



Cultural Heritage Agency  
Ministry of Education, Culture and Science

# Dutch presence in Cuban waters

*A first year of archaeological surveys*

**L.F. Derksen, R.W. de Hoop,  
M.R. Manders and M. Cacéres Suárez**



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**Colophon**

Dutch presence in Cuban waters: a first year of archaeological surveys

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Illustrations: Cultural Heritage Agency of the Netherlands and Consejo Nacional de Patrimonio Cultural, unless mentioned otherwise

Design and production: Xerox/Osage

ISBN/EAN 978-90-5799-340-4

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Cultural Heritage Agency, Netherlands Ministry of Education, Culture and Science

Postbus 1600

3800 BP Amersfoort

[www.cultureelerfgoed.nl](http://www.cultureelerfgoed.nl)

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Between 17 and 26 July 2019, the National Council of Cultural Heritage of Cuba (CNPC), the agency of the Ministry of Culture of the Republic of Cuba, and the International Programme for Maritime Heritage of the Cultural Heritage Agency (RCE) of the Ministry of Education, Culture and Science of the Netherlands jointly conducted fieldwork as part of the project entitled 'Dutch Presence in Cuban Waters'. This marked the first practical implementation of the Memorandum of Understanding (MoU) signed by CNPC and RCE in 2018<sup>1</sup>, in which both parties committed to joint research and management of Dutch-Cuban maritime heritage. For the fieldwork in 2019, emphasis was put on creating a solid basis for further collaboration by exploring the opportunities for research and the protection of Dutch-Cuban underwater cultural heritage.

The fieldwork consisted of a non-intrusive sonar survey as well as a dive survey focusing on three locations west of Havana. The surveys were conducted with the aim to assess whether these locations still hold archaeological evidence of three Dutch ships that were wrecked here in September 1640 in a storm that lasted for three days. These ships, the *Bul van Hoorn*, the *Alkmaar* and the *Keizerin*, were part of the fleet of Cornelis Jol (1597–1641), who was an admiral for the Dutch West India Company (WIC).

The main research question was what archaeological fieldwork could reveal about the location of the wrecks of Jol's fleet. The surveys revealed that two locations still hold a number of objects of archaeological significance. The discovery of three cast-iron cannons at Boca de Río Mosquito seems to match the historical record, since it's where the *Bul van Hoorn* is known to have sunk with all its cannons. In their current location underwater and in a heavily concreted state of preservation, however, the cannons could not be definitively linked to a country of origin. At the other sites, no possible remains of Dutch shipwrecks were found. Archaeological evidence at the three locations cannot currently be linked to the wrecks of Jol's fleet. Further research is recommended at Boca de Río Mosquito, with a particular focus on obtaining more information on the three cannons. New fieldwork was planned by CNPC and RCE in 2020, but has been postponed to a later date yet to be determined due to the COVID-19 pandemic. However, both parties are determined to continue their collaboration. Possible

future research interests include the Dutch shipwreck site of Zorrita la Tabla, situated in Golfo de Guanahacabides in the province of Pinar del Río. This shallow site was last visited in the 1990s, but is under threat of natural erosion while neither a detailed site plan nor management plan exists. A non-intrusive assessment would be a necessary first step in the preservation of this late 17th to early 18th century wreck site.

## The International Programme for Maritime Heritage

Dutch ships have sailed to every corner of the globe. The fruits of the exchange that ensued, both good and bad, have helped shape the Netherlands to what it is today. The tangible and intangible remnants of this maritime exchange can be traced beyond Dutch borders as well. There are at least 1,500 Dutch shipwrecks in foreign waters. This includes the state-owned wrecks of the Dutch East India Company, the Dutch West India Company, the Admiralty and the Royal Netherlands navy as well as wrecks that remain to be uncovered. This maritime heritage is part of our culture, our history and our national identity. In the absence of responsible management, these wrecks will disappear. Valuable maritime heritage must therefore be actively preserved for current and future generations. This is the goal of the International Programme for Maritime Heritage, which is run by the Cultural Heritage Agency of the Netherlands, an executive agency of the Ministry of Education, Culture and Science. The work of the programme is located at the interface between archaeology, policy and heritage management. Collaboration, knowledge exchange and capacity building are essential. This involves identifying and investigating sites, making decisions about management and protection, providing training and facilitating the exchange of knowledge. We do this in collaboration with coastal state governments, international organisations, embassies, maritime archaeologists, divers and volunteers. Without such wide-ranging cooperation, it would not be possible to take care of Dutch maritime heritage around the world.

<sup>1</sup> <https://english.cultureelerfgoed.nl/topics/maritime-heritage/international-projects/dutch-presence-in-cuban-waters/memorandum-of-understanding>

# Acknowledgements

The project, 'Dutch Presence in Cuban Waters', is a joint collaboration between CNPC and RCE, supported by the Embassy of the Kingdom of the Netherlands in Havana. We would especially like to thank Dr. Ovidio J. Ortega Pereyra, who remained our scientific adviser throughout the fieldwork. The following people contributed to the project.

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 Sonia V. Pérez Mojena – current president  
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Dr. Ovidio J. Ortega Pereyra – scientific adviser

*GEOCUBA Estudios Marinos: GEOEM – Havana, Cuba*

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## 1.1 Background

As early as the second half of the 16<sup>th</sup> century, Dutch ships found their way to the Caribbean.<sup>2</sup> Drawn by the promise of commodities such as sugar, hides, tobacco and salt,<sup>3</sup> more than once, Dutch ships docked at Havana and other places – much to the dismay of Spain. By the 17<sup>th</sup> century, when the Spanish and Dutch were intermittently at war on the European continent, small Dutch privateers and, shortly after, ships of the West India Company (WIC) swarmed the Caribbean and challenged the Spanish supremacy in the West. Especially in the first decades after its establishment in 1621, the WIC adopted a strategy of ‘raid and trade’, capturing Spanish ships as prizes while trying to establish a foothold in trade on Brazilian soil. Cuba, with Havana as its stronghold, was pivotal for Spain as the rendezvous point for the richly laden and heavily armed Treasure Fleet before its annual return to Europe. The gold, silver, tobacco and dye it carried were of paramount importance to the Spanish Crown. As part of the strategy of challenging the Spanish hegemony in the Caribbean, while simultaneously striking a blow that could be felt back in Europe, the WIC set its sights on capturing that very same Treasure Fleet. Only once did it succeed, when, under the command of commander Piet Hein, the WIC captured the ‘Silver Fleet’ in the Bay of Matanzas in 1628. Further attempts ensued, but to no avail. Yet, the Dutch presence in Cuban waters remained a fact and, to this day, the tangible and intangible heritage of this period has left its trace in the Cuban cultural landscape and society – from shipwrecks and the fortification of Santiago de Cuba in response to the Dutch threat to references in children’s songs.

This rich and dynamic intertwined history has inspired Cuba and the Netherlands to join hands in preserving the remains of their shared past. Since 2013, the National Council of Cultural Heritage of Cuba (CNPC), the agency of the Ministry of Culture of the Republic of Cuba, and subsequent maritime heritage programmes of the Cultural Heritage Agency (RCE) of the Ministry of Education, Culture and Science of the Netherlands have jointly set out to elucidate and ultimately manage what remains of the Dutch shipwrecks in Cuban waters. This has resulted in a list of 21 Dutch ships that have been lost

near Cuba over the centuries.<sup>4</sup> The most recent of these is the *SS Medea* – a Dutch merchant vessel that was torpedoed by a German U-boat in 1942. The lion’s share of Dutch ships lost near Cuba, however, date to the first half of the 17<sup>th</sup> century, corresponding with the most active period of the WIC in the West (1621-1648). Among them were vessels connected to WIC Admiral Cornelis ‘Houtebeen’ Jol, who dared to follow in the wake of Piet Hein’s prize success. Although Jol never managed to capture a ‘Silver Fleet’, he became well-known by both friend and foe for his feats in the Caribbean Sea. One such a feat happened in 1637, involving the capture of a merchant vessel stolen from under the many eyes on board 52 Spanish ships of what is said to have been one of the most richly-laden Treasure Fleets of its time. Or when in 1638, Jol mustered 17 sails with the aim to take hold of not one vessel, but the entire Treasure Fleet. Though twice in this attempt, more than half of his fleet stood idly by, watching Jol and his men clash with the side of General Don Carlos de Ibarra.<sup>5</sup> In the end, the prize got away, leaving Jol to try again in 1640, but more on this in Chapter 2. Even today, his name still appears in Spanish history books and is sung in children’s verses, where to this day he is still remembered in Spanish by his nickname *Pie* or *Pato de Palo*, which translates as ‘Peg Leg’.

This intense history, plus the potential of a large number of Dutch shipwrecks in Cuban waters, was the basis of a new-found maritime cultural partnership. It spurred Cuba and the Netherlands into signing a Memorandum of Understanding (MoU) on 11 July 2018, in which both parties committed to joint research and management of Dutch-Cuban maritime heritage. Between 17 and 26 July 2019, CNPC and RCE jointly conducted fieldwork as a first practical implementation of this MoU, of which this report represents the outcome. In this first year of archaeological surveys, emphasis was put on exploring collaborative opportunities and thus establishing a solid basis for intensified research and protection of Dutch-Cuban underwater cultural heritage in the years to come. On mutual grounds, CNPC and RCE selected three shipwreck locations (Fig. 1) for archaeological survey. These were the wrecks which were once part of the fleet of Admiral Jol, including the *Alkmaar*, which was wrecked near Boca del Río Banes, the *Bul van Hoorn*, wrecked near Boca de Río Mosquito, and the *Keizerin*, wrecked near Boca y Ensenada de Playa Herradura. All three were lost in a hurricane that raged from 11 to 13 September in 1640 while Jol’s fleet was waiting at anchor to strike at the

<sup>2</sup> Goslinga 1971.

<sup>3</sup> Previously, the Dutch obtained their salt from Portugal, but because the Dutch Republic was at war with Spain in what would come to be known as the Eighty Years’ War (1568-1648), usual trade with Portugal had ceased due to the Iberian Union.

<sup>4</sup> Ortega Pereyra 2016; Brouwers in press.

<sup>5</sup> Overeem 1941.

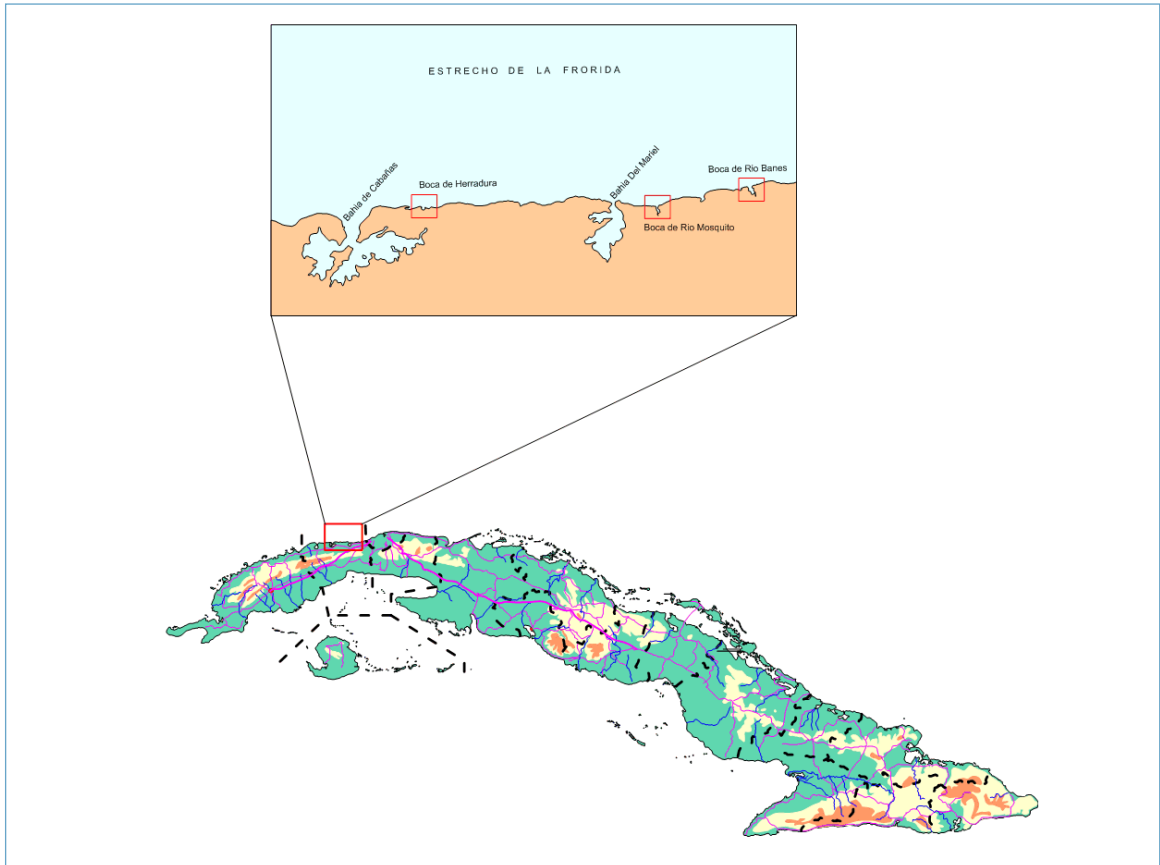


Figure 1 - Map of Cuba with an inset showing the research locations (Courtesy of GEOEM).

Treasure Fleet. This report celebrates the first field efforts to highlight and preserve this special history that bonds Cuba and the Netherlands.

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## 1.2 Reading guide

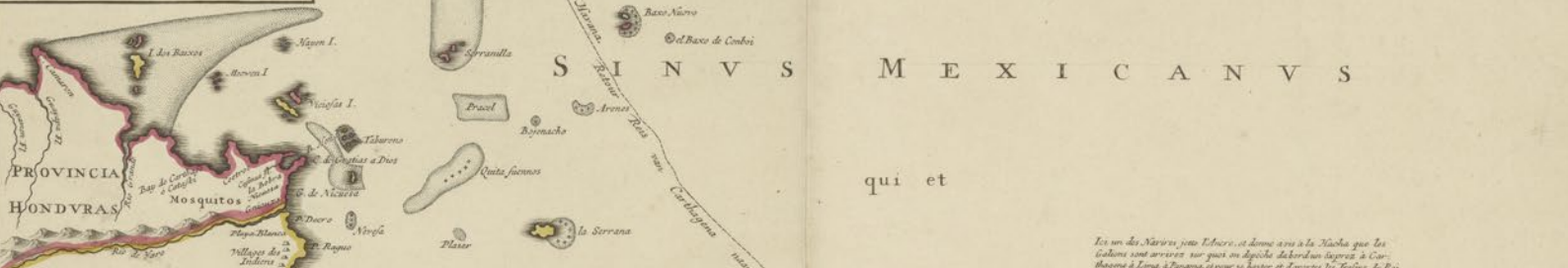
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This report presents the results of the first year of archaeological surveys jointly conducted by CNPC and RCE. After the introduction, Chapter 2 outlines the historical context as well as the archaeological

expectations. In Chapter 3, the research aims and research questions are presented, followed by a section on the methods and techniques employed. The results of the fieldwork are presented in Chapter 4, with a separate entry on each research area. In Chapter 5, the research questions are answered individually. The recommendations follow in Chapter 6, while final considerations with a view to future collaborative opportunities for CNPC and RCE are shared in Chapter 7. The appendices contain the table of contact points for each research area, while the drawings of the cannons found at Boca de Río Mosquito are also included.



NOVA ISTHMI AMERICANI, qui et PANAMIENSIS item DARIENSIS, TABVLA, in qua Vrbes PORTO BELLO PANAMA et CARTHAGENA, verissimis suis locis positæ, summo studio emendatæ, atque ex novissimis observacionibus in lucem editæ, a REINERO et JOSVA OTTENS AMSTELODAMI.



