TESTING THE WATERS: THE ROLE OF SOUNDING WEIGHTS IN ANCIENT MEDITERRANEAN NAVIGATION

John Peter Oleson

1. Introduction

The account of St. Paul's stormy voyage and shipwreck in the autumn of A.D. 60 is one of the most vivid and convincing narrative accounts of a ship's last moments to have survived in Greek or Latin literature (Acts 27:13–20, 27–32). As a result, it is frequently cited in publications concerned with Roman navigation.[1]

> Fearing that they might be driven on to the Syrtes, they let down a sea-anchor and so were carried along. Since we were being badly tossed about by the storm, the next day they began to jettison the cargo, and on the third day with their own hands cast overboard the ship's tackle. And when neither sun nor stars appeared for many days, and a great tempest was upon us, all hope of our being saved was at last abandoned.
>
> When the fourteenth night had come and we were being carried along in the Sea of Adria [Ionian Sea], the sailors suspected that they were nearing land, and casting the sounding-weight [βολίσαντες], they found 20 fathoms. A short distance along they sounded again [πάλιν βολίσαντες] and found 15 fathoms. Afraid that we might run up on some shoals, they let out four anchors from the stern and prayed for daylight. The sailors lowered the ship's boat into the sea under the pretence of setting anchors from the prow, scheming to escape from the ship. But Paul said to the centurion and his soldiers, "Unless these sailors remain on the ship, we cannot be saved," and the soldiers cut the rope holding the boat, and let it go.

The passage is notable in particular for its documentation of the use of sounding weights to determine whether the ship was approaching shoal water, a practice that must have been routine but that is mentioned or implied in only a few surviving passages from Greek and Roman authors.[2] One striking aspect of this account is the statement that the crew somehow suspected that land was near, despite having been two weeks without astronomical sightings and remaining very uncertain of the ship's position. Perhaps during the preceding day they had seen species of birds that usually keep close to land or observed clouds that formed over islands, warning them to track the subtler changes in the sea. During the night they may have smelled land or observed

[1] The most likely years are 59 or 60; see Betz 1992, 191. Achilles Tatius, *Leucippe and Clitophon* 2.32–3.5 provides another detailed account of a voyage that ended in a wreck, but the sailors gave up and abandoned ship before it struck a reef. Too many individuals have kindly assisted me in the compilation of my catalogue of sounding leads to provide a complete list here, but I must acknowledge the generosity of G. Kapitan, who shared his notebooks with me at an early stage in my research. I will fully acknowledge all assistance in my monograph on this subject.

[2] Oleson 2000 provides an introductory account of the history and use of ancient sounding weights in the Mediterranean world, along with a typology of their shapes; see also Oleson 1988; 1994; 1996. I present here a more complete discussion of the literary evidence, along with an expanded catalogue, revised statistics, and a revised typology of shapes. The final publication will contain numerous profile drawings and photographs.

changes in the shape and direction of swells and waves, and at this point they made use of the sounding weight to determine the depth of water and bottom topography.[3] The typical Roman sounding weight was a roughly bell-shaped lead casting of about 5 kg, with a sturdy attachment lug at its apex for a rope and a depression in its spreading base for tallow. Once the sailors manning St. Paul's boat had determined that they were in shoal water and that the depth was decreasing, they deployed their anchors. These were most likely wooden anchors with lead stocks and braces for the flukes.[4] The presence of Graeco-Roman anchor stocks and sounding weights on Mediterranean reefs, both alone and in association with shipwreck sites, further documents the procedures recounted in Acts.

The sounding weight was the most widely used and critical piece of navigational equipment in the Mediterranean cultures from at least the sixth century B.C. until the appearance of the compass in this region in the eleventh or twelfth century A.D.[5] Only the mythical, proverbially fortunate Phaeacians could navigate without a pilot or aids (*Od.* 8.557–63):

> For the Phaeacians have no pilots [κυβερνητῆρες], nor steering oars such as other ships, but their ships by themselves understand the thoughts and intentions of men, and they know the cities and rich fields of all peoples, and they swiftly cross the gulf of the sea hidden in mist and cloud. They never have any fear of harm or destruction.

This passage embodies the dreams of generations of Mediterranean seafarers. The Arabic astrolabe and the early medieval cross-staff, used in determining latitude, were not adapted to navigation until the fifteenth century.[6] In any case, these instruments had more importance in oceans than in the restricted confines of the Mediterranean Sea. The traditional sounding weight or "lead line," by contrast, remained in unbroken use without fundamental change from the Roman period until the introduction of "sounding machines" in the later nineteenth century.[7] Even then, the old type of lead weight survived for sounding by hand. Sounding weights continued to be important to navigation because they supplied information not just on depth but also on the "contours, colour, smell, taste, and texture of the sea-bed"—by means of the samples of the bottom they retrieved.[8]

Samuel Clemens, who took his pen name Mark Twain from the two-fathom mark that indicated

[3] Traditional navigators watch the sea for a wide variety of signs; cf. Lewis 1994; Morton 2001; Davis 2002.

[4] For composite wood and lead anchors, see Frost 1982, 263–273; Gianfrotta 1980, 103–116; Kapitän 1984, 33–44.

[5] Waters 1958, 21–22.

[6] Derry and Williams 1960, 201, 205.

[7] Waters 1958, 18–20 provides a good short discussion of the use of the sounding lead in late medieval navigation. According to him, the earliest illustration of a postclassical sounding lead appears in a Dutch work of 1584, and the earliest English description in documents of the 1620s. The *Oxford English Dictionary*, however, cites an occurrence of "sounding-line" as early as 1336, and of "sounding-lead" in 1485. Nautical terminology is rare in surviving early Middle English texts, but there is ample testimony in Old English for the sounding line (*metrap*) and sounding pole (*sundgyrd*) (Their 2002, 113–114, 141, 150). The relevant texts date from the eighth to the eleventh century. Certainly Eustathius in the twelfth century was familiar with sounding leads and their function (see text). As far as I can determine, surviving examples of early medieval sounding leads are rare or unrecognized. I have included a twelfth-century sounding lead from Sardinia in my corpus (cat. no. 095, unpublished). Their (2002, 114) comments on the lack of archaeological evidence for early medieval sounding leads, although she suggests that one is shown in use during Harold's landing in Normandy on the Bayeux Tapestry. The history of this artifact in the medieval period remains to be written. See also May and Holder 1973, 203–212 for a history of post-Roman sounding systems. McGrail 1983; 1987, 258–285 provides a good discussion on the ancient and recent techniques of navigation in the English Channel, including the use of sounding leads. The advent of inexpensive and accurate electronic sounding devices has driven the sounding weight out of use for the navigation of ships, but inshore fishing boats in developing countries still use the sounding weight, and large pleasure boats will often send out a dingy with sounding weight to check depths before entering an unfamiliar mooring.

