cultural heritage.¹⁹⁴

Divers and Technology

Divers use compressed gas supply such as SCUBA or surface-supplied air in order to dive in a depth of 40 meters or less. Nitrox and Trimix, that are constituted by a mix of gases, are used for technical or mixed gas diving for diving in depths of 80 meters or more. However, for depths of 100 meters or more, submarines are better to be used, because the human body is not exposed to high pressure and there is no

¹⁹² Davidde 2002, p. 85-86

¹⁹³ Delgado 2002, p. 4

¹⁹⁴ Oikonomopoulou 2018, p. 27-28

fear of decompression sickness. Titanic for example is approachable for scientific teams in submarines.



Fig 101. A diver surveys the Hannah M. Bell shipwreck on Elbow Reef, Key Largo, Florida.



Fig 102. Diver archaeologist with a drysuit at the Antikythera shipwreck.

Alternative ways of preservation

Apart from the preservation of material, there is the reconstruction of the original site by producing a physical or digital substitute. It is called informational preservation and is based on records that preserve the most important pieces of information about the site. The observer can have access to the content without having to have access to the material. a. virtual dives. the expansion of digital technologies has been proved an asset for the underwater cultural heritage for the archaeologists and the public. Technologies reconstruct the aquatic environment and the submerged features in a realistic way that imitates the underwater experience. Venus Virtual Exploration of Underwater Sites, sponsored by the European Community aims at the virtual exploration of deep underwater archaeological sites that are not accessible to people. The virtual environment is constructed according to a database that contains information collected from bathymetric and photogrammetric surveys that remote operated underwater vehicles have collected, such as photos and estimation of the location of each object. Archaeologists examine the cargo and the environment. The virtual environment aims to visualization of the full view and from close range, navigation to travel and find the way, interaction with the data of each artifact, type, dimensions, location, fragment status. VR technologies vs AR technologies that provide the possibility to extend, transform and combine different cultures in the same environment.¹⁹⁵

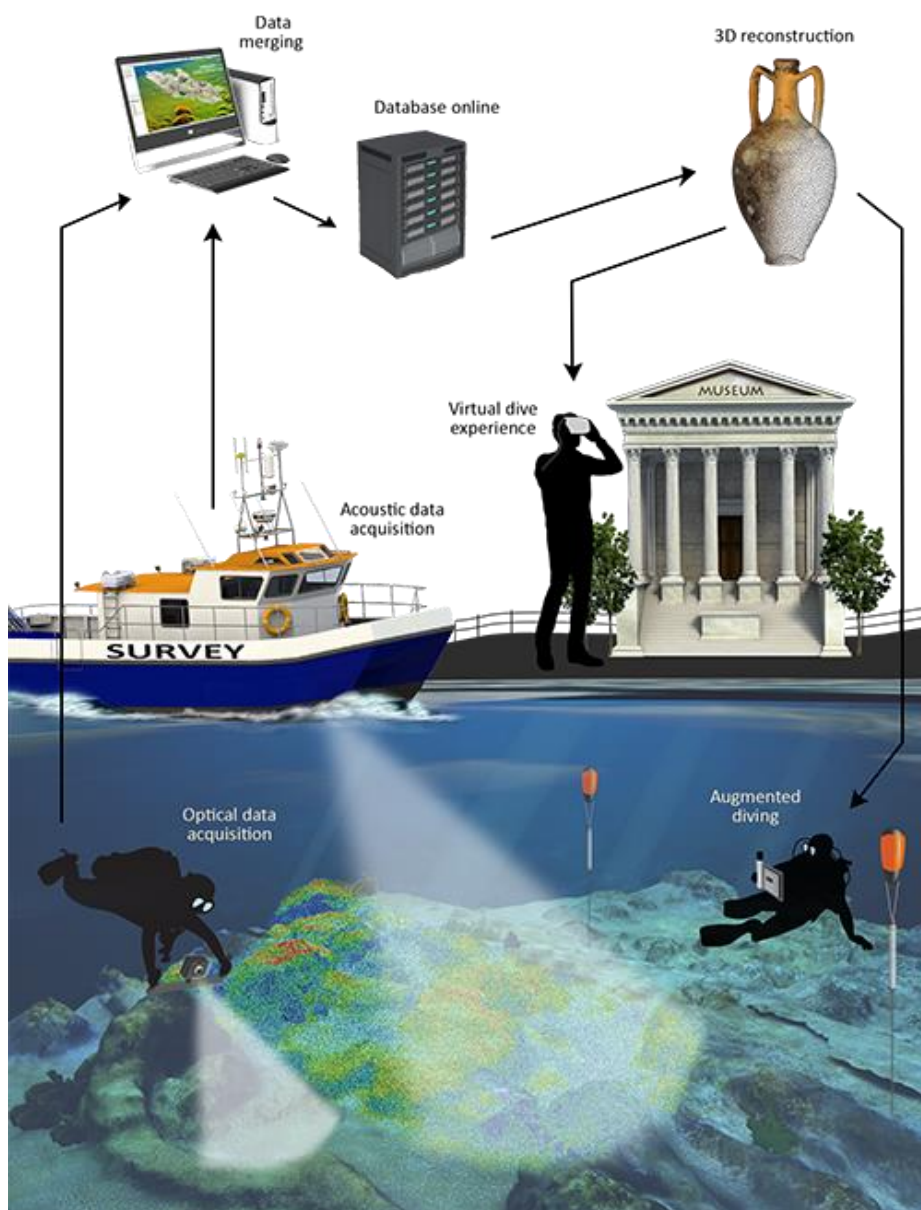
An immersive 3d visualization application that utilizes a VR CAVE Virtual Reality Cave Automatic Virtual Environment technology was developed for the 4th century BC Mazotos shipwreck in Cyprus. An opportunity for archaeologists to study the wreck. Navigation through the virtual environment, images of the artefacts. Feeling of examining the actual site underwater. That cannot be independent from traditional research methods.

The VISAS Virtual and augmented exploitation of Submerged Archeological Sites is a research project funded by the Italian Ministry of Education, University and Research that is more visitor oriented. Its aims are recreational and educational, for the visitor to enjoy the underwater archaeological sites. VR systems are employed and a user friendly platform addressed to various kinds of audiences. A Roman cargo ship at a depth of 25 to 30 meters and the site includes 3D models of both the ship and the surrounding geomorphology fauna and flora. Each feature is indicated by a different color, yellow for historical and archaeological information and green for the biological. Acoustic and visual graphic effects such as fog are used, to make the environment more realistic. There is a non-guided and a guided tour. In the non-guided tour the user can navigate to any direction and interact with the features without any limitations, but in the guided tour there are the limitations that scuba diving pose and there is specific route and time within the user can navigate. In any case, real scale

¹⁹⁵ Oikonomopoulou 2018, p. 29

graphics were based on images and measurements obtained from the site, and there is an immersive stereoscopic display consisting of a back-projected screen and polarized goggles, gesture-based interaction, immersive soundscape, that changes according to time and depth. Two main types of visitors, marine enthusiasts and schoolchildren with their teachers.

That way, the museum visitors participate actively through interactive functions and the site remains safe. Therefore, we come to the conclusion that virtual museums complement the values and aims of museums,¹⁹⁶ something that a video game could do too.



¹⁹⁶ Oikonomopoulou 2018, p. 30-32

Fig 103. Architecture of the integrated package of services proposed by the VISAS project.

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