## 2 Preliminary research

### 2.1 Historical context

In pursuit of trading commodities, including salt for the herring industry back in the Republic of the Seven United Netherlands, Dutch ships increasingly plied Caribbean waters. This was much to the growing dismay of the Spanish Crown, which was at war with the rebellious Dutch. While the war in Europe raged on, weapons increasingly clashed in the West. During a period of peace between Spain and the Republic, now known as the Twelve Years' Truce (1609-1621), the lure of free trade inspired minds in the Republic to establish a company similar to the Dutch East India Company (VOC), which had been established in 1602. In 1621, just when the war between Spain and the Republic in Europe had broken out once again, the *West Indische Compagnie* or Dutch West India Company was founded to bundle private investments into a trading company equipped to compete with Spain in the West. Under the fresh flag of

the WIC, the Dutch institutionalized privateering, while the hunt for the Spanish Treasure Fleet or *Flota de Indias*, especially in the first decades, became a goal in itself. After Piet Hein's successful raid on the *Flota de Indias* in 1628, others followed suit, including Cornelis Jol, whose multiple attempts to capture a Treasure Fleet are of particular interest to this project.

Jol's aforementioned first attempt in 1638, ten years after the success of Piet Hein, ended in a stalemate. His second attempt followed two years later. In early September 1640, after having rallied an impressive number of 36 ships, both small and large, Jol manoeuvred his fleet in front of Havana (Fig. 2). While Jol's fleet created a blockade, the ships lay in wait, ready to strike. On 11 September, with the fleet at anchor, fate struck a devastating blow to Jol's chances for his prize. A hurricane, lasting as long as three days, had prematurely drawn an end to Jol's expedition. Four ships were blown onto shore and wrecked west of Havana, while the others were forcibly dispersed in different directions. The ships



Figure 2 - View of Havana. Johannes Vingboons, *de stadt ende bay van Havana geleegeen op 't eylandt Cuba*, c. 1665 (Courtesy of Nationaal Archief).

that were wrecked were the *Cattenbau*, the *Alkmaar*, the *Bul van Hoorn* and the *Keizerin*. Not much is known about these individual ships apart from some scraps of information combined from both the Dutch and the Spanish-Cuban accounts.

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## 2.2 Archaeological expectations

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### 2.2.1 Jol's wrecks

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#### *Cattenbau*

The *Cattenbau* was wrecked at what is now a military zone called Jaimanitas, Havana. It was a small *jacht* of 50 *last* (100 tonnes), prepped as a fire ship.<sup>6</sup> It was wrecked near Playa Jaimanita in present-day Havana. Fire ships were often obsolete vessels that were filled to the brim with inflammable material. During battle, they would have been purposefully set alight, steered in the direction of an enemy ship and abandoned before reaching the target. The *Cattenbau* carried a small crew of 15 men, who were subsequently arrested after the ship became stranded. The vessel itself was burned.

#### *Alkmaar*

The *Alkmaar* was wrecked at Boca del Río Banés.<sup>7</sup> Apparently a fine private vessel commissioned by the WIC, the *Alkmaar* was a ship of 200 *last* (400 tonnes), carrying 32 cannons, 12 of which were bronze. It became stranded on Boca del Río Banés. It must have been well within reach of the Spanish coastal forces, as Spanish records reveal they managed to arrest a total of 95 men, 45 of which were identified as soldiers. Meanwhile, the vessel was stripped and set alight.

#### *Bul van Hoorn*

The *Bul van Hoorn* was a ship of 200 *last* (400 tonnes) carrying 19 cannons, six of which were bronze. According to archival sources,<sup>8</sup> this ship broke apart and was completely lost to the sea. Of the 122 crew members, all but 22 drowned, while the survivors were immediately arrested when they reached the shore.

#### *Keizerin*

The *Keizerin* was wrecked at Boca y Ensenada de Playa Herradura.<sup>9</sup> Although its carrying capacity of 200 *last* (400 tonnes) is similar to the other ships, the Spanish deemed the *Keizerin* to be the largest of those wrecked in the storm. It carried a crew of around 120 men. Spanish sources reveal that the ship was mostly intact when it became stranded.<sup>10</sup> This allowed the Spanish to remove a lot of material, after which it was burned.

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### 2.2.2 General

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Considering the historical context of each of the four shipwrecks, expectations of finding shipwreck-related material related to these specific wrecks were highest for the *Bul van Hoorn*, as this ship went down with all 19 cannons. Especially when made of bronze, cannons can be preserved for long periods of time in a marine context. Only the *Bul van Hoorn* seems to have been completely lost to the sea. Since the stranding of the other wrecks allowed for their plunder and burning by Spanish forces on the coast, this probably means that only the more perishable features remained, such as the wooden structure of the ship itself, with the cannons and other valuable objects removed. The chance that any remains of these particular wrecks could still be found was therefore considered less likely. Nonetheless, the historical records revealed too little to make a sound judgment of these expectations. In addition, it was not only Dutch shipwreck material that was expected to be found, as explained further below.

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### 2.2.3 Dating

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The targeted wrecks were lost in September 1640; however, the research areas are in fact in a coastal domain with a long history of marine activity, and therefore objects of different origins dating to different time periods were to be expected. According to Dr Ovidio Ortega's research, a 19<sup>th</sup>-century corvette, for instance, was also wrecked at Boca del Río Banés.

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<sup>6</sup> Brouwers in press, 48.

<sup>7</sup> Brouwers in press, 50.

<sup>8</sup> As transcribed from the Spanish contemporary records (*Archivo general de indias. Audiencia de Santo Domingo*. Legajo: 101. No.: 143B. Fecha: 11 de septiembre de 1640).

<sup>9</sup> Brouwers in press, 49.

<sup>10</sup> As transcribed from contemporary Spanish records (see also footnote 8).

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#### 2.2.4 Complex type

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Possible shipwreck sites, former flotsam, jetsam, lagan, derelict and possible other sites related to marine anthropogenic activities.

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#### 2.2.5 Integrity and state of preservation

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Iron and bronze material, such as cannons and anchors, were among the possible remains expected to be found. With shipworm (*Teredo navalis*) in the subtropical Cuban waters and heavy coastal mechanical action of the waves, wooden ship structures were expected to be preserved primarily if covered by sediment, although finds of elements recently laid bare, as well as more modern material, were also among the expectations.

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#### 2.2.6 Physical features

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The underwater topography along the coast west of Havana is known to consist of coarse-grained sandy sediment interspersed with volcanic rock. The surveys in this project were used to gain more detailed information on the local underwater environment.

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#### 2.2.7 Possible disturbances

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Possible disturbances were expected from human coastal and marine activity, such as fishery and construction work along the coast. Natural forces, such as wave action (especially during hurricane season) and deterioration of wooden features due to micro and other organisms such as shipworm, were other factors expected to have a major influence on the seabed composition.

Initially, the intention was to devote part of the project to two sites that are known to still hold Dutch shipwreck material: Zorrita de la Tabla and Punta del Holandés.<sup>11</sup> The project had to be limited, however, to five days of fieldwork and five days of preparation, discussions and post-processing the data. This was due to the fact that the organization of the fieldwork took longer than expected, while the fieldwork was also dependent on the right weather conditions. Therefore, full priority was given to surveying the target areas related to Jol's 1640 fleet. Furthermore, since the area where the *Cattenbau* was wrecked is now a military zone requiring additional permits, the project team decided to shelve the idea of surveying the *Cattenbau* wreck area for the time being. The site may still be surveyed in the future. Although time was limited, a practical follow-up to the Memorandum of Understanding was deemed paramount by all partners involved. Part of the objective was therefore for CNPC and RCE to use the project as a warm-up to get acquainted with each other and find the best ways to collaborate in the field, as well as to explore the collaborative opportunities that accompany the MoU.

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## 3.1 Objectives

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In short, the objectives of the project therefore comprised:

- Surveying the three target areas:
  1. Boca de Río Mosquito for the *Bul van Hoorn*
  2. Boca del Río Banas for the *Keizerin*
  3. Boca y Ensenada de Playa Herradura for the *Alkmaar*
- Becoming acquainted with each other's modus operandi, finding ways to enhance collaboration in the field, as well as exploring collaborative opportunities

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## 3.2 Research questions

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The main research question of this fieldwork was:

*What can archaeological fieldwork reveal about the locations of the Dutch vessels of Cornelis Jol that were wrecked in 1640 during a hurricane near Havana?*

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<sup>11</sup> Brief information on these sites can be found online at <https://mass.cultureelerfgoed.nl/zorrita-la-tabla> and <https://mass.cultureelerfgoed.nl/punta-del-holandes>.

Answering this question required a marine geophysical survey, followed by a dive survey, the details of which are discussed in the next section. The following sub-questions were formulated to structure the surveys:

- What is the nature of the contact points located during the marine geophysical survey?
- If remains of archaeological interest are found, what are the (estimated) dimensions, position and orientation of these remains?
- What can be said about the type and origin of the objects found?
- What preliminary conclusions can be drawn about the dating of the objects of archaeological interest?
- What relationship do the site and the objects have to their surrounding environment?
- What threats to underwater cultural heritage can be identified in the area?
- What constraints had a negative impact on the execution of the survey?
- Based on the answers to all of the questions above, what are the implications for further research?

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## 3.3 Methods and techniques

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Following the rules stipulated in the Annex<sup>12</sup> of the UNESCO 2001 Convention and the guidelines of the Dutch Archaeology Quality Standard (KNA) protocol 4103<sup>13</sup> for reconnaissance Field Surveys (sediment), above as well as under water, it was decided to survey each of the three target areas in two steps – a marine geophysical survey followed by a dive survey to check any anomalies encountered. The details of both techniques are outlined below.

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### 3.3.1 Marine geophysical survey

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Prior to the marine geophysical survey, GEOCUBA Estudios Marinos (GEOEM) studied previous work carried out in the region in order to grasp the physical, geographical and geological characteristics of the study area, as well as to determine the appropriate methods and techniques for the survey.<sup>14</sup> The aim of the marine geophysical survey itself was to gain an impression of the underwater topography and to discern anthropogenic

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<sup>12</sup> <http://www.unesco.org/new/en/culture/themes/underwater-cultural-heritage/2001-convention/annex-of-the-convention/>

<sup>13</sup> Inventariserend veldonderzoek, op-/onderwaterfase in Dutch, as outlined by SIKB (<https://www.sikb.nl/archeologie/richtlijnen/brl-4000>).

<sup>14</sup> Castillo & Cacéres Suárez 2019.



Figure 3 - The Pilar II moored in the Marina Hemingway west of Havana.

objects from natural features prior to diving. This action was expected to result in several targets within each research area that could be investigated further in the dive survey. For each area, the team started with a side-scan sonar survey (SSS). From the (real-time) sonar image of the local underwater topography, contact points representing possible anthropogenic features were discerned from the otherwise natural phenomena and marked for further investigation in the dive survey. After the SSS, a magnetometer was used to locate ferro-metallic objects on and in the seabed following in the wake of the SSS-lines. If ferro-metallic anomalies were discovered, these were also selected for further inspection by divers – especially when these anomalies matched the contact points from the SSS.

#### Technical details

Using Marina Hemingway<sup>15</sup> as a base, the team travelled back and forth to the survey locations on board the Pilar II (Fig. 3). The equipment used by GEOEM included a dual frequency side-scan sonar (SSS) and a magnetometer (Fig. 4). The SSS towfish used was a C-MAX CM2 of the EDF type, equipped with 325/780kHz dual frequency. The SSS-survey was conducted running lines with a spacing

of 55 m, predominantly in an E-W-E direction in most of the areas investigated, including a lateral survey range of 75 m to ensure the required overlap of 125% of coverage between survey lines. On the axis of each area, two to three sonar lines were completed, maintaining an approximate N-S-N direction to guarantee total coverage. In all cases, the sonar frequency used was 325 kHz. The sonar transducer was towed from the stern of the boat using an average distance of 6 m from the DGNS antenna to its geometric centre. The team sailed between 2 m and 3 m deep at a speed of 4 knots, ensuring proper resolution of the sonar image of the seabed. A total of 18.5 km of prospection lines were completed, distributed as presented below:

- 8.7 km at Boca del Río Banes
- 4.5 km at Boca de Río Mosquito
- 5.3 km at Boca y Ensenada de Playa Herradura

The sonar data was acquired and processed digitally using C-MAX's MaxView and SonarWiz mapping software by the North American Chesapeake Technology. This allowed the processing and storage of a large amount of information well within the projected timeframe. This was also according to the current processing standards in use at GEOEM. A GEOEM specialist monitored the rendition of the SSS in real time.

<sup>15</sup> 23° 5.35' N, 82° 30.5' W.





Figure 4 - Side-scan sonar (centre) and magnetometer (right) devices on board the Pilar II.

The following parameters were kept by GEOEM:

- Measuring the depth of the seabed: 0 m to 30 m
- Average speed of the survey vessel: 4 knots
- Average measurement error with DGPS:  $\pm 0.15$  m
- Magnetometer measurement interval: 1 second
- Towing distance of the magnetometer sensor from the DGPS antenna to the geometric centre of the sensor: 43 m
- Average immersion depth of the magnetometer sensor: 4 m
- Background magnetic field level: 42,000 nT
- Average towing distance of the sonar transducer: 6 m
- Average depth of immersion of the sonar: 2 m

The magnetometer survey was carried out with the SeaSPY Marine Protonic Magnetometer developed by Marine Magnetics, which has 0.001 nT of absolute resolution. The measurement interval for all the magnetometer surveys was 1 second, while the towing distance between the magnetic sensor and the vessel was 43 m. To guarantee the desired resolution as well as to protect the sensor, an average speed of 4 knots was maintained, while a small buoy was attached to the towing cable to ensure the safety

and a stable depth of immersion of the sensor at approximately 1 m.

For the magnetic profiling, field measurements were made in a grid with a higher density than employed in the SSS method (20 m). The predominant direction of the profiles was E-W-E in most of the surveyed areas, while two to three magnetometer lines were completed along the axis of each area, with an approximate N-S-N direction, to guarantee total coverage, levelling of the measurement grid and calibration of the mean square error of the survey. The data was recorded digitally on the on-board computer using the latest version of the SeaLink 8.4 system.

In total, 27.2 linear km of magnetometer prospecting lines were recorded. These were distributed as follows:

- 12.1 km at Boca del Río Banés
- 10.9 km at Boca de Río Mosquito
- 4.2 km at Boca de Herradura

In order to georeference the profiles and research stations with the required precision, the OmniSTAR Global Positioning System (GPS) by Hemisphere was



Figure 5 - The team discussing the acquired marine geophysical data in preparation of the dive surveys.

used in the differential variant (DGPS) based on the L-Band subscription. This system is designed for marine and terrestrial applications that require great precision in positioning and orientation. It consists of a receiver and two separate or independent antennas, which allow precise heading with a mean square error in a range between 0.01 and 0.17 degrees, taking into account the separation between the antennas, which can vary between 1 m and 10 m. The average errors in the determination of the coordinates of the stations and survey lines obtained with this methodology were approximately 0.15 m.

In order to guarantee the stability and quality of the measurements with the DGPS, static measurements were taken each day before and after the survey by using the Marina Hemingway support point as a reference, as its coordinates were known with great precision. These measurements were taken for 2-3 minutes, recording with a cycle of 1 sec, using the Hypack 2017 digital data acquisition system.

After each field day, preliminary processing of the technical parameters of the survey, positioning and field descriptions of the work done on the day was carried out, allowing an assessment of the fulfilment of the work schedule and adaptation of the proposed project plan

(Fig. 5). When reviewing the database resulting from the fieldwork, it was found that the quality of the geophysical records obtained was good in relation to the positions and in accordance with the established standards, meaning the information was suitable to move on to subsequent processes (final interpretation of the investigation).