[8] Waters 1958, 18; McGrail 1983, 304.

dangerous shallows to a "leadsman" on a riverboat, records the employment of sounding weights on a steamboat plying the Mississippi River in the mid-nineteenth century.[9]

> Mr. B— [the river boat pilot] pulled the cord, and two deep mellow notes from the big bell floated off on the night. Then a pause, and one more note was struck. The watchman's voice followed, from the hurricane deck:
>
> "Labboard lead, there! Stabboard lead!"
>
> The cries of the leadsmen began to rise out of the distance, and were gruffly repeated by the word-passers on the hurricane deck.
>
> "M-a-r-k three! M-a-r-k three! Quarter-less-three! Half twain! Quarter twain! M-a-r-k twain! Quarter-less."
>
> Mr. B— pulled two bell-ropes, and was answered by faint jinglings far below in the engine-room, and our speed slackened. The steam began to whistle through the gauge-cocks. The cries of the leadsmen went on—and it is a weird sound, always, in the night. . . . Nobody was calm and easy but Mr. B—. He would put his wheel down and stand on a spoke, and as the steamer swung into her . . . marks . . . he would meet and fasten her there. Talk was going on, now, in low voices.
>
> "There; she's over the first reef all right!"
>
> After a pause, another subdued voice:—
>
> "Her stern's coming down just exactly *right*, by *George*! Now she's in the marks; over she goes! . . . Oh it was done beautiful—*beautiful*!"

These two eyewitness descriptions indicate a striking continuity in reliance on the sounding weight for navigation over a period of at least 1,800 years. The vivid account by Samuel Clemens reminds us that we have lost forever the singsong formulas ancient sailors must have used to communicate with the helmsman. Nevertheless, the navigational problems and technology of communication were virtually identical on both the ancient and modern ships, so the ancient leadsman may have communicated with his helmsman in a manner similar to the haunting cries Clemens records.[10] Although no surviving ancient text records whether or not Greek or Roman lead lines—like those Mark Twain describes—were marked for easy calculation of the depth of water, the story of St. Paul's boat suggests that they were. The sailors in Acts took several soundings quickly and were able to determine that the depth of water was decreasing.

The surviving evidence for the use and history of the sounding weight in the ancient Mediterranean includes a scanty but evocative corpus of literary evidence, along with a rapidly increasing number of published examples, many from dated wreck sites. At the time the final version of this article was submitted (April 2006), my database of sounding weights contained 177 entries, of which approximately 20 examples should be considered "doubtful" or post-Roman. Seventy-four of the sounding weights were found in datable contexts, although the precision and reliability of the dates vary significantly. A careful evaluation of the relevant literary sources reveals a previously unappreciated enthusiasm among Greek and Roman scientists and geographers, as well as among seafarers of various types, for mapping the Mediterranean seafloor.

2. *The Use of Sounding Weights in Antiquity*

Nearly all ancient sounding weights were cast in lead and follow one of several variations on hemispherical, bell, or conical shapes. There is a tethering hole in a stout lug or added iron ring

[9] Twain 1877, 31–32.

[10] Although we hear little about them, sea shanties were also a part of the ancient nautical tradition; see, e.g., Longus, *Daphnis and Chloe* 3.21.

Fig. 1. Class 1A: 002 (Gela Archaic Wreck, 500 B.C.). Class 4B: 090 (Wreck off Haifa, sixth–seventh century A.D.).

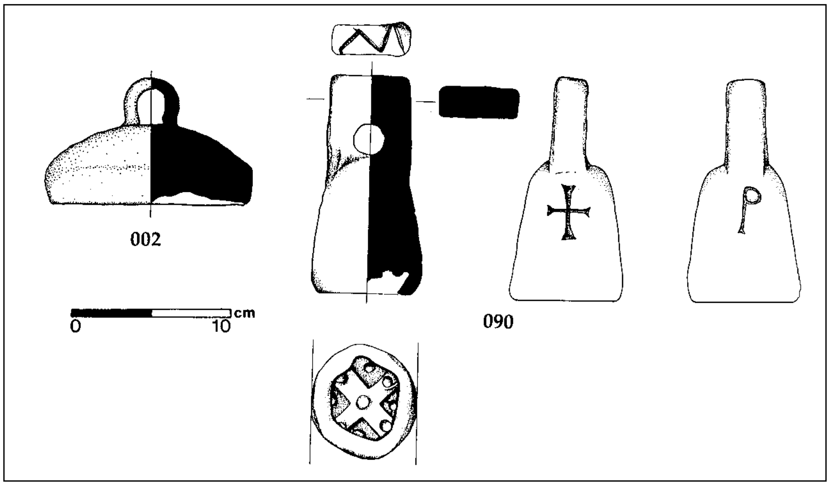
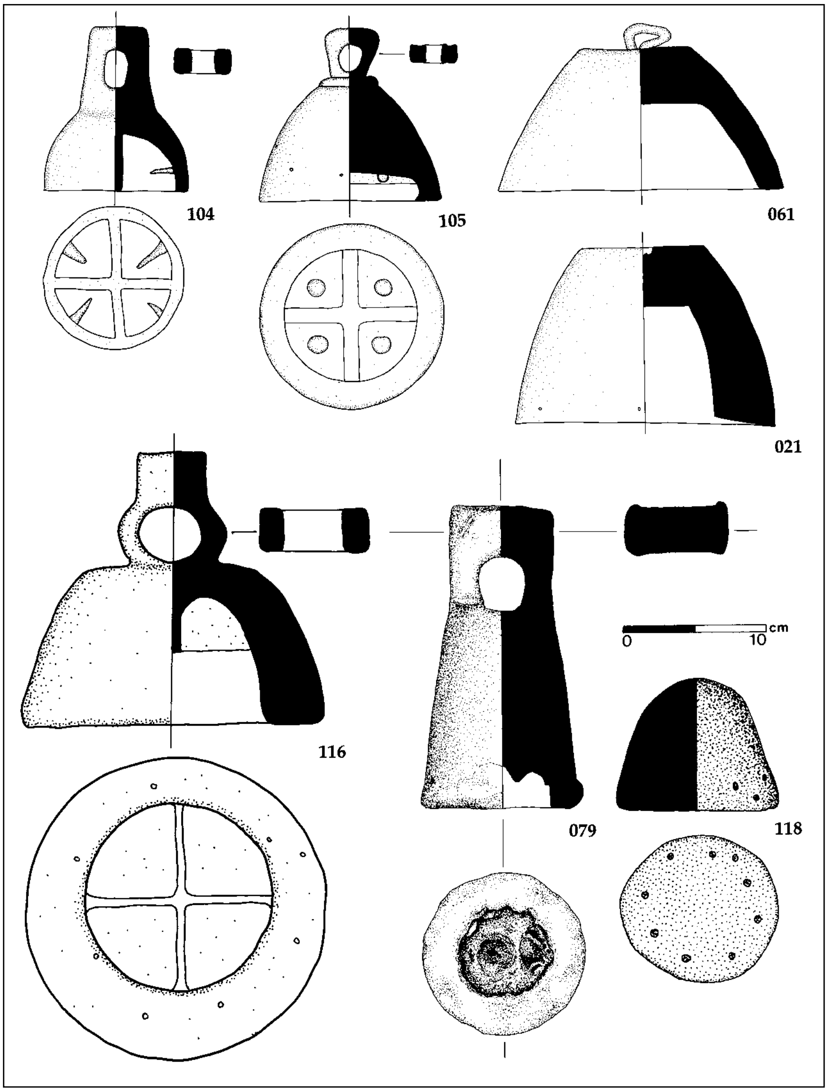


Fig. 2. Class 1A: 104 (Syracuse, sporadic), 105 (Lampedusa, sporadic). Class 2A: 116 (Cape Taillat, sporadic). Class 2B: 021 (Mahdia Wreck, 110–90 B.C.), 061 (Capo Taormina Wreck, 125–150). Class 3B: 118 (Dor, sporadic). Class 4A: 079 (Caesarea harbor, third century A.D.?).



