*“The ingots cargo of* Capo Sagro 2 *shipwreck: 2,5 Millions sesterces on the bottom of the Mediterranean”*

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The Capo Sagro 2 shipwreck lies at a depth of almost 500 metres off the cape of the same name some miles to the north-east of the coast of Corsica.

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Discovered by chance, a number of remotely operated dives to verify the site quickly demonstrated the unusual nature of the cargo, which is very largely composed of ingots of tin.

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A photogrammetry survey of the clearly visible mound on the surface of the site revealed the relative homogeneity of the cargo.

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Practically intact, the wreck is oriented S/SE-N/NW and occupies a surface of about 16.5 meters in length and nine meters in width at its maximum extension. It consists of a fairly compact central tumulus, composed essentially of tin ingots.

The area occupied by the mound and the densest group of amphorae that surrounds it is barely more than nine meters long. About four-five meters to the southeast, along the axis of the wreck, three amphorae with a batch of tableware and four lead anchor stocks are visible, grouped two by two and distributed on either side of the longitudinal axis of the wreck. This area must have corresponded to the front of the ship, but the space between it and the mound of ingots and the group of amphorae seems completely empty. This configuration is not easily explained. One possible hypothesis is that this part of the hold was occupied by perishable goods, such as sacks of wheat for example, which have left no visible traces, at least on the surface.

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The central tumulus consists primarily of large ingots, seemingly rectangular or elongated with rounded ends, all likely tin.

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Portable X-ray fluorescence analysis performed on a sample by Cécile le Carlier (Archéoscience - CNRS Rennes) confirmed that it is 98% pure tin. The dimensions of the ingot tumulus are a maximum of 6.40 meters long by 4.10 meters at its widest point (northwest end) and 3.27 meters at its narrowest point (southeast end).

Three types of ingots are recognizable in this tumulus:

1- elongated, rectangular ingots, of which the orthophoto of the upper layer shows us essentially the lower face. It is difficult to determine with certainty their profile, which seems to be more rectangular and crushed than bulging. The thickness of these ingots could be measured on several specimens on the west side and also on the east side; it is between 3.5 and 5.5 cm. The dimensions, in the visible layers, are quite regular: 61 cm x 23 cm; some ingots however reach 68/71 cm in length.

2- elongated ingots, more or less ovoid, flat, with rounded ends and rounded upper face, like the ingot that was sampled (fig. 3). They are smaller than the others: the dimensions of the specimens we were able to measure are 40/50 cm by 22/18 cm with a maximum thickness of 3.5/4 cm.

3- Stockier ingots, rectangular but short, and apparently with a truncated pyramidal profile and a much greater thickness. Their dimensions are 32/36 cm long by 22.5 cm wide; the thickness is between 11 and 14 cm.

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Tin of various origins, mainly from Spain and Great Britain, circulated regularly in the western Mediterranean during the period of Roman domination.

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Two main routes of circulation existed; one, from the Iberian Peninsula, undoubtedly used the same routes as Hispanic lead and copper48 . The second, used by Cornish pewter, crossed Gaul from north to south and ended up in the great Mediterranean ports of Narbonne, perhaps Arles-Fos or Marseilles. The pewter was then redistributed by sea with other goods of various origins, local or external, stored in these same ports. This was obviously also the case for the pewter from Capo Sagro 2.

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The tumulus of tin ingots is surrounded by about thirty amphorae, scattered or gathered in small groups of a few individuals. We note that the Oberaden 74 amphorae, dated between 20 BCE and 20 CE, among the most numerous (22 NIM in total), can be interpreted, in their great majority, as being part of the ship's cargo. Only the two specimens visible at the front of the wreck, in the area interpreted as belonging to a possible cabin or, in any case, to a living area, could have been part of the ship's equipment. The largest group of these Oberaden 74 (fourteen specimens) is located in the center of the wreck, mainly at the edge between the tumulus of ingots and the empty "space" that separates it from the front of the ship. Here, we could restore an arrangement in two parallel rows of seven amphorae in correspondence with the N.W. end of the ingot mound. Finally, the last six amphorae of this type are placed in symmetry on the port and starboard sides at the back of the deposit, the three individuals located on the west side thus appearing perfectly preserved. These six amphorae seem to have occupied very specific spaces.

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Establishing the dimensions and tonnage of a ship from the observation of the visible remains of a wreck at great depth is a phenomenon that has developed greatly in recent years with the multiplication of deep-sea prospecting.

In most cases, the exceptional preservation of the cargo allows, by simply counting the elements that compose it, to make a relatively accurate estimate of the original weight of the cargo. However, the inaccuracy of this method is naturally due to the presence of large buried parts whose proportions are difficult to estimate. However, the appreciation of the overall dimensions of the deposit associated with the count carried out on the visible parts, generally leads to establish an order of magnitude of the tonnage which seems globally satisfactory in its accuracy.