During the DGPS control, it was observed that the daily average value of the coordinate measurements made at the control point did not differ by more than  $\pm 0.15$  m in relation to the calculated value for that point. The final processing of the geophysical data was carried out by specialists from the Hydrography and Geology and Geophysics Agencies of the GEOCUBA Marine Studies Company.

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### 3.3.2 Dive survey

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After targets were selected from the contact points and anomalies found in the marine geophysical surveys, a team of at minimum two and at maximum four divers with SCUBA gear dived on site to locate and visually inspect the respective targets up close.



Figure 6 - The fieldwork crew on board the Pilar II.

With three different research areas to be surveyed, there was a lot of ground to be covered. The initial dives were quick-scan surveys of these locations in order to get a first impression of the potential these sites could have for finding Dutch shipwreck material. This would allow the team to cover enough ground in only a few days. In case the team would discover finds that could potentially be linked to Jol's shipwrecks, the option was held open to revisit and inspect these finds in more detail on the last day of fieldwork. In the end, only the research area at Boca de Río Mosquito was revisited during this campaign.

At each research area, the divers inspected the contact points, searching an area of at least 10 m in diameter around the point of interest. Objects of archaeological

interest were recorded in photos and on video for future reference, while a select number of objects were measured and schematically drawn to scale. For the drawings, the divers used a drawing slate and pencil. Measurements were taken using a tape reel. Anchors and cannons were measured to obtain the most indicative measurements in width and height, focusing on diagnostic features if recognized as such. The camera equipment used consisted of a SeaLife DC2000 and a Nikon D7100 Digital SLR camera in waterproof housing, as well as a GoPro HERO 7 Black for shooting videos, photos and post-fieldwork 3D photogrammetry processing. The team (Fig. 6) kept daily records of all project-related activities, reviewing the work done in relation to the project plan so as to base the next steps on both plan and practice.



## 4.1 Boca de Río Mosquito

### 4.1.1 Marine geophysical survey

The first area selected for survey was the area in front of Boca de Río Mosquito. Located approximately 23 km from Marina Hemingway, the coastline is characterized by an indentation leading to Río Mosquito. This is where the *Bul van Hoorn* was wrecked according to historical sources.

The side-scan sonar survey (Fig. 7), comprising 4.5 km of lines set out parallel to the shore, resulted in 12 initial contact points (A 1). A number of lines east from the river mouth, however, could not be surveyed as planned as there were a lot of clandestine, makeshift fishing nets deployed perpendicular to the coastline. These fishing lines had to be evaded to mitigate the risk of the towfish becoming entangled in the nets. Nonetheless, from the total of 12 contact points, the SSS-image yielded two points of interest that were selected for inspection by the dive team. The magnetometer employed afterwards (Fig. 8) yielded one small magnetometer anomaly at another location, which was also selected for closer inspection.

### 4.1.2 Dive survey

This particular area and its contact points were inspected in three dives, stretched over a period of two days, with the entry point above the coordinates of the first magnetic anomaly.

#### Iron cannons

Three iron cannons were found within close distance of each other, at depths ranging from 18 metres farther out to sea to 15 metres closer to the coast. The first cannon was found at the bottom of the entry point, lying next to a modern long metal pipe (Fig. 9; Appendix IV).<sup>16</sup> A total length of 270 cm was recorded, its muzzle pointing north. The cannon was heavily concreted, meaning that otherwise diagnostic features, mostly at the breech end, were no longer visible. Leaving not much more than the outlines of a cannon, the only roughly discernible features were its button and a trunnion on the eastern lateral side. At first glance, the cannon appeared to be a heavily corroded cast-iron 12 pounder.

<sup>16</sup> See the 3D model at: <https://sketchfab.com/3d-models/middle-cannon-off-mosquito-beach-cuba-77b2fdea4e6144cabf60dc944c74470d>.

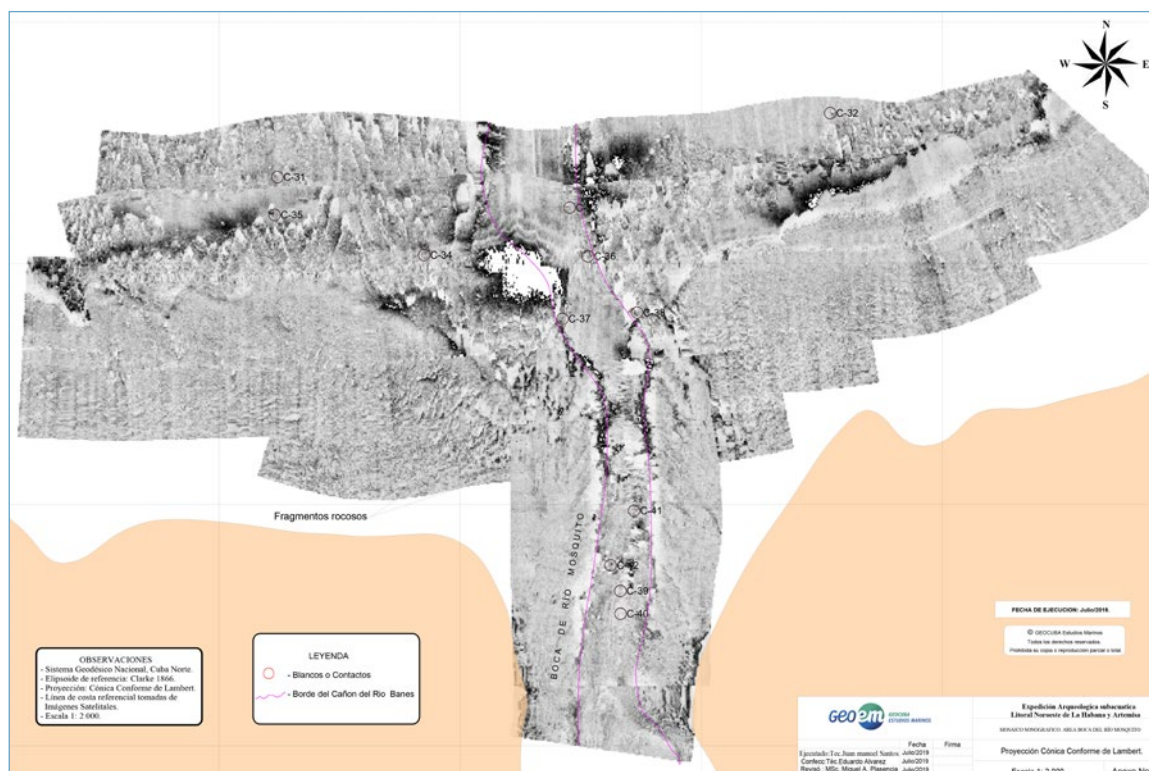


Figure 7 - Side-scan sonar image of the seabed at Boca de Río Mosquito. A total of 11 contact points are circled. Diver's points of entry were chosen to correspond with the two magnetometer anomalies. Scale 1:2000 (Courtesy of GEOEM).

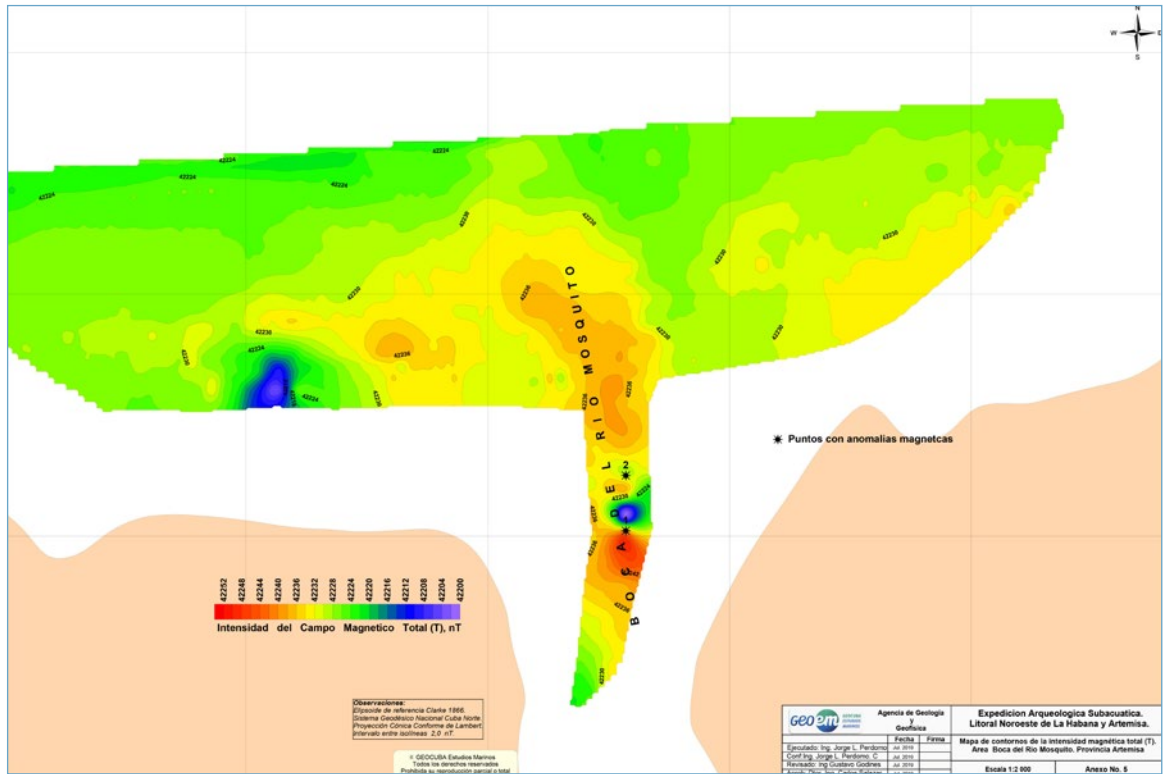


Figure 8 - Magnetometer rendition of the area near Boca de Río Mosquito, showing the intensity of the magnetic field (T). Scale 1:2000 (Courtesy of GEOEM).



Figure 9 - 3D photogrammetry depiction of the middle cannon, corresponding to the drawing in Appendix IV.

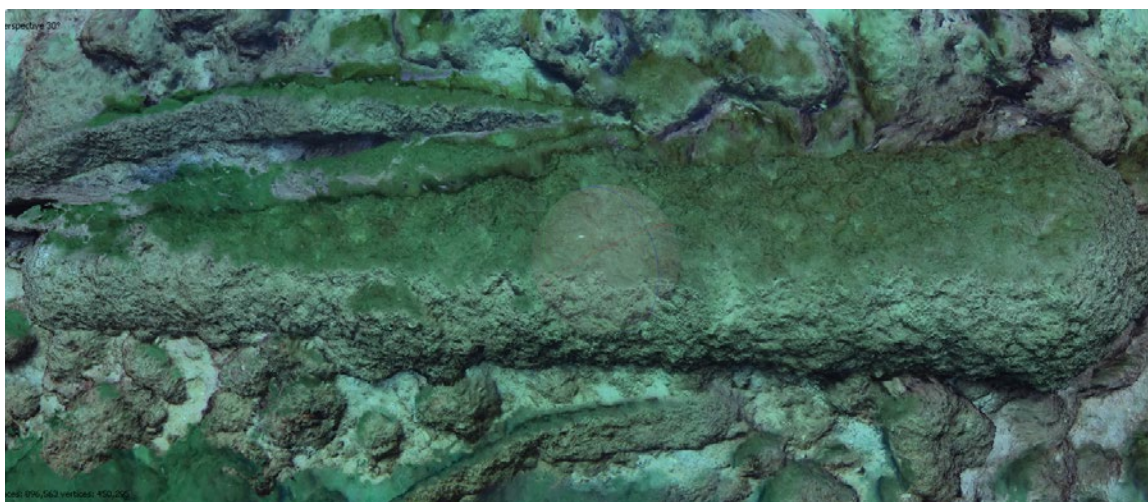


Figure 10- 3D photogrammetry depiction of the southern-most cannon, corresponding to the drawing in Appendix VI.

Approximately 10 metres south of the cannon, another cannon was found (Fig. 10; Appendix VI).<sup>17</sup> The muzzle and button were the only recognizable features of this equally heavily concreted cast-iron specimen. It had a length of 294 cm, with its muzzle pointing north. It was initially assessed to be a 24 pounder.

Only a few metres north from the entry point, a third concreted cast-iron cannon was located (Fig. 11; Appendix V).<sup>18</sup> This cannon measured 276 cm in length. Its muzzle pointed north.

The three cannons were found in line west to east, the first two of which were found nearly aligned and approximately three metres apart, while one was slightly oriented to the northwest. Nico Brinck, an expert<sup>19</sup> on

ship's cannons, was consulted for further analysis of the three cannons.<sup>20</sup> At the time of writing, however, he has concluded that in their current heavily concreted condition, the cannons cannot be tied to a specific provenance or date. Identification may, however, be possible if the breeches were to be made visible in their entirety.

#### Wooden structures

Further inspection of the immediate surroundings of the cannons yielded a few loose pieces of wood, probably oak. Some of them were definitely younger in age, but others could be old. Upon inspection, some of the wood showed blue paint (Fig. 12). These could not have been above the seabed for long, otherwise the wood would have been eaten away by shipworm (*Teredo navalis*), which is present in the warm Cuban waters.<sup>21</sup>

<sup>17</sup> See the 3D model at: <https://sketchfab.com/3d-models/southernmost-cannon-off-mosquito-beach-cuba-881ebffdec34488985d6581007cf7ad5>.

<sup>18</sup> See the 3D model at: <https://sketchfab.com/3d-models/northernmost-cannon-off-mosquito-beach-cuba-da976d8fac1045e8b0f074e5af6e10d2>.

<sup>19</sup> See his most recent bilingual work *Guns of the Netherlands*, including a reference to Jol: Brinck 2020a, 229.

<sup>20</sup> Brinck 2020b.

<sup>21</sup> Turgeon et al. 2009



Figure 11 - 3D photogrammetry depiction of the northern-most cannon, corresponding to the drawing in Appendix V.

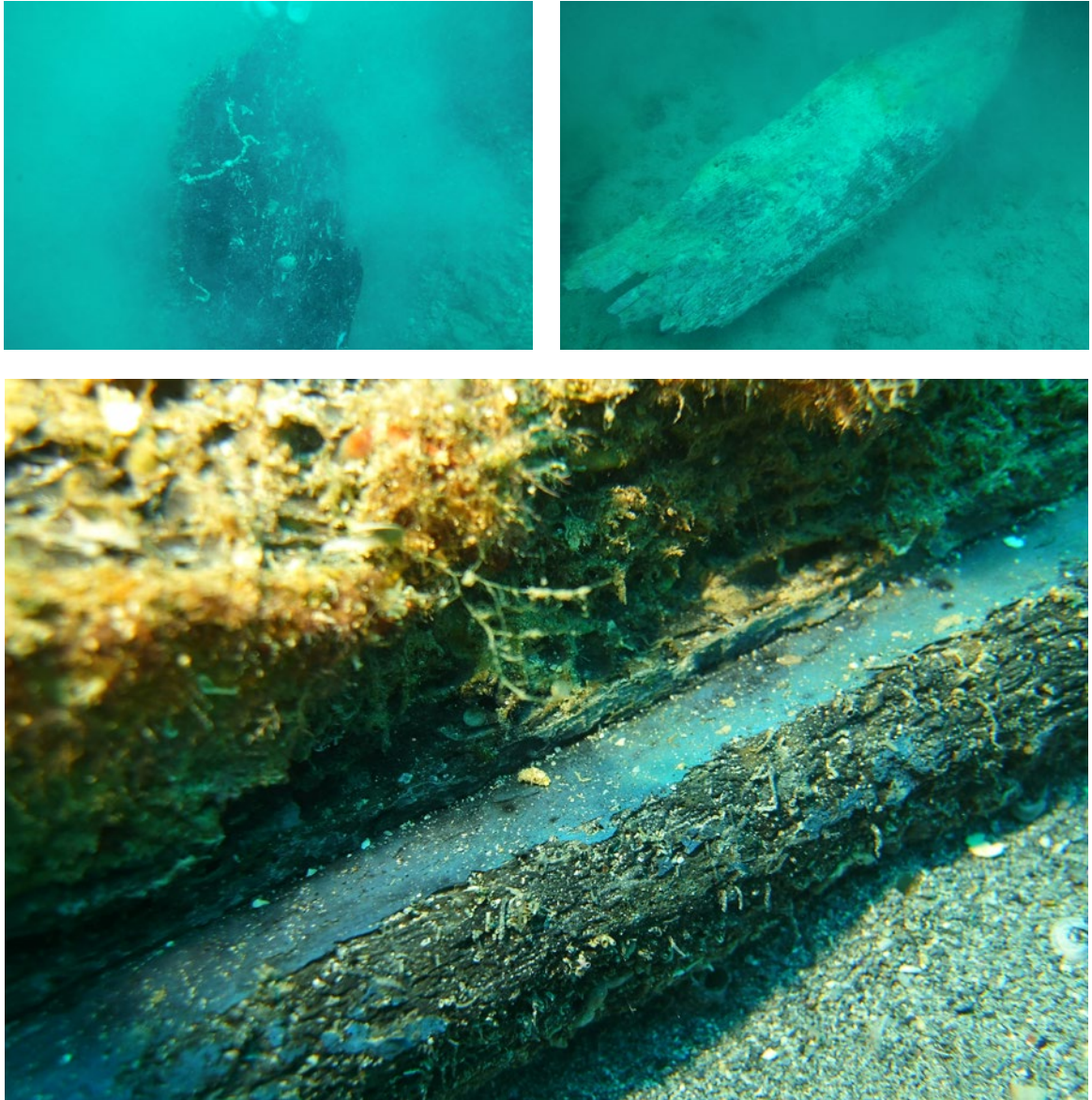


Figure 12 - Wooden shipwreck material as found at Boca de Río de Mosquito, including one specimen with remains of blue paint.