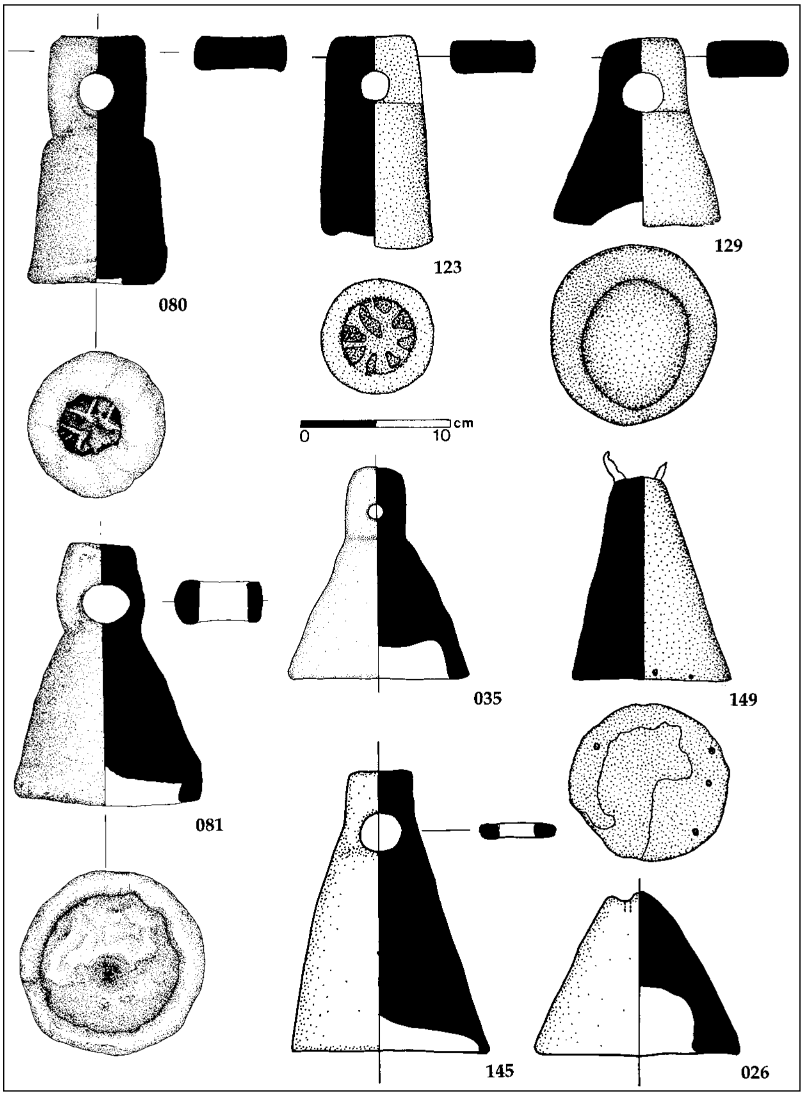
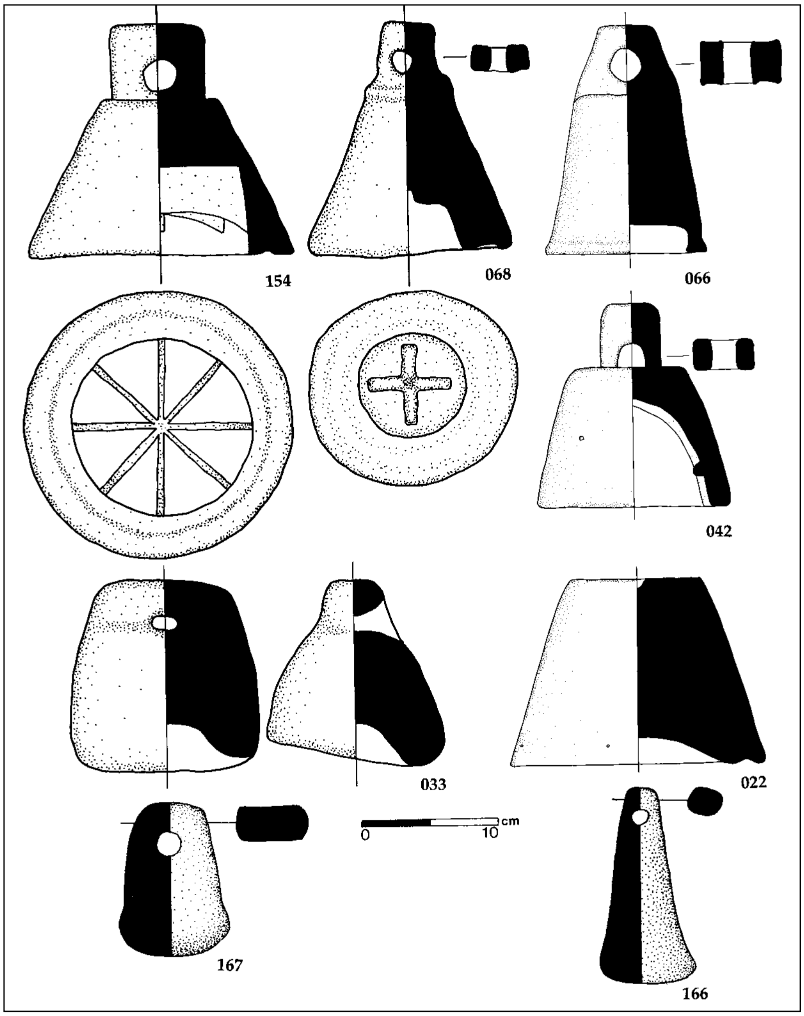


Fig. 3. Class 4A: 080 (Caesarea harbor, third century A.D.?), 123 (Dor, sporadic). Class 4B: 129 (Dor, sporadic). Class 5A: 035 (Sa Nau Perduda Wreck, 60–40 B.C.), 081 (Caesarea harbor, third century A.D.?), 145 (Brindisi, sporadic). Class 5B: 026 (Cavalière Wreck, 100 B.C.), 149 (Dor, sporadic).

at the upper end, and very often a concave base designed to hold a lump of tallow (figs. 1–4). I have defined seven major shape classes, along with a catchall "Miscellaneous" class (see below). The form is determined by the function: a strong and convenient attachment lug for the rope, a wide base and low center of gravity to ensure solid contact with a representative portion of the sea bottom. The tallow cups were usually provided with a projecting lip, interior septa, or inwardly projecting nipples and nails to hold the charge in place. Tallow is not particularly sticky, but it has the advantage of remaining relatively soft even when cold, allowing pebbles, sand, and even bits of finer sediments to penetrate deep enough into the lower surface to be carried up for inspection. Tallow was also cheap and probably formed part of the stores of most ships for use in cooking and for maintenance of equipment. Traces of beef tallow were in fact found in the cup of a sounding lead from Dor (cat. no. 091).[11] Lead is an ideal material for sounding weights; it is dense, resistant

[11] Rosen, Galili, and Sharvit 2001. Lard from pork would be more common outside the Levant.