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The very precise photogrammetry carried out in 2015 allows the same type of assessment to be made on the dimensions and original tonnage of the vessel based on the visible cargo.

But in the specific case of Capo Sagro 2, a number of identifiable morphological data make it possible to greatly refine the interpretation of the deposit and to propose a more accurate estimate of the ship's dimensions.

Indeed, beyond the simple data provided by the total weight of the cargo (amphorae and ingots), several significant markers of the original morphology of the ship can be distinguished on the deposit.

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First of all, we can see on the longitudinal axis a well-marked void within the cargo, as if the cargo was restoring in its shape the presence of an important longitudinal obstacle such as a keelson or a mastep.

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Moreover, in the north-western part of the cargo, various elements lead us to identify the remains of the bilge pump.

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The presence of a square depression that marks the place of a structure that can be interpreted as the pump's protective cage, like what was found on the Madrague de Giens or on the wreck Dramont E wreck.

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In addition, two lead pipes are visible, almost symmetrically located on the sides of the wreck. They were posted on the deck to drain the water from the pump box through the bulwark.

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Traditionally placed in the lowest part of the hull, it is reasonable to place the bilge pump on commercial ships of this period between the quarter and the rear third of the ship.

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On the same area, we can also see on the edges of the tumulus, formed by the tin ingots, the punctual shape of the planking as well as the heads of the frames.

[DIAPO]

Viewed from the top, these elements have a symmetrical curvature on the two edges of the wreck, which allows us to restore the shapes at this precise location, shapes that clearly indicate the closure of the hull (here in red).

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On the opposite side, on the south-east end, we can see four anchor stocks which seem to indicate the stem of the ship.

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All of these elements allow us to define several important elements concerning the original vessel: with a minimum length of 16.20 m and a width of 5.00 m, its bow can probably be located at the southeast end of the deposit where the four lead anchor stocks.

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However, given the degradation of wooden part of the hull and the position of the most scattered elements, it is necessary to consider, on the basis of the morphology of the tumulus that the area of the deposit does not represent the exact initial dimensions of the boat. But only the lower part of the hull.

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If we use the lines of a contemporary ship of similar dimensions (in this case the Napoli A wreck) to try to find the initial dimensions of the boat based on the area of the wrecking site, we can finally consider a ship of about 20 m in lenght for a width of 7.00 m.

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Regarding the tonnage, considering a ship of 18 to 22 m length for a width of 6 to 7 m, it is possible to establish, a displacement in between 100 to 120 metric tons which would correspond to a deadweight of 70 to 90 tons.

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Regarding now specifically the tin ingot cargo, the morphology of the tumulus allows us to establish a minimum stacking height of 40 cm, corresponding to the average height of the load of ingots measured from the bottom level. If we add to this data the number of apparent ingots (84 clearly discernible on the upper layer) in the upper layer as well as their apparent arrangement, it seemed feasible to propose an evaluation of the tin load. In the case of Capo Sagro 2, the main estimate is that of the volume occupied by the cargo of tin, of the order of fifteen cubic meters. This space, considering a relatively low stowage coefficient (2.55 t.m², to be compared with the density of the raw tin of 5.75 t.m²), leads to restore a cargo of about 1100 average ingots close to type 1. This estimate would correspond to a total weight for this part of the cargo of approximately 42.5 tons.

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This seems considerable, and Capo Sagro 2 would rise to the first place of ancient Mediterranean wrecks containing a known metallic load.

For the moment, without being able to excavate the site, we will retain that the ship contained, at the time of its shipwreck, several hundreds of ingots, constituting the largest load of tin known today in the Roman Mediterranean.

Looking at the wreck, it appears that the ship was loaded in one unique moment: the ingots beeing placed before the amphorae and other possible goods, of a perishable nature, which would not have been conserved.

But it is true that the value of the cargo of tin alone would largely justify, from an economic point of view, the voyage of this ship, without the need to add an additional cargo. According to Pliny the Elder (NH, XXXIV, 161), tin was traded for 80 denarii per pound. The calculation is quickly done: the cargo of tin from Capo Sagro 2 would represent a value of 9,600,000 denarii,or 2,5 millions denari, a figure that turns the heads!

If the presence of a complementary cargo may seem coherent in order to optimize the loading space, the question of the stability of the vessel counterbalances this first aspect. With its sole cargo of tin, relatively well centered and arranged at the bottom of the hold, the ship should indeed have had the best navigation configuration: a relatively low center of gravity and a significant freeboard. On the other hand, the presence of an additional load placed above the ingots would have had the direct consequence of reducing both the transverse stability of the boat and its freeboard, and thus increasing the risk of sinking. This raises the question of the interest of a possible additional profit, which is economically negligible in view of the value of the tin ingots, but which would, on the other hand, endanger the entire cargo.