Figure 13 - Bathymetry at Boca de Río Mosquito. Carta náutica, scale 1:150,000, de Cayo Arenas a Bahía de La Habana.

**Natural environment**

The natural environment is characterized by a channel-shaped declining slope, walled in by high-reaching rocky sides (Figs. 7 & 13). Fine sandy sediment covers most of the area, interspersed with occasional rocks and a mix of modern and natural rubble. Tested once, the sediment seemed very deep: to at least an arm’s length. All in all, the area appears to be a natural trap for ships.

**Miscellaneous**

After recording all the cannons, the four divers split into groups of two to further scan the surroundings for additional archaeological finds. In this particular survey, a brick of yellow clay (Fig. 14) measuring 20 cm x 8 cm x 5 cm





Figure 14 - A yellow brick lying on the seabed

was found lying on top of the seabed. Since it was found outside any clear context, its relevance to the site remains unknown at this point. There is, however, a possibility that the brick could be associated with a Dutch ship, as it bears resemblance to an *IJsselsteen* brick. Similar bricks were used as ballast or in the construction of the galleys of Dutch ships.<sup>22</sup> The brick was recorded on video and recovered by the second team of divers for future analysis. Future chemical analysis of the clay may point out its origins.

Another find included a pewter box, which was also recovered (Fig. 15). However, close inspection revealed that it was relatively modern. Furthermore, on the west side of the mouth of the Río Mosquito inlet, two iron-stock anchors were found (Fig. 16). Iron-stock anchors and chain were introduced around the second half of the 19<sup>th</sup> century and continued to be in use into the first half of the 20<sup>th</sup> century.<sup>23</sup> A stockless anchor dating from the period of WWII was located near the site as well. These anchors support the idea that this was an



Figure 15 - Pewter box found lying on the seabed at Boca de Río Mosquito.

ideal place for ships to lay anchor, but that danger was always close.

Near the high bridge that stretches over Río de Mosquito, there was a lot of debris found that appeared to be quite recent, perhaps related to the construction of the bridge itself, which was completed on 16 July 1958. Objects encountered ranged from tractor tyres to possibly even train or cart wheels and concrete pillars. While archaeological objects could be mixed in with the debris, it was not possible to discern any shipwreck material.

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#### 4.1.3 Interpretation

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While the *Bul van Hoorn* broke apart at Boca de Río Mosquito, it cannot be definitively stated that the three cannons found belong to this ship. Cleaning away the concretion underwater might reveal the breeches in more detail, which could potentially allow an assessment of provenance and date. However, it could very well be the case that these cannons were a part of the Spanish coastal defence. Theoretically, shipwreck material could still be buried underneath the sediment. This was partly checked with the magnetometer, but only at the locations investigated. Another method could be sub-bottom profiling. However, the area seems to be very disturbed, with lots of modern material scattered throughout. Without knowing for a fact that there is a shipwreck underneath the sediment, it will be very difficult to discern shipwreck material from other objects and phenomena in the seabed, as modern rubble scatters the area and the current techniques available are too limited to distinguish objects in the seabed.<sup>24</sup>

Judging from the natural environment, a possible wrecking scenario for the *Bul van Hoorn* is that during the storm, with water levels rising and falling due to extreme wave heights and lengths, it could have hit rocks hidden beneath the waves. The gully in which the cannons are situated is quite narrow and, on both sides, rocks are just a few metres under the current water surface. Although the natural surroundings, with fine sediment, suggest conditions favourable for preservation of a wooden shipwreck within the sediment, it is currently not possible to say whether this location holds any traces of a wooden wreck in addition to the modern material found. Only intrusive work can confirm this.

<sup>22</sup> Veit 2000.

<sup>23</sup> Curryer 1999.

<sup>24</sup> Manders & Gregory 2015, 26-27.



Figure 16 - Two iron-stock anchors at Boca de Río Mosquito.

Furthermore, the presence of relatively modern pipelines and construction rubble in close proximity to the cannons is evidence of recent disturbances such as dredging activities, which may have laid bare the cannons. Other remains may have also become visible during these activities, potentially leaving them exposed to salvage, although this is only speculation, as only the cannons remain visible. CNPC is investigating whether there is any information on construction work carried out in this area. Another possibility is that a hurricane laid bare the objects, as the sediment may be stirred up by the energy of the storm.

If time and capacity allows, CNPC could inspect the site on an annual basis: especially after a strong hurricane, as this could also reveal what effect it might have on the site.

## 4.2 Boca del Río Banes

### 4.2.1 Marine geophysical survey

The second site selected for survey was the area immediately in front of Boca del Río Banes, where the *Alkmaar* stranded.

The SSS-survey initially marked a total of 13 contact points (Fig. 17; Appendix II), while the magnetometer run (Fig. 18) resulted in two anomalies. This large number of targets to choose from required an adaptive strategy in the dive survey, discussed further below.

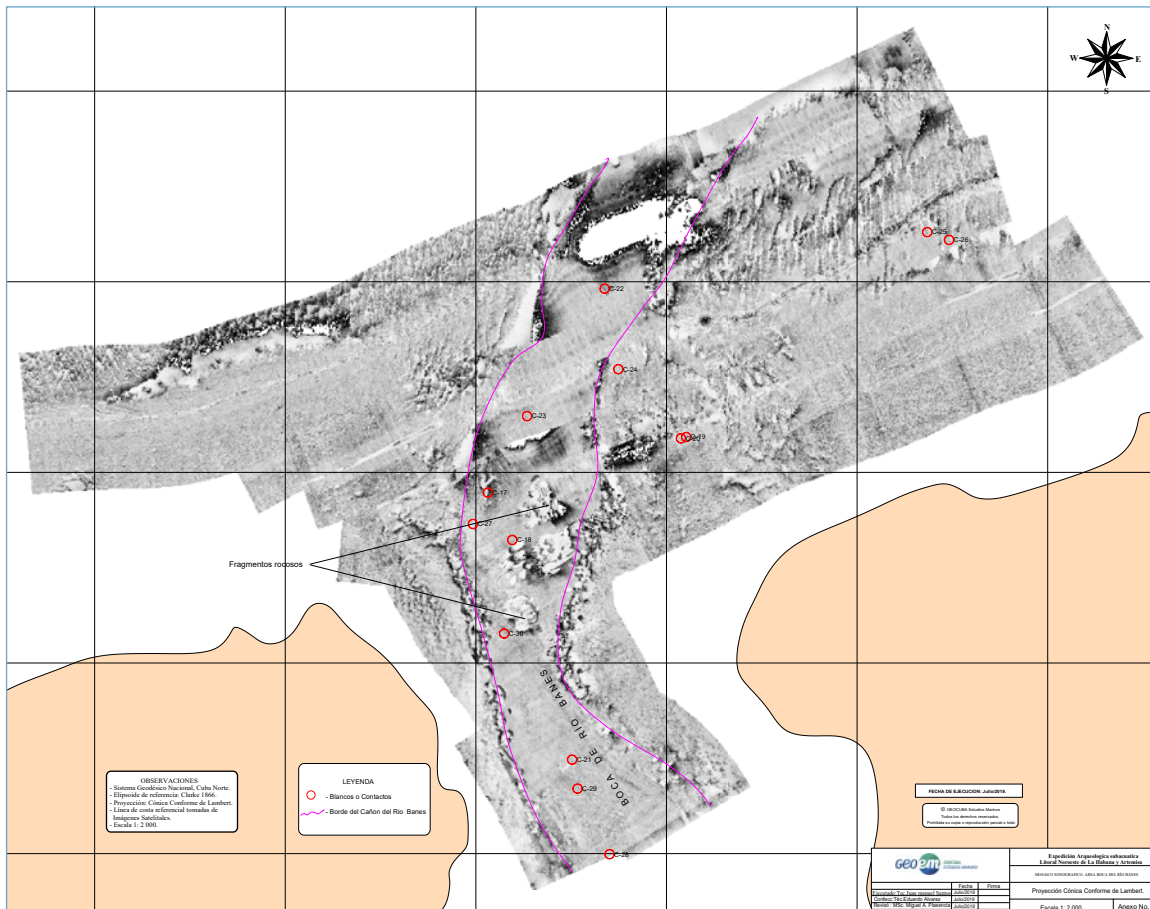


Figure 17 - Side-scan sonar rendition of the seabed at Boca del Río Banes. A total of 13 contact points are circled in red. Scale 1:2000 (Courtesy of GEOEM).

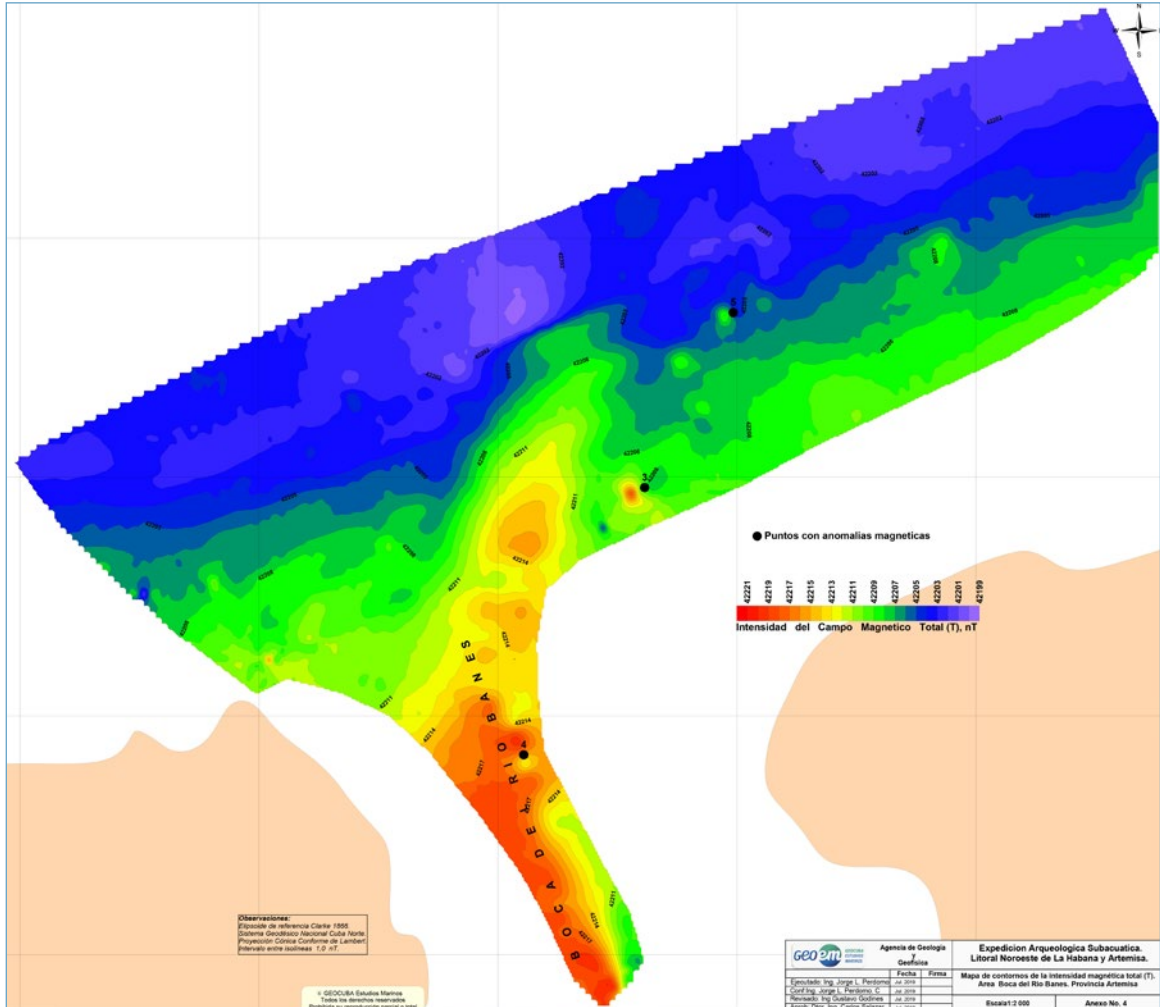


Figure 18 - Magnetometer rendition of the area near Boca del Río Banes, showing the intensity of the magnetic field (T). Scale 1:2000 (Courtesy of GEOEM).

#### 4.2.2 Dive survey

With 15 potential targets, only one day available at the site and only two 200 bar cylinders per diver, it was decided to split into groups of two, while four entry points were selected based on the proximity of most other targets. This was to ensure the inspection of as many targets as possible per dive. The first entry point was situated farthest out to sea, at a depth of 22 metres. The next entry point was situated above the magnetic anomaly, in waters with a depth of 8 metres. The third entry point was at 15 to 18 metres of depth near large rocky features jutting out of the seabed. This is where most contact points were concentrated, resulting in numerous finds. Due to the large size of the area, it was surveyed in two dives. The final entry point in pursuit of the three contact points closest to

shore was in an area of 6 to 12 metres of depth, though here no pertinent finds were made. This selection of four entry points allowed the team to inspect 11 targets and two magnetic anomalies in five dives. Two targets were not surveyed because these were too far apart from the other targets, situated east in Figure 17.

#### anchors

Multiple anchors were discovered at Boca del Río Banes (Fig. 19). Most of these were found stuck in the rocky features jutting out of the seabed, which were located in the centre of the natural channel leading into Boca del Río Banes.