Fig. 4. Class 6A: 154 (Cagliari, sporadic), 068 (Plemmirio Wreck B, 200), 066 (Camarina Wreck A, 175–200), 042 (Isla Medas, sporadic). Class 6B: 022 (Mahdia Wreck, 110–90 B.C.). Class 8: 033 (Jeune-Garde Wreck A, 100–25 B.C.?). Class 9: 167 (Dor, sporadic), 166 (Dor, sporadic).



to corrosion and fracturing, cheap, and, most important, easy to cast. Stone seems to have been used only occasionally for carefully shaped sounding weights, although many irregular, unworked stones may have found casual use as sounding weights.[12]

No ancient representations of the lead line being thrown have yet come to light, although one probably existed on the damaged portion of a third- or fourth-century A.D. mosaic representing ships found at Althiburus in North Africa.[13] A fresco in the late sixth-century B.C. Etruscan Tomb of Hunting and Fishing at Tarquinia shows a related activity involving two fishing boats. A young man on one of the boats leans over the bow and jigs a vertical line with his right hand while holding the bight in his left.[14] It is more likely he is fishing than sounding the bottom, but even if the objective is fishing, the scene shows how the use of weighted lines gave fishermen an intimate knowledge of bottom topography in their home waters (see below). Given the low social status of the sailor in antiquity, and the relatively unspectacular nature of depth-sounding procedures, it is not particularly

[12] Eight stone objects have been identified as sounding weights, although three of them (cat. nos. 028, 093) are more likely to have served as diving or beam balance weights; see cat. nos. 013, 028, 033, 069, 070, 093, 164.

[13] Saint-Denis 1935, 45–46; *CIL* 8.27790; Oleson 2000, 297–298.

[14] Casson 1995, fig. 192.

surprising that sounding was not represented frequently enough for representations to have survived or to be recognizable as such.

Wachsmann has proposed that sailors standing at the bow of six of the twelve wooden ship models from the tomb of Meket-Re' at Thebes in Egypt held sounding weights.[15] These models are far earlier (2000 B.C.) than any likely sounding leads in the archaeological record and are themselves very doubtful. The earliest item in my catalogue, a lead weight from the Ulu Burun Wreck (cat. no. 001, ca. 1325 B.C.), has a different shape than the Meket-Re' examples, and it is not particularly convincing as a sounding weight on its own merits. The Meket-Re' models each show a sailor standing at the bow, holding a long, cylindrical, black and white spotted object with rounded apex (reconstructed scale ca. H 0.40 m, base D ca. 0.10 m) suspended from a rope wrapped around his right hand. The objects resemble the cylindrical shape of post-Classical sounding leads, but their dimensions (if the scale is accurate) are much larger than needed for sounding weights in river navigation. The sailors seem to handle the objects far too easily for the originals to have been made of stone or lead, and it may be significant that the objects are not attached to a length of rope appropriate for sounding. Winlock refers to the objects more reasonably as "bumpers covered with spotted bull's hide," presumably designed to protect the boat from abrasion when docked.[16] An identical spotted object can in fact be seen in use as a bumper tied to the sheerstrake of a model in the Egyptian Museum.[17]

Only a few ancient literary sources describe or imply how the weights were used. They were thrown into the sea on a line as a ship approached a questionable situation—land, a reef, or an anchorage—note was taken of the length of line played out, and if the character of the seafloor was important, the tallow was examined for samples of the bottom sediments.[18] The method of heaving the weight in antiquity is undocumented, but it was most likely similar to that described in nineteenth- and early twentieth-century manuals of seamanship.[19] The leadman stood outboard, midships, swung the lead around, and threw it forward, parallel to the ship's course. In moderate depths of water (up to 20 fathoms, ca. 40 m?),[20] the lead would touch bottom as the ship passed directly overhead, giving the most accurate measurement of depth. In two scenes on the Bayeux Tapestry a sailor is shown in just such a position on one of King Harold's ships as it approaches land, holding a tight line that disappears into the water toward the bow. It is very likely that he is sounding with a lead line, while a sailor on the following ship uses a sounding pole.[21] Medieval Italian *portolani* (coastal pilots) often specify that one enters a harbor *a tocco di scandaglio* ("sounding with the lead"), and the Romans likely followed the same procedure.[22] In depths such as 100 m, where a ship might need to sound in order to test the composition of the bottom for purposes

[15] Wachsmann 1998, 300; cf. Landström 1970, 79; Agouridis 1997, 15. For the tomb models, see Winlock 1955, 45–97, models N, O, P, Q, R, S, pls. 33–43.

[16] Winlock 1955, 56, 58.

[17] Reisner 1913, pl. XII, no. 4872. Reisner (pp. xiv, 31–32, 51, 65, 95) refers to objects of this type as "bumpers" or "buffers."

[18] Cf. Casson 1995, 246; Gianfrotta and Pomey 1981, 288–289.

[19] Oleson 2000, 295–296; Great Britain, Admiralty 1922, 130–131.

[20] Early modern handbooks of navigation specify the use of distinct lead lines for "shoal water"—20 fathoms or less—and for "deep water"—20 to 150 or 200 fathoms; Waters 1958, 19–20. The deep-water "dipsie line" carried a sounding lead weighing 14 lbs. (6.35 kg), while the shorter line carried a lead weighing 7 lbs. (3.18 kg). By the mid-eighteenth century these weights could be 14 and 28 lbs. respectively, and deep-sea leads could weigh as much as 70 lbs. (31.75 kg); Hewson 1963, 217; May and Holder 1973, 204.

[21] Scenes 5 and 34; see Their 2002, 114, fig. 80 for scene 5.

[22] Kretschmer 1909, 190, note; Motzo 1947, 2:3, 29–30.

of navigation rather than to avoid a reef, an inaccurate, oblique reading of depth would not be of great concern. If accuracy were required, a ship could heave to. From at least the early seventeenth century, the length of line that ran out after a weight had been thrown was marked by differentiated bits of cloth, leather, and string rove through the rope. This arrangement allowed illiterate sailors and sailors working in the dark—like the leadsmen in the passage from Mark Twain quoted above—to determine the depth of the sounding quickly and by feel alone.[23]

The earliest reliable ancient description of the sounding weight in use appears in Herodotus (2.5.28; ca. 440 B.C.).

> For the nature of the Land of Egypt is this: first, as you sail towards it and are still a day's run from land, if you cast the sounding weight [κατεὶς καταπειρητηρίην] you will bring up mud and the depth will be eleven fathoms. This shows that the alluvium from the land extends out so far.

A sample of the bottom sediments brought up by the tallow charge embedded in a sounding weight allowed detection of nearby river mouths or known local geological or benthic phenomena. In the absence of the compass, this information facilitated navigation in fog, under overcast skies, or out of site of land. As Herodotus was aware, the low-lying topography of the Nile delta and the adjacent North African coastline makes navigation by sight very difficult. Use of the sounding weight, however, allowed sailors to navigate by following both bottom topography and the submerged Nile alluvium. The thirteenth-century A.D. *Compasso da Navigare* mentions the same procedure in use in the shallow waters of the Adriatic Sea.[24] Such information was also used by ancient fishermen and salvage or pearl divers throughout the Mediterranean to feel out and evaluate the invisible sea bottom in preparation for their activities (see below).[25]

Remarkably, this is one of only two ancient literary sources that make reference to the use of the lead to recover a sample of the bottom. The other passage occurs in Olympiodorus's *Commentary on Aristotle's Meteorologica* (p. 107, lines 21–25), composed at Alexandria in the second half of the sixth century A.D. The situation concerns the effect of strong submarine springs on sounding lines and weights in the Black Sea ("Pontus").

> Therefore, the ropes holding the weight are pushed away to the side and on account of this the depth is not sounded even when many, very great lengths of rope have been let down. Propose either this explanation, then, or yet another. For those who devote themselves to such things think that the bottom has been touched if sand is brought up by the weights [ἐν ταῖς βολίσι] they have thrown in, by which sign they also sound different places in the seas [but in Pontos the springs wash the sand off the sounding weights].

The relevant passage in Aristotle (*Mete.* 1.13.351a) does not mention collection of a sample of the bottom.

> . . . the so-called Deeps of Pontus. This is a certain part of the sea the depth of which is immeasurable. No one, at any rate, letting down a line has been able to find the bottom.

Pliny the Elder (*HN* 1.224) echoes Aristotle.

[23] Great Britain, Admiralty 1922, 130; cf. Waters 1958, 19–20. May and Holder 1973, 203–204.

[24] Motzo 1947, 2:29–30; Taylor 1956, 107.

[25] On diving in antiquity, see Oleson 1976, 22–29; Nardi 1984–1985, 51–63; Tchernia 1988, 489–499. E. de Bruijn of the University of British Columbia is preparing a Ph.D. dissertation concerning diving in antiquity.

> Others report an immense depth of water, called the Deeps of Pontus, off the coast of the Coraxi tribe on the Pontus, nearly 300 stades (54 km) from land, where soundings have never reached bottom.

The greatest depth in this part of the Black Sea has now been measured at 2,155 m.[26] The passage in the *Meteorologica* is interesting because it implies that deep sounding was a routine activity and that there was already a significant corpus of depth soundings available for the Mediterranean and Black Sea in the fourth century B.C. But why would one take soundings in deep water 54 km from land unless the activity was part of a larger program of scientific research? Herodotus (*Hist.* 2.28) mentions an attempt by the pharaoh Psammetichus I to sound the sources of the Nile with a line carrying a sounding lead. Given the date of his reign—656–610 B.C.—this is the earliest testimony for the use of sounding weights, and in this case, too, the purpose was scientific curiosity rather than practical navigation.

> King Psammetichus . . . had a rope made many thousands of fathoms long which he let down into the water without finding the bottom. It seems to me that if there is any truth in this scribe's story, it indicates the presence of powerful whirlpools and eddies in the water . . . which prevented the sounding weight [καταπειρητηρίην] from reaching the bottom.

Invisible whirlpools and eddies that thwart attempts at sounding appear in most accounts of the Greek and Latin literature that deals with attempts at measuring the depth of mysterious rivers, lakes, and seas, and these hazards represent real conditions (see below). Some Roman emperors showed similar curiosity. Pausanias (2.37.5), for example, reports that the emperor Nero, like Psammetichus I, used a sounding lead tied on "several lengths of rope" to plumb the depths of the Alcyonian Lake near Lerna, but that he was unsuccessful.

> The depth of the Alkyonian Lake has no limit, and I do not know of anyone who has been able to plumb its limits with any device [οὐδεμιᾷ μηχανῇ]. Even Nero, who had ropes made many stades long and tied end to end, fastening a sounding lead [μόλυβδον] to them and omitting nothing that might help his experiment—even he was not able to find any limit to its depth.

Finally, there is a similar tale about the emperor Hadrian in the Talmud (Midrash Psalms 93.6, 415–416): "Once, Hadrian the emperor wished to measure the depth of the Adriatic [Sea]. He took ropes and lowered them [into the sea] for three and a half years . . ."[27] Sperber's glossary of Greek and Latin nautical loan words in Talmudic literature, however, does not contain any terms for sounding weight.[28]

Herodotus unfortunately does not indicate the material of the weights he mentions, and the Greek term—καταπειρητηρίη, more or less "test below"—is unspecific. The term used by Olympiodorus regarding the passage in Aristotle—βόλις, "missile"—is also unspecific. The earliest clearly identifiable sounding weight in the archaeological record, from a ship that sank at Gela around 500 B.C., about fifty years before Herodotus wrote his history, is a flattened hemisphere with slightly flattened sides and shallow tallow cup, made of lead (cat. no. 002, fig. 1). A rectangular lead weight with a suspension hole at one end, and about the same size as later sounding weights, was found on the Ulu Burun Wreck (cat. no. 001, 1325 B.C.).[29] Given the absence of a tallow cup, however, and

[26] Leier 2001, 234–235.

[27] Quoted in Sperber 1986, 110.

[28] Sperber 1986, 128–158.

[29] Pulak 1988, 33, no. KW 267, fig. 41; Parker 1992, 439–440.

the long chronological gap between this weight and the Gela sounding lead, identification of it as our earliest sounding weight is problematic.

The first literary mention of lead as the material of a sounding weight, a verse by the poet Lucilius quoted in Isidore (*Origines* 19.4.10), belongs to the mid-second century B.C.

> *Catapirates linea cum massa plumbea, qua maris altitudo temtatur. Lucilius (1191):*
> *Hunc catapiratem puer eodem devoret*[30] *unctum*
> *Plumbi paucillum rudus lineique mataxam.*
>
> A sounding weight, a line with a lump of lead, with which the depth of the sea is tried. Lucilius (1191):
> "A slave boy would swallow down this sounding weight if it were smeared with the same stuff,
> A small lump of lead and a flax rope."

Although the context is not preserved, Lindsay suggests that "the delicious flavour of some syrup or paste is being described."[31] Description of the weight as "smeared" or "anointed" strongly suggests that Lucilius was familiar with the practice of applying a greasy substance to the tallow cup on a sounding lead.

The remaining Greek and Latin literary testimonia provide little further information. Plautus, about a generation before Lucilius, compares the slave of a love-struck master to a lifeboat (*Aulularia* 598):

> *ut toleret, ne pessum abeat tamquam <catapirateria>*
>
> "[he is meant] to hold him up, so he doesn't sink like a <sounding weight>."

Unfortunately, the crucial word for sounding weight is corrupt. The text of a passage in Statius (*Silv.* 3.2.30) concerning tasks on board a boat also seems hopelessly corrupt. One popular reading provides this text:

> *†Sint quibus exploret plumbo gravis alta molybdus†*
>
> "Let there be some to make the heavy sounding-lead explore the depths . . ."