Among them was a large iron-stock anchor and chain. It was found resting on its shank, with one arm sticking up from the seabed and the other end buried in the sediment. Iron-stock and chain anchors of the Admiralty

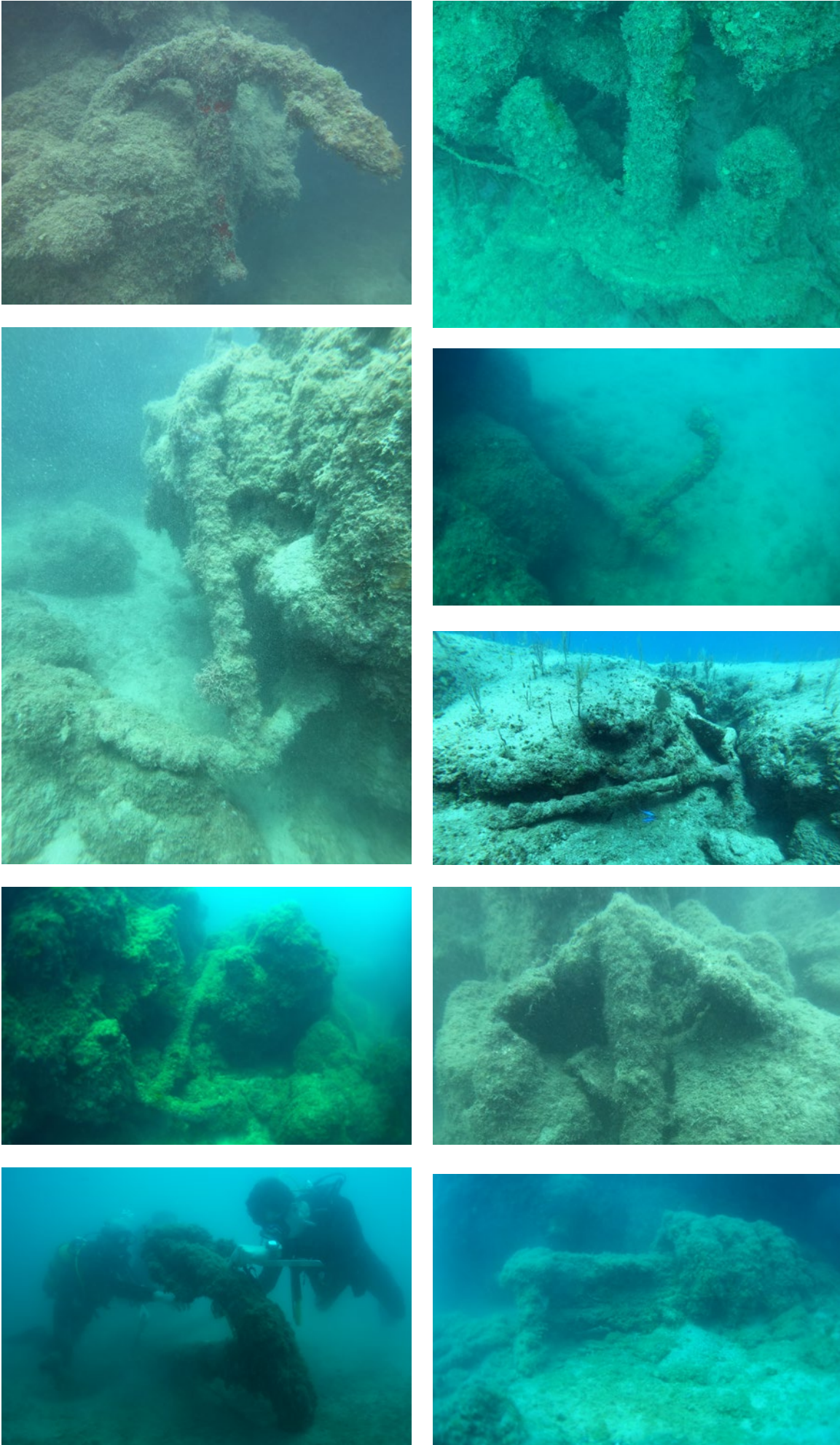


Figure 19 - A collage of the anchors found at Boca del Río Banes.

pattern date, at the earliest, to around the middle of the 19<sup>th</sup> century, although this classic style is still in use even today.<sup>25</sup> This anchor was sketched, measured and photographed (see cover photo). From crown to top end, the shank measured 220 cm. The iron stock measured 189 cm in length. The fluke that was visible was measured over the palm, recording a length of 56 cm, while the broad end of the fluke measured 30 cm in width.

Four small wooden-stock anchors were also found. These included the three small wooden-stock anchors as depicted in Figure 19. Those depicted have typical straight arms. Some were found upside down, suggesting that they probably got stuck when they were dropped. While wooden-stock anchors generally remained in use far into the 19<sup>th</sup> century, anchors with straight arms are typical of 18<sup>th</sup>-century designs that were predominantly used by the British Admiralty.<sup>26</sup> A stockless anchor from the late-19<sup>th</sup> century at the earliest was also found. Most of the anchors found were photographed.

### Wooden structures

At the entry point set near the contact points found farthest out to sea, at a depth of approximately 22 metres, the team came across loose pinewood planks, probably belonging to a modern shipwreck. All of the planks were photographed (Fig. 20) and a few quick measurements were made. One plank was approximately 130 cm long and 10 cm thick. The smaller planks measured were 3 cm thick. The seabed here was found to contain a thick layer of sediment, interpreted as fine river silt. The thick, soft layer of sediment suggests more finds could be buried underneath.

North of the rocky features set in the centre of the channel, divers found a shipwreck of pinewood. Wreckage material consisted of planks and a keel with some frames. The shipwreck material stretched over an area of an estimated length of 20 m and a width of 4 m. Although thought to be rather modern, this site was recorded with photography.

<sup>25</sup> Curryer 1999.

<sup>26</sup> Pering 1819.

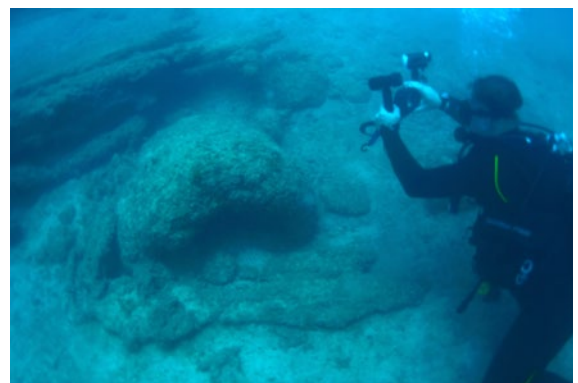


Figure 20 - Remains of a wooden shipwreck found at Boca del Río Banes.

### Miscellaneous

A pile of stones nearby appeared natural, but could also be ballast. Following the rocks to the west from the large anchor, parts of an iron wreck were found, while following the rocks to the east, parts of some sort of engine were found. These parts were all videoed and photographed.

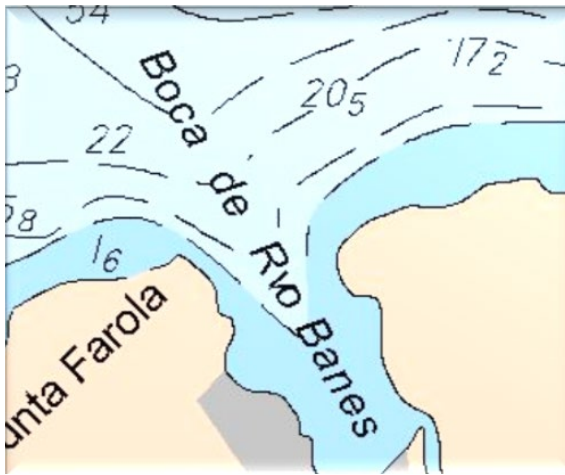


Figure 21 - Bathymetry at Boca de Rio Banes. Carta náutica, scale 1:150,000, de Cayo Arenas a Bahía de La Habana.

### Interpretation

The local topography (Fig. 21), characterized by rocky features jutting out of the seabed, proved a menace for anchoring, as testified by the numerous anchors found. The presence of two relatively modern shipwrecks among the tall rocks suggests that other ships also ran the risk of wrecking here. A deep layer of fine, sandy sediment that characterizes the area further suggests that shipwreck material could be buried underneath. While the magnetometer survey gave no further indications of the presence of buried ferrous anthropogenic objects, this cannot be ruled out completely, due to the coarse intensity of the magnetometer deployed. During the survey, the team did not encounter any shipwreck material that could be related to a 17<sup>th</sup>-century Dutch

shipwreck. The oldest material consisted of anchors dating back to at most the 18<sup>th</sup> century. These do not appear to be Dutch, as their typical straight arms would suggest they are English in origin. It was therefore decided not to return to this area during the current project.

## 4.3 Boca y Ensenada de Playa Herradura

### 4.3.1 Marine geophysical survey



Figure 22 - Bathymetry of the marine area near Boca y Ensenada de Playa Herradura. Carta náutica, scale 1:150,000, de Cayo Arenas a Bahía de La Habana.

Knowing that the *Keizerin* was stranded here on the shore, the survey vessel had to get as close to the coast as possible. However, this proved difficult, as, after surveying only three lines, the local topography already became very shallow, with large rocks situated only 3-5 metres below surface level (Fig. 22). This meant that the boat could not get closer to the shore to continue the SSS and magnetometer tracks.

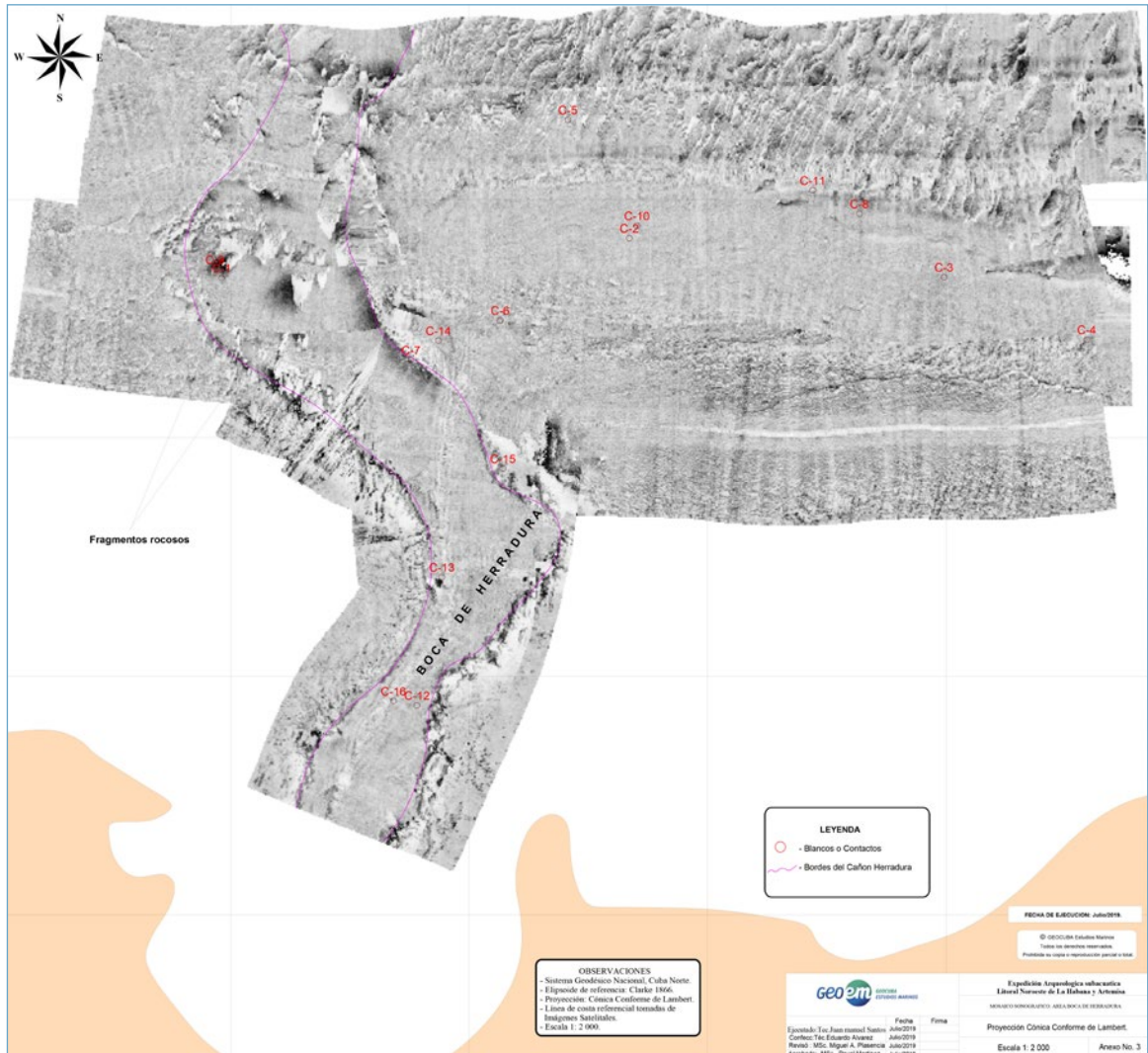


Figure 23 - Side-scan sonar rendition of the area in front of Herradura. The 15 contact points are shown in red. Scale 1:2000 (Courtesy of GEOEM).

Three survey lines were parallel to the coast while another three went into the channel that led into Herradura bay. A total of 16 contact points were marked

as points of interest (Fig. 23), while two magnetic anomalies were spotted (Fig. 24).



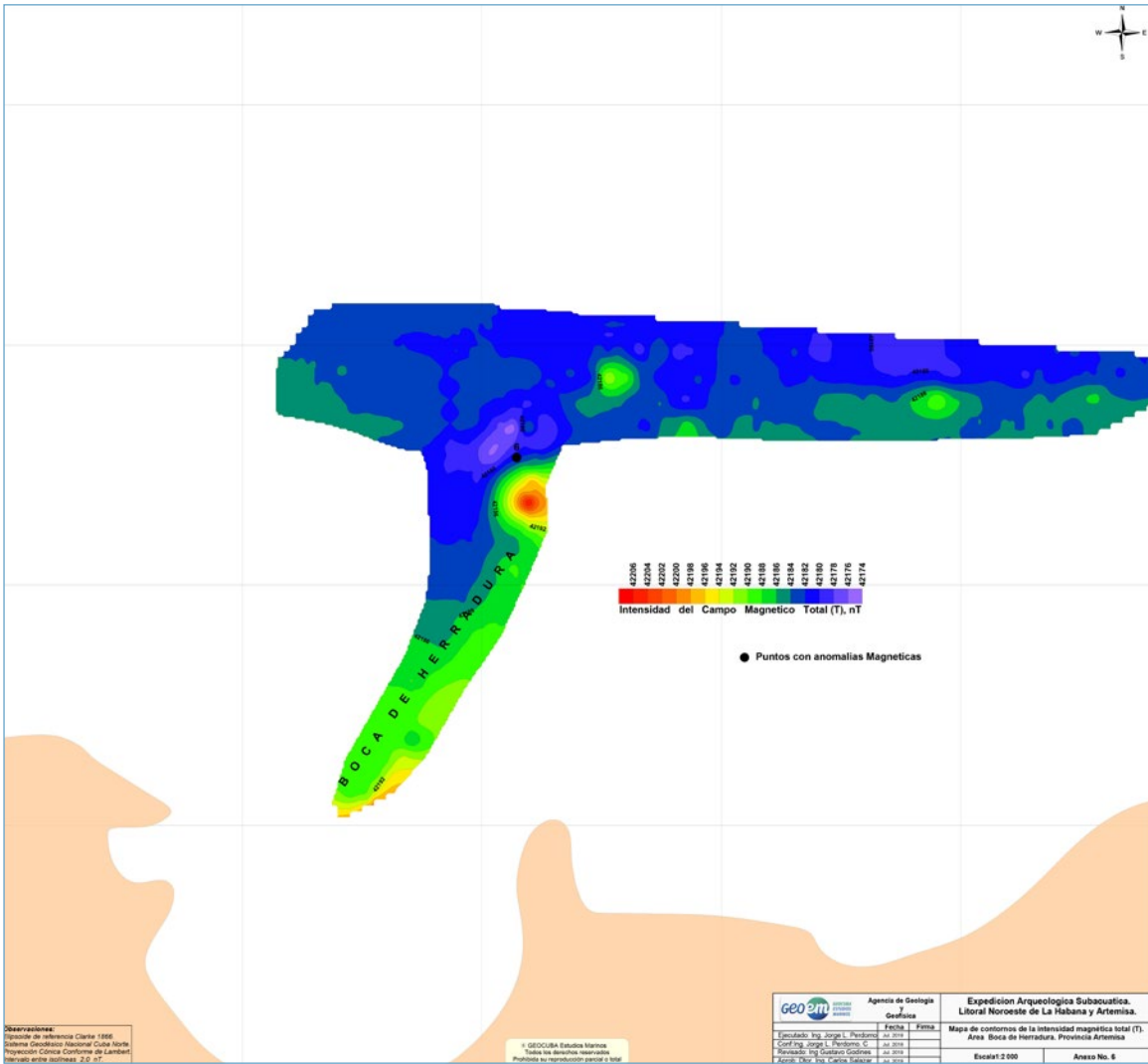


Figure 24 - Magnetometer recording of the area in front of Herradura. Scale 1:2000 (Courtesy of GEOEM).