Other editors, however, come up with solutions that have nothing whatsoever to do with sounding weights.[32]

Herodotus, Lucilius, and Plautus all use essentially the same word for sounding weight—καταπειρητηρία (Ionic: καταπειρητηρίη), *catapirateria*, *catapirates*. Pausanias (and possibly Statius) uses the term μόλυβδος/*molybdus*, "lead," derived from the material. In Acts 27:28 the verb βολίζειν is employed, "to throw the sounding weight," and Olympiodorus uses the related term βόλις, "missile." In fact, like καταπειρητηρία, these terms are also not specifically nautical, related instead to a

[30] Comparison with *CIL* 8.27790 (*ILS* 9456) suggests the reading *devoret* rather than *deferet*; see Lindsay 1911, 97.

[31] Lindsay 1911, 97.

[32] Mozley in the Loeb edition accepts this reading by Turnebus but notes that none of the proposed emendations of the manuscript readings are convincing. Marastoni 1970, 61 reconstructs: *†sint quibus exploret primos gravis artemo flatus†*; "let there be some whose task it is that the heavy foresail try the first puff of wind."

"throw of the dice" or the "throw *or* strike of a missile," or the "missile" itself. In his twelfth-century commentary on the *Iliad*, Eustathius uses βολίς, βολεῖν, and βολίζειν with reference to sounding water depth, and at several points he refers to lead as the material: e.g., ὁ βολίζων μόλιβδος (*Il.* 2.622.2).

> Whence also the proper verb in use τό βολίζειν ("to heave the lead line"), that is to say to measure the depth of the sea with a bit of lead let down [μολιβδίνῃ καθέτῳ], or with some such thing. (*Il.* 2.106.17)

Eustathius certainly seems familiar with the goals and methods of sounding, suggesting that the sounding lead was still in common use in the eastern Mediterranean in the twelfth century.[33]

3. Ancient Research on the Depth of the Mediterranean Sea

There may, in fact, be some truth in the stories of pharaohs and emperors sponsoring attempts to document the depths of the sea. Among the many stories about the deeds of Alexander the Great preserved in the *Alexander Romance*, one of the most fascinating is an account of his descent into the sea in a glass sphere (1.38).[34]

> So I, Alexander, had the idea of taking a large iron cage and putting an enormous glass vessel inside the cage, with walls a cubit and a half thick, and I ordered a hole to be made in the base of the vessel to fit a man's hand, because I wanted to go down and discover what was at the bottom of this sea. My intention was to put my hand through the hole, and pick up from the sand beside it whatever I found at the bottom of this sea. . . . So I ordered a chain of 308 fathoms (about 560 m) to be made and gave instructions that I was not to be pulled back up until there was a tug on the chain.
>
> When everything had been prepared, I entered the glass vessel to attempt the impossible. The entry was immediately sealed with a lead lid. I had descended 120 cubits (about 60 m) when a passing fish shook the cage with its tail, and they brought me up because the chain had been tugged. I descended again and the same thing happened to me. Going down for the third time, around 308 cubits (about 154 m), I saw all sorts of fish swimming around me, when lo and behold, the biggest fish of them all came and seized me and my cage in its mouth and took me far off to the land a mile away. Having reached dry land it crushed the cage with its teeth, then cast it aside. I was scarcely breathing and frightened to death. . . . And I said to myself, "Alexander, give up attempting the impossible, in case by investigating the deep you lose your life."

Is there any truth to this story? The glass sphere and the perilous descent to a depth of 154 m are not credible, but it would have been characteristic of Alexander to be interested in exploring the deep sea and adding it, as it were, to his list of conquests. Although the *Alexander Romance* first appears in the third century A.D., some of the information goes back to the Ptolemaic period, and despite the skepticism of some modern editors, the story probably contains a kernel of truth.[35] Alexander's tutor Aristotle, or at least members of his school, were familiar with the diving bell, since a comment in the *Problems* (3.2.5) describes the diving bell as a refuge for divers or a place to refresh their lungs with air without surfacing: "They give respiration to divers by letting down an inverted cauldron. For this does not fill with water but retains its air." Certainly Alexander the

[33] Cf. also Eustathius, *Il.* 2.643.7; *Od.* 1.40.37–38.

[34] Dowden 1989, 708–709.

[35] Dowden 1989, 650–652.

Great could have heard of this device, which did not become common again until the seventeenth century.[36] An equally surprising comment in Aristotle's *Parts of Animals* (2.16.659a) makes reference to the use of the snorkel for breathing.

> Some divers, when they go down into the sea, provide themselves with a breathing device, by means of which they inhale air from the surface while they remain a long time in the water. Nature provided the elephant with something of this sort by giving it a long snout.

The extent and frequent accuracy of Aristotle's research on fish and marine invertebrates indicates that oceanography was part of his research agenda,[37] and some of his information—such as the breeding habits of the octopus (*Hist. an.* 8[9] 622a)—can only have been gathered through observation by divers.

There may well have been organized programs behind the stories of pharaohs and emperors sponsoring projects to document the deep sea. Both Greek and Roman geographers made impressive strides in mapping the Mediterranean world, and attempts to provide sounding charts of the mysterious depths of the sea would have been a logical extension of their surveys on land. Diogenes Laertius (2.1.2) describes the sixth-century philosopher Anaximander as "the first man to draw the circumference of the *land and sea*, and he also made a globe" (cf. Strabo 1.1.11).[38] In the first century B.C., the geographer Strabo (2.5.17) is more explicit.

> The sea in particular draws the outlines of the land and gives it its shape, producing bays, deep sea, and straits, also isthmuses, peninsulas, and promontories. Both rivers and mountains assist in this. Through such features we gain a clear idea of continents, favorable locations for cities, and all the other striking details a geographic map is filled with. Among these details is the multitude of islands scattered across the open sea and along the whole coastline.

As noted above, in the first book of his *Geography* Strabo provides a careful discussion of the topography of the Mediterranean seabed (1.3.4–7).

Furthermore, the citation in the Greek and Roman accounts of invisible whirlpools and eddies as impediments to accurate sounding at great depths reflects the actual situation. This problem was recognized once again in the mid-nineteenth century as the deep Atlantic was sounded for scientific purposes and to find a route for the submarine telegraphic cable between Ireland and North America.[39] John Brooke, a member of the American North Pacific Exploring Expedition of 1853, reported many failures and "no bottom" measurements, meaning that either the lines broke or the lead returned without any sediment to confirm it had struck bottom. Early deep-water measurements often turned out to overestimate the actual depth, since it was difficult to determine when the weight had struck bottom because of the effects of submarine currents on the cable. Some nineteenth-century scholars, unlike the ancient Greeks, even hinted at the intervention of mermaids![40]

So far, this reconstruction is based mostly on conjecture. Are there any concrete data to support my contention that Aristotle and others engaged in systematic deep sounding of the Mediterranean? I believe there are. In the late first century B.C., Strabo (1.3.9) repeats a report by the early first-century B.C. philosopher Posidonius that "the Sea of Sardinia is said to be the deepest of all

[36] Marx 1990, 30–39.

[37] Higgenbotham 1997, 42.

[38] Bunbury 1883, 1:122, 145, 618.

[39] Rozwadowski 2005, 67–97.

[40] Rozwadowski 2005, 202.

seas that have been sounded, about 1,000 fathoms." This figure corresponds to about 1829 m—in fact, quite close to the correct one. The flat Algerian Plain west of Sardinia averages just over 2,000 m in depth, so the error is only about 8 percent.[41] I believe that this measurement was taken in the fourth century B.C., since Aristotle—in addition to his citation of the "Deeps of Pontus" quoted above—is confident that he has a correct knowledge of the relative depths of the major Mediterranean basins (*Mete.* 2.1.354a).