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#### 4.3.2 Dive survey

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Since the SSS and magnetometer surveys could not be completed to satisfaction, it was decided to visually inspect the shallower area using divers. The entry point was set above the anomaly located in the magnetometer survey, situated on the northeast side of the natural channel. This anomaly turned out to be a large pipeline (Fig. 25) trapped between the rocks. No other significant finds were discovered.

A second rather quick search effort was conducted using snorkelling equipment. A shallow area of 4 to 5 m deep, this area contained a magnetic anomaly, while the SSS also showed a point of interest. This investigation did not yield any finds of archaeological interest.

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#### 4.3.3 Interpretation

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Due to the shallow, rocky submarine surroundings near the shore, not all planned survey lines could be completed, so an evaluation of the work is based on less than ideal data. It became clear from the marine geophysical survey, as well as the diving survey, that the presence of large rocky structures so close to surface level must have meant it was a very difficult coast for ships to navigate. It would not be much of a surprise if the area witnessed many shipwrecks other than the *Keizerin*. Since the historical records show that the *Keizerin* was beached, stripped by the Spanish and then set on fire, it is most likely that, if any traces were left, they would be minor. While finds could still be preserved closer to shore, no objects were found to suggest this. The team therefore concluded that the chances of a breakthrough find were very slim.

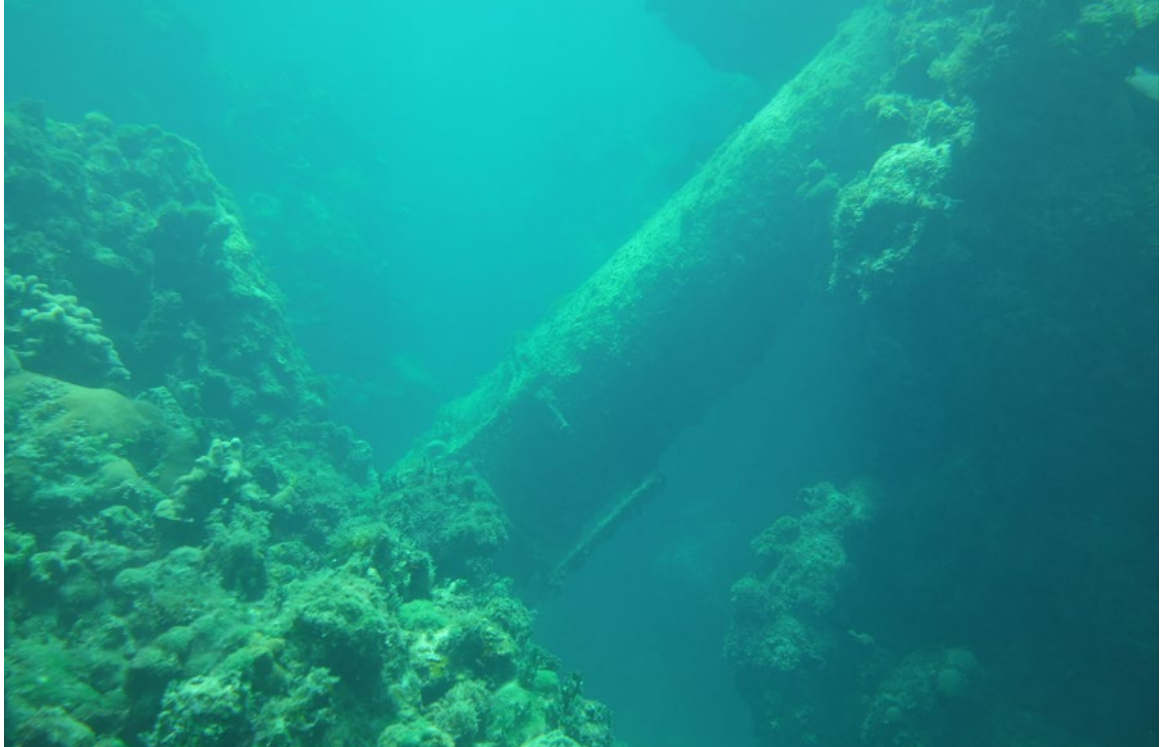


Figure 25 - Pipeline

# 5 Conclusion

Bearing in mind the results outlined above, the research sub-questions used to structure the research project will be addressed below individually, followed by a response to the main research question.

## 5.1 Sub-questions

*What is the nature of the contact points located during the marine geophysical survey?*

The surveys conducted at two of the three sites resulted in a variety of finds of an anthropogenic nature. A number of these were of archaeological interest, such as the numerous anchors found at Boca del Río Banes and the three cast-iron cannons and anchors found at Boca de Río Mosquito. Except for a part of a large modern iron pipeline and small samples of modern rubble, no significant anthropogenic finds were found at Boca y Ensenada de Playa Herradura.

*If remains of archaeological interest are found, what are the (estimated) dimensions, position and orientation of these remains?*

The three cast-iron cannons found at Boca de Río Mosquito were distributed more or less in a line running west to east over an area stretching approximately 15 metres. The most northern cannon, with its muzzle pointed south, had a length of 276 cm; the cannon in the middle, with its muzzle pointed north, had a length of 270 cm; and the most southern cannon, with its muzzle pointed north, had a length of 294 cm.

The wooden-stock anchor at Boca del Río Banes measured 204 cm in length and 118 cm in width. The anchor was oriented in a north to south position. The iron-stock anchor measured 220 cm in length, while the stock measured 189 cm in length. The modern wooden shipwreck materials found were stretched over an area of 20 m x 4 m.

*What can be said about the type and origin of the objects found?*

Starting with Boca de Río Mosquito, the cannons found there can at this point not be linked to a specific provenance or date. Two appear to be 12 pounders, while the other seems to be a 24 pounder. Their presence at this location does seem to fit with the Spanish historical records that mention the breaking apart of the *Bul van Hoorn* at this point, which suggests the cannons sank with the ship. Theoretically, the cannons could also be related to the Spanish coastal defence, most likely installed on the shore there as well, or they may altogether belong to

a shipwreck unrelated to Jol's fleet. Other finds, such as the yellow brick, if found to be an *IJsselsteen*, could be an indicator of a Dutch shipwreck at this location. Wooden shipwreck parts found at the site appear to be modern, due to the presence of a coat of blue paint on some of them.

With regard to the anchors found at Boca y Ensenada de Playa Herradura, although a rough estimate of a dating can be made based on the shape of the anchors, there is too little information to determine the origins of the objects. Generally speaking, some of the wooden-stock anchors that were found had a pointy, triangular straight-arm design typical of 18<sup>th</sup>-century anchors used by the English, which coincides with English activity in the Caribbean. However, without the presence of further distinct markings or the context of a shipwreck, these wooden-stock anchors, as well as the more modern specimen, cannot be tied to a provenance at this point.

*What preliminary conclusions can be drawn about the dating of the objects of archaeological interest?*

Considering the state of preservation of the cannons, they cannot be dated precisely at this point, although they could roughly be assumed to originate somewhere between the 17<sup>th</sup> and 18<sup>th</sup> centuries.

Two wooden-stock anchors found have the distinct triangular shaped crown-and-arms characteristic of 18<sup>th</sup>-century anchor manufacture of the countries mentioned above. Iron-stock anchors found could date from the 19<sup>th</sup> and 20<sup>th</sup> centuries, while the stockless anchors found date from the late 19<sup>th</sup> century at the earliest. These are all too modern to be linked to the 17<sup>th</sup>-century shipwrecks of Jol.

*What relationship do the site and objects have to their surrounding environment?*

The anchors found at Boca del Río Banes provide little assistance in answering the main research questions other than showing that the area in front of Boca del Río Banes was used as an anchorage throughout the centuries, and probably by ships from various nations. In some cases, the rocky features appear at depths of less than 8 metres, which in stormy weather would constitute a potential risk for ships. These rocky areas are also places where anchors could easily become stuck. The fact that numerous anchors and a wooden shipwreck were found shows that this risk of losing anchors and wrecking on the rocks was a real hazard.

The research areas at Boca de Río Mosquito and Boca del Río Banes are both characterized by sandy river silt

sediment, which, although easily disturbed, can function as protective layers for any underwater cultural heritage that may be hidden underneath, keeping objects from exposure to oxygen and organisms.

*What threats to underwater cultural heritage can be identified in the area?*

At Boca de Río Mosquito, anthropogenic activity was identified as a possible threat to the site (e.g. dredging, fishermen, divers). Hurricanes that regularly hit all three research areas could also stir up the seabed, uncovering objects otherwise hidden under sediment and dispersing elements of the archaeological sites. Exposed wood will be easily destroyed by micro and other organisms such as the shipworm (*Teredo navalis*).

*What constraints had a negative impact on the execution of the survey?*

There were noticeable constraints in all three research areas. The seabed at all three locations was very inconsistent, which made the sonar images quite difficult to read. This in turn made it difficult to identify anthropogenic objects. At Boca de Río Mosquito, the geophysical survey occasionally could not be completed in straight lines due to the presence of illegal makeshift fishing nets running perpendicular to the shore. At Boca del Río Banes, survey lines close to shore could not be completed due to shallow rocky features, which was an even greater issue in the case of Boca y Ensenada de Playa Herradura.

While these points above obviously negatively impacted the survey, they could partially be compensated for during the dive inspections, during which almost all contact points selected for further inspection appear to have been relocated. However, it is very likely that a number of objects, especially the anchors at Boca del Río Banes, were not all recognized as contact points from the marine geophysical survey alone, as some of these had become amalgamated with their rocky or other environment.

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## 5.2 Main research question

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*What can archaeological fieldwork reveal about the locations of the Dutch vessels of Cornelis Jol that were wrecked in 1640 during a hurricane near Havana?*

The areas that were researched are all characterized by predominantly rocky features in waters that can sometimes suddenly become treacherously shallow. An understanding of the environment is important for any reconstruction of what happened during the hurricane in 1640. Navigating these waters can be a risky venture, as can be judged from the modern shipwreck material found. In addition to Jol's ships lost at these locations, others have certainly been lost there as well. Despite all that was found during the 2019 survey, the team did not find any decisive proof of Cornelis Jol's wrecked ships in the areas pinpointed. Only Boca de Río Mosquito gave some indications of a possible historic wreck site, which may be Dutch. At this site, according to the historical records, the *Bul van Hoorn* sank onto the seabed, while the ships at the other locations were stranded. The yellow brick and the three cannons found at Boca de Río Mosquito may indicate the presence of the *Bul van Hoorn* at that location. However, at the moment, these finds are not sufficient to make a positive identification. The cannons and the brick require further research, in order to determine their age and origin and a more intrusive archaeological study will have to be conducted. What implications this has for further research planning is discussed below.

Based on our conclusions, the area in front of Boca de Río Mosquito holds the most potential for finding objects relating to a 17<sup>th</sup>-century Dutch shipwreck. It is recommended that future research opportunities focus on cleaning the cannons in an attempt to reveal the breeches, record more detail and possibly identify a provenance and date. Chemical analysis of the yellow brick is also an option that could be pursued. It is considered that ground-penetrating research such as sub-bottom profiling will produce heavily distorted results due to the numerous anthropogenic objects expected to be buried in the seabed. In this regard, it may prove useful to dig a test trench in the area. Such

intrusive work, however, requires time, capacity and a budget that may quickly outweigh the expected results.

It is recommended that CNPC in particular monitor the site regularly, especially after hurricanes, when changes to the natural environment in terms of sediment distribution may have occurred. While the surveyed area at the Boca del Río Banes site did not yield any results related to Dutch 17<sup>th</sup>-century shipwrecks, the researchers did encounter many anchors and other, somewhat younger, shipwreck material. Although not directly the focus of this project, the area remains interesting and might become a focal point of study for our Cuban counterparts.

## 7 Future collaboration

In addition to the recommendations mentioned above – to revisit the site of Boca de Río Mosquito – it is also recommended that RCE and CNPC continue collaboration, focusing on new sites to be surveyed, while a portion of the fieldwork could also focus on additional research at the site of Zorrita la Tabla (Fig. 26),<sup>27</sup> which is situated in Golfo de Guanahacabides in the province of Pinar del Río. Spanning an area of 852 m<sup>2</sup>, this site is engulfed by a shallow coral reef of 1.5 to 3 metres deep.<sup>28</sup> The site was investigated by CARISUB S.A.<sup>29</sup> in 1994 and 1997. On both occasions, numerous objects were found, including six cannons. Part of the finds have been recovered and are kept in an archaeological depot. The site has been dated to the late 17<sup>th</sup>, early 18<sup>th</sup> century based on the find of a tobacco box from

1696 and copper coin from the Netherlands dating back to 1723. These and other finds were reinvestigated in 2014 at the start of the collaboration between CNPC and RCE, after which it was concluded that most of these finds directly and indirectly suggest a Dutch origin. During this fieldwork in the 1990s, the site was not recorded in much detail, though at the time it was clear that it was threatened by natural erosion, such as wave energy. Monitoring of the site, including a non-intrusive assessment, would be a necessary step in any further research after so many years. Discussions between CNPC and RCE to continue their collaborative work on the Dutch wrecks of Jol and the Zorrita la Tabla site are currently underway.

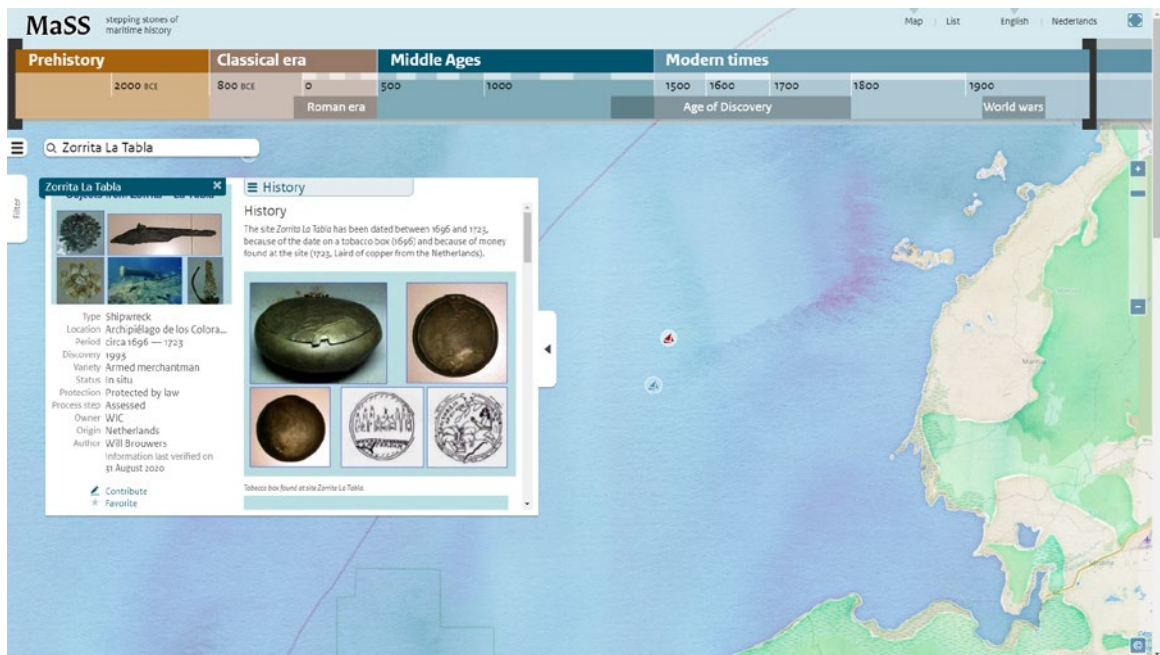


Figure 26 - The site of Zorrita la Tabla as described in the MaSS database.

<sup>27</sup> The coordinates of the site are 22° 20.160' N, 84° 38.438' W.

<sup>28</sup> See <https://mass.cultureleerfgoed.nl/zorrita-la-tabla> for images.

<sup>29</sup> A former Cuban research department for maritime archaeology.

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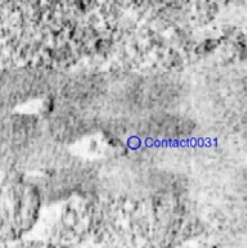
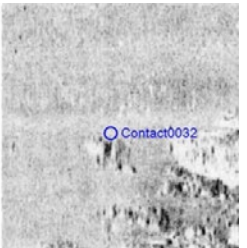
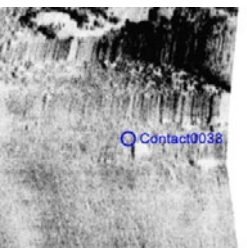
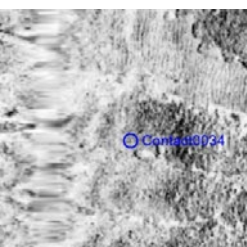

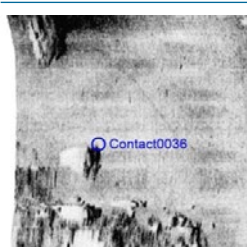


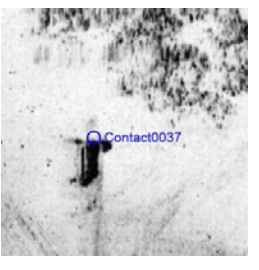
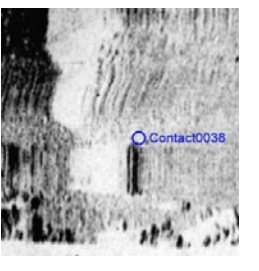
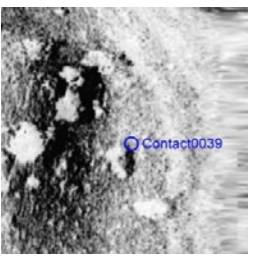
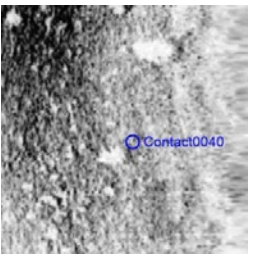

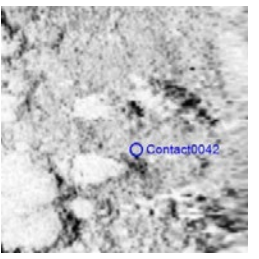




# I – Table of Contact Points


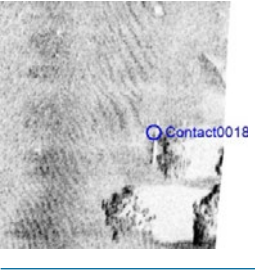
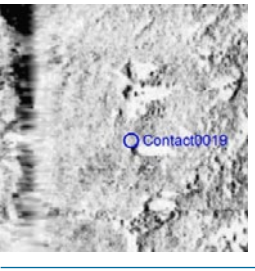
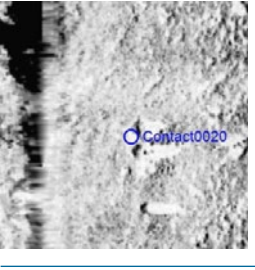

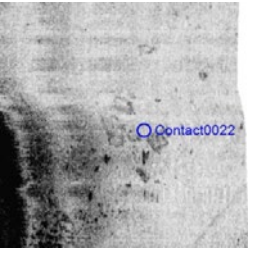
## Boca de Río Mosquito


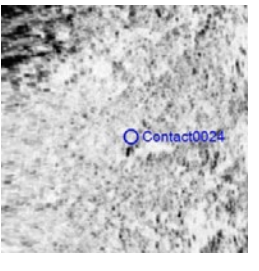
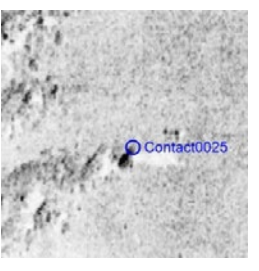
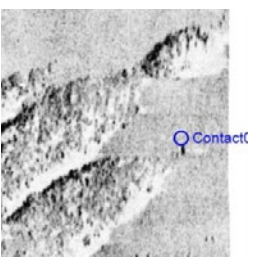
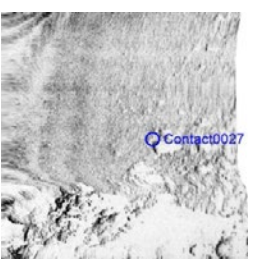
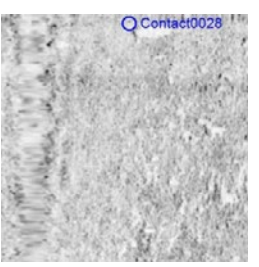
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	<b>C-34</b> <ul style="list-style-type: none"> <li>Recorded time: 20/07/2019 10:02:59</li> <li>Event number: 59</li> </ul>	<b>Dimensions and attributes</b> <ul style="list-style-type: none"> <li>Width of point: 0.55 m</li> <li>Height of point: 1.52 m</li> <li>Length of point: 1.54 m</li> <li>Shadow of point: 2.62 m</li> </ul>
	<b>C-35</b> <ul style="list-style-type: none"> <li>Recorded time: 20/07/2019 10:03:48</li> <li>Event number: 64</li> </ul>	<b>Dimensions and attributes</b> <ul style="list-style-type: none"> <li>Width of point: 4.44 m</li> <li>Height of point: 1.05 m</li> <li>Length of point: 5.43 m</li> <li>Shadow of point: 5.97 m</li> </ul>
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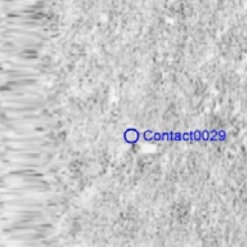
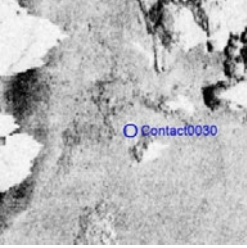
Sonar image of contact point	Information on the contact point	Information entered by the user
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	<p><b>C-42</b></p> <ul style="list-style-type: none"> <li>Recorded time: 20/07/2019 10:28:22</li> <li>Event number: 6</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.95 m</li> <li>Height of point: 3.78 m</li> <li>Length of point: 2.36 m</li> <li>Shadow of point: 6.21 m</li> </ul>

## II – Table of Contact Points

Boca del Río Banés

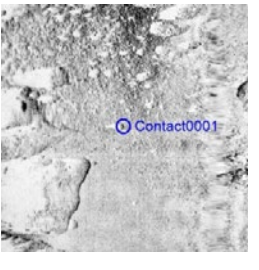

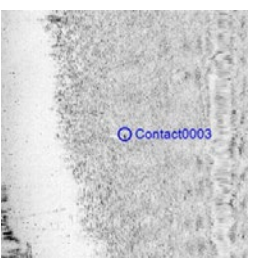
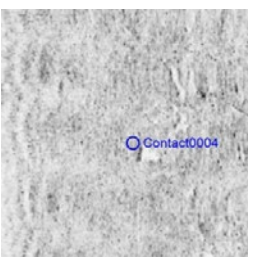
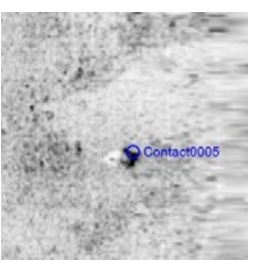
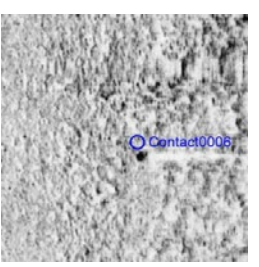
Sonar image of contact point	Information	Dimensions and attributes
 <p>A sonar image showing a small, light-colored object on a dark, textured seabed. A blue circle with the text 'Contact0017' is positioned over the object.</p>	<p><b>C-17</b></p> <ul style="list-style-type: none"> <li>Recorded time: 21/07/2019 11:31:05</li> <li>Event number: 111</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 2.16 m</li> <li>Height of point: 3.68 m</li> <li>Length of point: 3.25 m</li> <li>Shadow of point: 6.79 m</li> </ul>
 <p>A sonar image showing a small, light-colored object on a dark, textured seabed. A blue circle with the text 'Contact0018' is positioned over the object.</p>	<p><b>C-18</b></p> <ul style="list-style-type: none"> <li>Recorded time: 21/07/2019 11:31:06</li> <li>Event number: 111</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 0.47 m</li> <li>Height of point: 0.32 m</li> <li>Length of point: 4.38 m</li> <li>Shadow of point: 0.75 m</li> </ul>
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 <p>A sonar image showing a small, light-colored object on a dark, textured seabed. A blue circle with the text 'Contact0021' is positioned over the object.</p>	<p><b>C-21</b></p> <ul style="list-style-type: none"> <li>Recorded time: 21/07/2019 11:48:26</li> <li>Event number: 48</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 0.89 m</li> <li>Height of point: 3.41 m</li> <li>Length of point: 1.88 m</li> <li>Shadow of point: 14.19 m</li> </ul>
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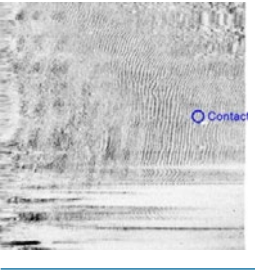


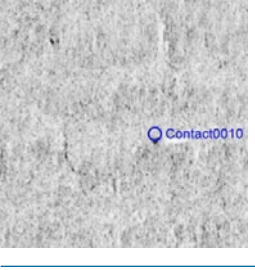
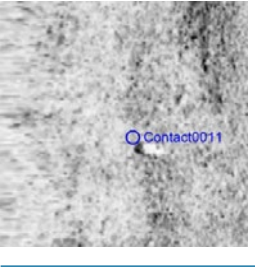
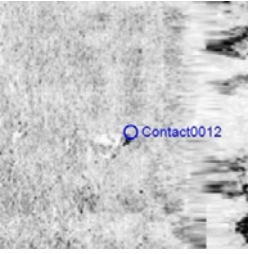
Sonar image of contact point	Information	Dimensions and attributes
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 <p>○ Contact0025</p>	<p><b>C-25</b></p> <ul style="list-style-type: none"> <li>Recorded time: 21/07/2019 11:20:41</li> <li>Event number: 66</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.02 m</li> <li>Height of point: 1.57 m</li> <li>Length of point: 1.86 m</li> <li>Shadow of point: 3.61 m</li> </ul>
 <p>○ Contact</p>	<p><b>C-26</b></p> <ul style="list-style-type: none"> <li>Recorded time: 21/07/2019 11:20:48</li> <li>Event number: 66</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 0.37 m</li> <li>Height of point: 0.62 m</li> <li>Length of point: 1.58 m</li> <li>Shadow of point: 1.95 m</li> </ul>
 <p>○ Contact0027</p>	<p><b>C-27</b></p> <ul style="list-style-type: none"> <li>Recorded time: 21/07/2019 11:42:28</li> <li>Event number: 31</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.75 m</li> <li>Height of point: 2.81 m</li> <li>Length of point: 5.30 m</li> <li>Shadow of point: 7.39 m</li> </ul>
 <p>○ Contact0028</p>	<p><b>C-28</b></p> <ul style="list-style-type: none"> <li>Recorded time: 21/07/2019 11:58:46</li> <li>Event number: 75</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 0.68 m</li> <li>Height of point: 1.30 m</li> <li>Length of point: 1.59 m</li> <li>Shadow of point: 4.91 m</li> </ul>

Sonar image of contact point	Information	Dimensions and attributes
 A sonar image showing a textured seabed surface. A blue circle with the label 'Contact0029' is positioned in the lower-middle part of the image.	<b>C-29</b> <ul style="list-style-type: none"><li>Recorded time: 21/07/2019 11:59:16</li><li>Event number: 78</li></ul>	<b>Dimensions and attributes</b> <ul style="list-style-type: none"><li>Width of point: 0.97 m</li><li>Height of point: 1.31 m</li><li>Length of point: 1.40 m</li><li>Shadow of point: 2.34 m</li></ul>
 A sonar image showing a seabed with some darker, irregular patches. A blue circle with the label 'Contact0030' is positioned in the lower-middle part of the image.	<b>C-30</b> <ul style="list-style-type: none"><li>Recorded time: 21/07/2019 11:47:24</li><li>Event number: 42</li></ul>	<b>Dimensions and attributes</b> <ul style="list-style-type: none"><li>Width of point: 2.19 m</li><li>Height of point: 0.91 m</li><li>Length of point: 4.65 m</li><li>Shadow of point: 3.29 m</li></ul>

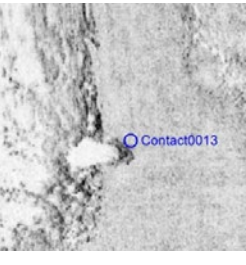

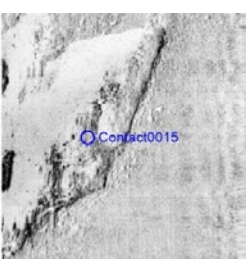
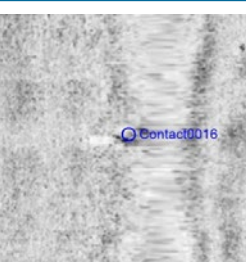
# III – Table of Contact Points

## Boca y Ensenada de Playa Herradura

Sonar image of contact point	Information on the contact point	Information entered by the user
 <p>Image showing a contact point labeled 'Contact0001' on a sandy seabed.</p>	<p><b>C-1</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 10:00:16</li> <li>Event number: 119</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 0.98 m</li> <li>Height of point: 1.73 m</li> <li>Length of point: 1.39 m</li> <li>Shadow of point: 5.44 m</li> </ul>
 <p>Image showing a contact point labeled 'Contact0002' on a sandy seabed.</p>	<p><b>C-2</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 10:02:37</li> <li>Event number: 133</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.33 m</li> <li>Height of point: 0.96 m</li> <li>Length of point: 2.37 m</li> <li>Shadow of point: 11.07 m</li> </ul>
 <p>Image showing a contact point labeled 'Contact0003' on a sandy seabed.</p>	<p><b>C-3</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 10:04:27</li> <li>Event number: 144</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.15 m</li> <li>Height of point: 0.77 m</li> <li>Length of point: 1.28 m</li> <li>Shadow of point: 3.57 m</li> </ul>
 <p>Image showing a contact point labeled 'Contact0004' on a sandy seabed.</p>	<p><b>C-4</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 10:05:20</li> <li>Event number: 149</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 0.52 m</li> <li>Height of point: 0.65 m</li> <li>Length of point: 2.29 m</li> <li>Shadow of point: 2.51 m</li> </ul>
 <p>Image showing a contact point labeled 'Contact0005' on a sandy seabed.</p>	<p><b>C-5</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 9:37:18</li> <li>Event number: 20</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.02 m</li> <li>Height of point: 1.72 m</li> <li>Length of point: 1.66 m</li> <li>Shadow of point: 2.15 m</li> </ul>
 <p>Image showing a contact point labeled 'Contact0006' on a sandy seabed.</p>	<p><b>C-6</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 10:10:22</li> <li>Event number: 173</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.24 m</li> <li>Height of point: 1.45 m</li> <li>Length of point: 1.79 m</li> <li>Shadow of point: 11.26 m</li> </ul>