> For the sea appears to be ever deeper and deeper: the Black Sea deeper than Lake Maeotis, the Aegean deeper than the Black Sea, the Sicilian Sea [Ionian Sea] deeper than the Aegean, and the Sardinian and Tyrrhenian the deepest of all. The water outside the Pillars of Hercules is shallow . . .

The Aegean, of course, is not deeper than the central basin of the Black Sea, and significant areas of the Ionian Sea are deeper than the Sardinian and as deep as the Tyrrhenian.[42] The greater portion of the Tyrrhenian Sea has depths between 2,500 and 3,500 m. In any case, it seems that Aristotle had generally the right idea. Strabo, who defines the extent of the Sicilian Sea (2.5.20), repeats the same calculations (1.3.4–7) in the context of a discussion of the overall topography of the Mediterranean and Black Seas and its relation to sea currents. Strabo attributes his information to Strato of Lampsacus, an early third-century B.C. philosopher associated with Theophrastus and the Lyceum. Pliny the Elder (1.224), citing the first-century philosopher Fabianus, indicates that the maximum depth of the sea is 15 stades, or 2,700 m, a good approximation for large areas of the Tyrrhenian basin. This information, too, may go back to Aristotle, since Pliny follows it up with the reference to the immeasurable Deeps of Pontus quoted above.

One might suspect that the upper limit of actual measurement of 1,829 m cited by Posidonius resulted from the difficulty of preparing a rope of natural fibers that could support its own weight to a length greater than about 2,000 m. We have no information on the ancient method for a sounding of this depth, but we do not need to propose a hemp or esparto grass rope of enormous diameter. These fibers are nearly buoyant in sea water, so there would have been no need for a cable of increasing diameter to support the increasing weight of cable played out. In 1851, Samuel Lee on the U.S. brig *Dolphin* used twine rather than rope to make 32 soundings in the Atlantic up to 3,825 fathoms, just under 7,000 m.[43] In the 1853 North Pacific expedition mentioned above, John Brooke found that a heavy hemp rope was useless for deep soundings, and lighter line was much more effective. A relatively light line can be seen in use as well on Ross's Antarctic Expedition of 1839–1843.[44] Very little of the technology used for these soundings would have been unfamiliar to Aristotle. It may be that ancient Greek twine or the associated windlass could not support the various strains involved in sounding much beyond 2,000 m, or that some logistical problems impeded soundings beyond this depth. In any case, the accuracy of Posidonius's figure suggests that the measurement west of Sardinia actually took place. I am confident that a data bank of absolute depth soundings—although incomplete and probably full of errors—lay behind Aristotle's comparison of relative sea depths cited above. Another depth measurement, preserved in Seneca's *Naturales Quaestiones* (2.26.6), was probably also part of this early corpus. Recording the formation of a new island in the Aegean Sea by volcanic action in A.D. 46, Seneca cites Asclepiodotus, a pupil of Posidonius, as an authority for the fact that the sea was originally "200 feet deep" at that spot. This long-forgotten project to map

41 Leier 2001, 228–229.

42 Leier 2001, 230–231.

43 Rozwadowski 2005, 76–77.

44 Rozwadowski 2005, 49, 54.

the deep Mediterranean seabed was the ancient Greek equivalent of Auguste Piccard's pioneering research with the *bathyscaphe* in the 1950s[45] or recent deep-space probes—that is, pure scientific inquiry. Both the difficulty of the undertaking and the apparently comprehensive scope of the inquiry reveal a profound and so far underrated interest among Greek and Roman intellectuals in the world hidden beneath the sea.

It is unlikely that the Romans could have exploited the seabed commercially at depths of 1,000 fathoms, but in the second century A.D., Oppian (*Haliutica* 1.82.5) asserted that men had comprehensive knowledge of the seafloor down to 300 fathoms (ca. 550 m), a depth more easily achieved with fishing line: "No man has yet reached the limit of the sea, but down to more or less 300 fathoms men know and have explored the deep sea." One striking indication of the extent of the Greek and Roman accomplishment in mapping the seafloor is that prior to the nineteenth century, navigators had no use for sounding lines longer than 100 fathoms, and explorers no use for any longer than 200 fathoms.[46] Both measures are far short of Oppian's limit of "comprehensive knowledge."

Elsewhere, Oppian also makes reference to "fishermen who have beheld the unseen deeps and by their arts have mapped out the measures of the sea" (*Halieutica* 1.9–12). Oppian's vocabulary makes it sound as if he is referring to visual inspection of the seafloor by divers, but—as Aelian rightly points out (9.35)—this would have been impossible. The method of exploration was through sounding leads and dredges, which gave information on both depth and type of bottom. Fishermen, coral harvesters, and commercial divers were well aware of the importance of the depth, topography, and composition of the seafloor to the success of their endeavors, and there is no technical reason why such individuals should not have developed a working knowledge of the topography of enormous areas of the coastal shelf and shared it with scientists such as Aristotle. Aristotle (*Hist. an.* 7[8] 20.603a) mentions the temporary failure of the scallop fishery in the Straits of Pyrrha (the entrance to the Kaloni Gulf) on Lesbos as a result of dredging and drought. This information, like much of the information concerning fish in this work, must have been supplied by fishermen. Dredging remained the principal method for research on life in deeper waters until well into the twentieth century.[47]

Although the range of depth measurements between 50 and 600 m should be the fruits of long periods of practical research by fishermen using weighted lines and dredges, and by coral harvesters using grabs, sponge divers and salvage divers also provided eyewitness accounts of the seafloor around most of the Mediterranean down to 30 or 40 m. Oppian (*Halieutica* 5.634–38) describes the descent of one such diver, who carried a lead weight in one hand to speed his passage to the seafloor. Presumably these weights, like the diver himself, were attached to ropes, allowing their recovery for reuse.

> A man is fitted with a long rope tied above his waist, and using both hands, he grips a heavy mass of lead in his left, and in his right a sharp billhook. Standing on the prow of the boat he scans the waves of the sea, pondering his heavy task and the infinite water. . . . When he has roused his courage, he leaps into the eddying water and the force of the gray lead weight drags him down. Now when he arrives at the bottom, . . . approaching the rocks he sees the sponges which grow on the ledges of the seafloor. . . . He cuts the body of the sponges and quickly jerks the rope, signaling to his comrades to pull him up swiftly. . . . Often when the sponge-cutter has leapt into the deep waters of the sea and won his loathsome and unkindly spoil, he comes up no more, having encountered some huge and hideous sea monster.

Some of the weights in my catalogue that lack tallow cups may in fact be diving weights.[48]

[45] Broad 1997, 49–55.

[46] Rozwadowski 2005, 32.

[47] Rozwadowski 2005, 133–173.