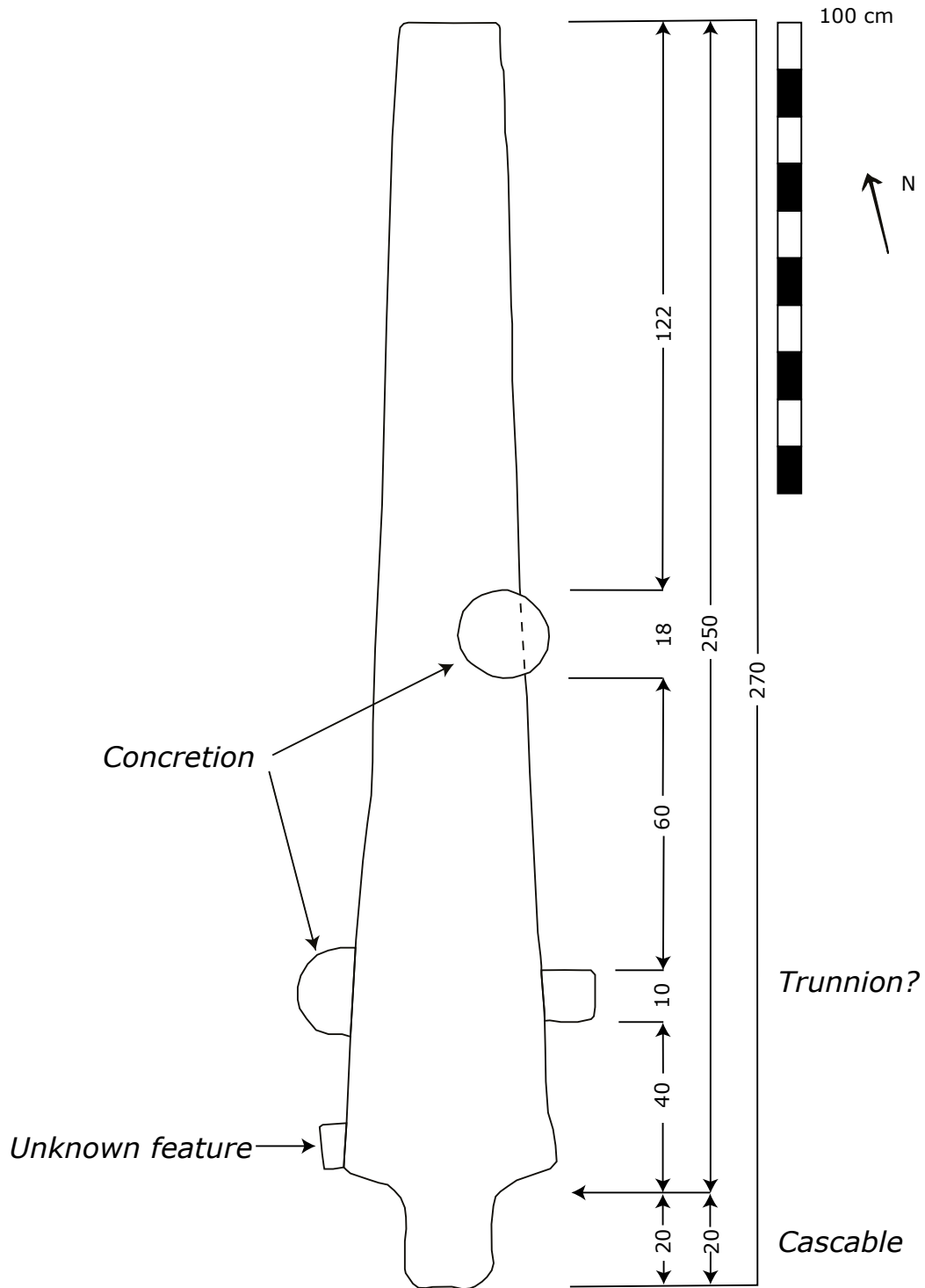
Sonar image of contact point	Information on the contact point	Information entered by the user
	<p><b>C-7</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 10:43:38</li> <li>Event number: 25</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 0.69 m</li> <li>Height of point: 0.39 m</li> <li>Length of point: 2.00 m</li> <li>Shadow of point: 2.18 m</li> </ul>
	<p><b>C-8</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 9:50:19</li> <li>Event number: 83</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.09 m</li> <li>Height of point: 0.71 m</li> <li>Length of point: 2.45 m</li> <li>Shadow of point: 2.59 m</li> </ul>
	<p><b>C-9</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 9:53:59</li> <li>Event number: 105</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.39 m</li> <li>Height of point: 1.27 m</li> <li>Length of point: 2.55 m</li> <li>Shadow of point: 5.18 m</li> </ul>
	<p><b>C-10</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 9:45:15</li> <li>Event number: 58</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 0.64 m</li> <li>Height of point: 1.14 m</li> <li>Length of point: 1.44 m</li> <li>Shadow of point: 4.51 m</li> </ul>
	<p><b>C-11</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 9:46:16</li> <li>Event number: 64</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 0.92 m</li> <li>Height of point: 1.49 m</li> <li>Length of point: 1.62 m</li> <li>Shadow of point: 2.10 m</li> </ul>
	<p><b>C-12</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 11:03:30</li> <li>Event number: 26</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.06 m</li> <li>Height of point: 2.38 m</li> <li>Length of point: 1.80 m</li> <li>Shadow of point: 3.71 m</li> </ul>



Sonar image of contact point	Information on the contact point	Information entered by the user
 <p>A sonar image showing a contact point labeled 'Contact0013' in blue text with a small blue circle next to it. The image shows a textured seabed with a distinct bright spot indicating the contact point.</p>	<p><b>C-13</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 11:04:18</li> <li>Event number: 30</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.91 m</li> <li>Height of point: 3.09 m</li> <li>Length of point: 3.76 m</li> <li>Shadow of point: 8.55 m</li> </ul>
 <p>A sonar image showing a contact point labeled 'Contact0014' in blue text with a small blue circle next to it. The image shows a seabed with a bright spot and some surrounding texture.</p>	<p><b>C-14</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 10:58:49</li> <li>Event number: 1</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 0.52 m</li> <li>Height of point: 0.66 m</li> <li>Length of point: 1.21 m</li> <li>Shadow of point: 2.75 m</li> </ul>
 <p>A sonar image showing a contact point labeled 'Contact0015' in blue text with a small blue circle next to it. The image shows a seabed with a bright spot and a shadow extending to the right.</p>	<p><b>C-15</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 10:59:28</li> <li>Event number: 5</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 12.98 m</li> <li>Height of point: 3.51 m</li> <li>Length of point: 82.83 m</li> <li>Shadow of point: 23.67 m</li> </ul>
 <p>A sonar image showing a contact point labeled 'Contact0016' in blue text with a small blue circle next to it. The image shows a seabed with a bright spot and a shadow extending to the right.</p>	<p><b>C-16</b></p> <ul style="list-style-type: none"> <li>Recorded time: 23/07/2019 11:00:58</li> <li>Event number: 14</li> </ul>	<p><b>Dimensions and attributes</b></p> <ul style="list-style-type: none"> <li>Width of point: 1.04 m</li> <li>Height of point: 2.81 m</li> <li>Length of point: 1.29 m</li> <li>Shadow of point: 3.78 m</li> </ul>

# IV – Drawing of Cannon Middle

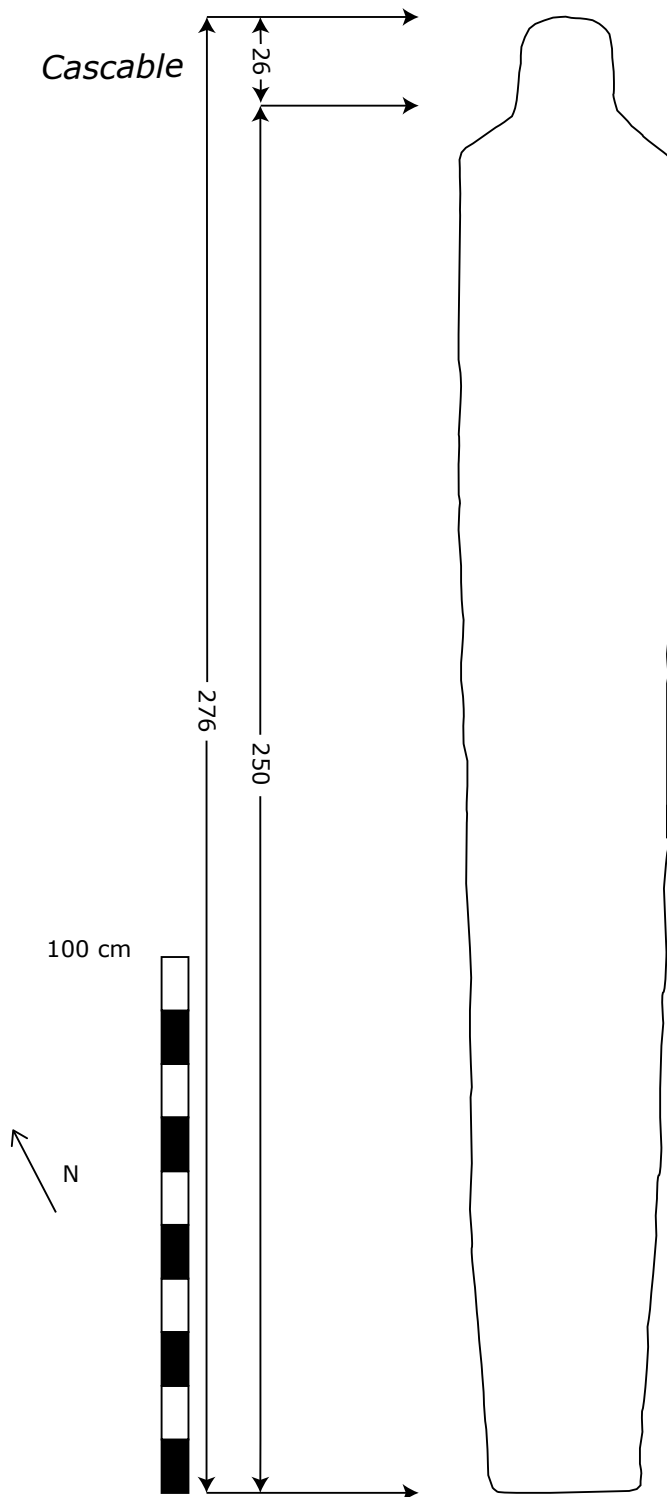
(Boca de Río Mosquito)



Middle Cannon  
 Boca de Río Mosquito, Artemisa, Cuba  
 Scale 1:10  
 Analogue drawing by Robert de Hoop (August 2019)  
 Digitized January 2021

# V – Drawing of Cannon North

(Boca de Río Mosquito)

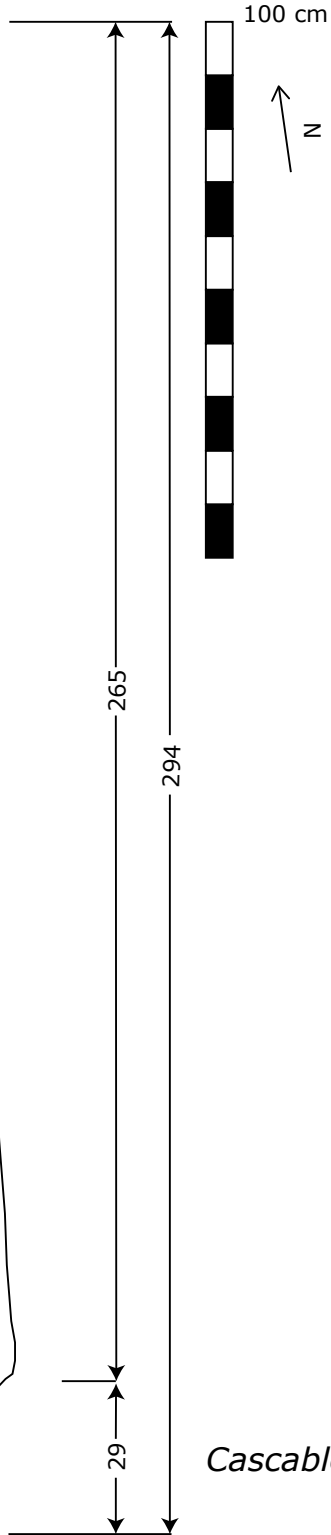
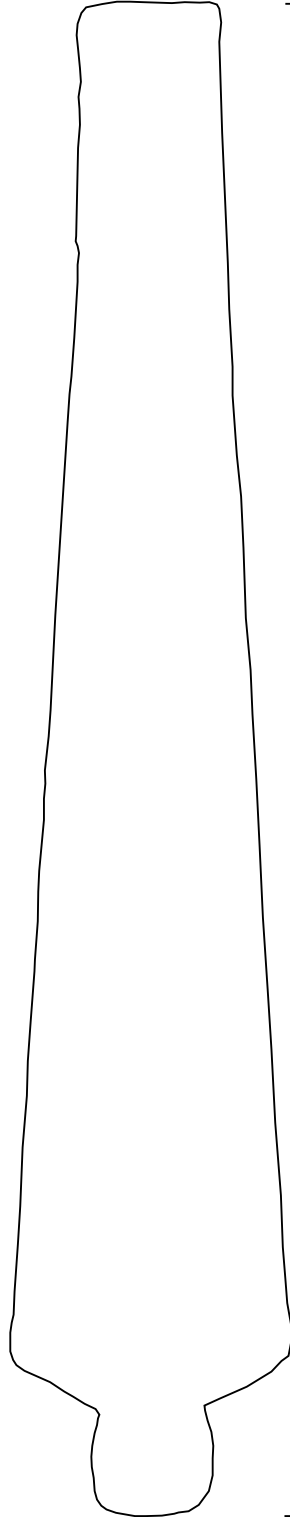
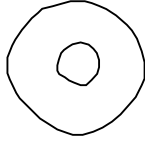
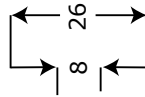


Cannon North  
Boca de Río Mosquito, Artemisa, Cuba  
Scale 1:10  
Analogue drawing by Robert de Hoop (August 2019)  
Digitized January 2021

# VI – Drawing of Cannon South

(Boca de Río Mosquito)

*Muzzle bore*



Cannon South  
Boca de Río Mosquito, Artemisa, Cuba  
Scale 1:10  
Analogue drawing by Robert de Hoop (August 2019)  
Digitized January 2021





This report presents the results of non-intrusive maritime archaeological assessments carried out in August 2019 by a team of Cuban and Dutch maritime archaeologists and geophysicists. The research was carried out under the collaborative project 'Dutch Presence in Cuban Waters' of the Consejo Nacional de Patrimonio Cultural (CNPC) and the International Programme for Maritime Heritage of the Cultural Heritage Agency of the Netherlands (RCE). It marked an important follow-up to the Memorandum of Understanding signed between Cuba and the Netherlands in 2018. Three locations west of Havana (Cuba) were surveyed in an attempt to locate and assess the wreck sites of the West India Company (WIC) vessels the *Bul van Hoorn*, the *Alkmaar* and the *Keizerin*, three ships associated with the fleet of WIC Admiral Cornelis 'Houtebeen' Jol (1597–1641). These vessels wrecked in a September storm in 1640 when Jol's fleet was preparing to attack the Spanish Treasure Fleet anchored in Havana. Most promising finds include three heavily corroded cast-iron cannons found at Boca de Río Mosquito, where the WIC-ship the *Bul van Hoorn* went down.

The Cultural Heritage Agency of the Netherlands provides knowledge and advice to give the future a past.