[48] Cat. nos. 93, 161–162. The swimmer on a late first-century

Greek, Latin, and Talmudic literature all provide references to the sounding pole as well, an obvious alternative to the sounding weight for maneuvering in rivers, lakes, and shallow moorings. The sounding pole is shown in use on Egyptian New Kingdom frescoes that represent Nile riverboats or maritime craft approaching their moorings.[49] Jones identifies some of the Egyptian terms for these poles.[50] Although easy to use, sounding poles could not be employed while a ship was making much headway, or in water more than about 2 m deep. In the late second century, Festus provides an optimistic account of the sounding pole's utility in a Roman context:[51]

> . . . *ex nautico usu, quia conto pertentant, cognoscuntque navigantes aquae altitudinem.*
>
> . . . from nautical practice, because those who travel on boats make trial with a pole and find out the depth of the water.

In Rabbinical literature the sailor using the pole was called the *gashosha* ("sounder"), the pole *gashosh*; the context is usually that of a ship going up on a beach or entering a mooring.[52]

4. Summary of Data from the Corpus of Sounding Weights; A Revised Typology

My corpus includes 177 examples from the territorial or inland waters of fourteen modern nations: Belgium (1), Croatia (9), Cyprus (3), France (40), Germany (1), Israel (44), Italy (59), Lebanon (1), Libya (1), Malta (2), Portugal (2), Spain (8), Tunisia (2), Turkey (4). I classify 16 of these weights as "doubtful" in varying degrees (Class 9; 5 from Italy, 3 from France, 3 from Israel, and 1 each from Belgium, Croatia, Cyprus, Spain, and Turkey) and 3 as probably post-Classical (Class 10; 1 each from France, Italy, and Turkey). Several of the "doubtful" weights also share a shape classification. In summary, the catalogue presents approximately 158 examples of certainly or probably ancient sounding weights. The geographical distribution of the catalogued weights raises questions about the comprehensiveness of the corpus.

Although the group under consideration—after making adjustments for doubtful or post-Classical examples—is 28 percent larger than the group analyzed in Oleson 2000, it is still clear that the vast majority of the weights (80.7 percent) have been found in the waters of Italy (32.2 percent), Israel (26.1 percent), and France (22.4 percent). Croatia is a distant fourth (5.6 percent), and Spain fifth (4.3 percent), increasing the total to 90.6 percent of the corpus of sounding weights accepted as ancient. It cannot be an accident that recreational and archaeological use of SCUBA has been very intensive in the waters of these countries for over four decades, resulting in the recovery of numerous weights from reefs or shipwreck sites. Conversely, the strict regulation of SCUBA diving in Greece and Turkey may help explain the poor representation of these countries in the corpus, particularly when combined with more than a century of unsupervised activity by hard-hat sponge divers. The lifting of the ban on recreational diving in Greek waters in 2006 may alter these patterns by providing new data. Many of the ancient sounding weights lost off the coastlines of Spain and

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B.C. mosaic in the House of Menander at Pompeii is widely considered to be one of our few surviving representations of a diver; Dunbabin 1999, 57–58, fig. 57.

[49] E.g., Wachsmann 1998, fig. 2.15; Landström 1970, figs. 104, 109–110, 137–138, 236, 246, 316, 319, 354, 372; Patai 1998, 49.

[50] Jones 1988, 197–201.

[51] Lindsay 1913, 236.4–6. A sounding pole also seems to appear on the Bayeux Tapestry; Their 2002, 113–114.

[52] Sperber 1986, 110; Patai 1998, 48, 61.

Portugal, where SCUBA diving also has a long history, most likely have been covered up by the silt carried down the rivers as a result of Roman mining and agricultural activity. Both of the Roman sounding weights from Portugal, for example, were found in spoil dredged from an ancient river port (cat. nos. 110, 148). The spread of the Nile delta and the heavy load of sand carried farther up the coastline of Palestine explain the absence of finds in this region. Off the coast of Israel, the bottom sand is relatively mobile, and as it moves patches of a viscous clay sub-bottom are temporarily exposed off the coastline or in bays. Careful monitoring of this phenomenon by archaeological authorities has resulted in the recovery of many of the weights attributed to Israel in the corpus, and at least 20 more that remain unpublished.[53] Siltation, along with political conditions, has undoubtedly also restricted the finds of sounding weights off Lebanon and Syria, in the Black Sea, and along the North African coastline west of Egypt. It remains puzzling, however, why there should be so few published sounding weights from the waters around Cyprus and Malta. It is, of course, possible that fewer sounding weights were lost in the waters of Greece and Turkey in antiquity because of topographical conditions and the patterns of sea trade (see below). The rarity of sounding weights in the rivers of Europe is not surprising, since sounding is less useful to navigation in such situations. Of the three proposed examples—at Xanten (cat. no. 063), Pommeroeul (cat. no. 070), and Wantzenau (cat. no. 083)—only the Xanten example resembles a sounding weight, and it may in fact be a net retriever. Given the intensive maritime trade between the Mediterranean and the British Isles during the Empire, it is puzzling that no Roman sounding leads, and very few Roman lead anchor stocks, have been found in Atlantic waters north of Portugal.[54]

The statistics from my expanded corpus correspond somewhat better to the statistics for the location of the shipwrecks in Parker's catalogue than did those of the earlier version.[55] Wrecks have been recorded off the Mediterranean coasts of Italy, France, Croatia, and Spain in approximately the same proportions as sounding weights (Italy, 428 wreck sites, 36 percent of total; France, 282, 24 percent; Croatia, 92, 8.4 percent; Spain, 134, 11 percent). The proportion of wrecks off Israel is significantly lower than its portion of the sounding weights (31, 2.6 percent), and that of wrecks off Greece (84, 7.1 percent) and off Turkey (63, 5.3 percent) very much higher. The apparently complete absence of sounding weights from the territorial waters of Greece is particularly striking. It is possible that some mechanism of ancient use, loss, and survival is at work here alongside the modern restrictions on diving mentioned above.

The typology of ancient sounding weights in Oleson 2000, based on body shape and lug design, has held up well as new examples have been added to the corpus, and only one new subclass (4C) has had to be added. Sorting the expanded corpus by weight, height, or lower diameter yields no coherent results other than isolation of the tall, narrow post-Classical sounding weights. Geographical location of the find spot—as one would expect, since ships are roving archaeological contexts—yields only one significant pattern. The weights of Class 4A, 4B, and 4C (Tall Bell shape) are found overwhelmingly in Israeli waters: 22 out of 27 examples. One example of Class 4B has been found near Bodrum (cat. no. 132), two examples of Class 4A and 4B near Brindisi (cat. nos. 125, 131), one example of Class 4B at Camarina (cat. no. 064), and one example of Class 4B at Ibiza (cat. no. 057). The distribution pattern is consistent with use on ships plying the long-distance routes connecting Alexandria (or Caesarea Palaestinae) with major ports in Italy, the examples at Bodrum, Camarina, and Ibiza representing ships driven to ports of refuge by storms or other mishaps. The weights found off the coastline of

[53] Galili, Dahari, and Sharvit 1993, 61; Galili, Rosen, and Sharvit 2002. Unpublished weights: oral communication, E. Galili, April 2001.

[54] For the single known Roman anchor stock in British waters, see Boon 1977. Possibly ships headed for the channel used iron anchors and chains, which have disappeared or have not yet been recognized as Roman.

[55] See Oleson 2000, 299; also Parker 1992, 7.

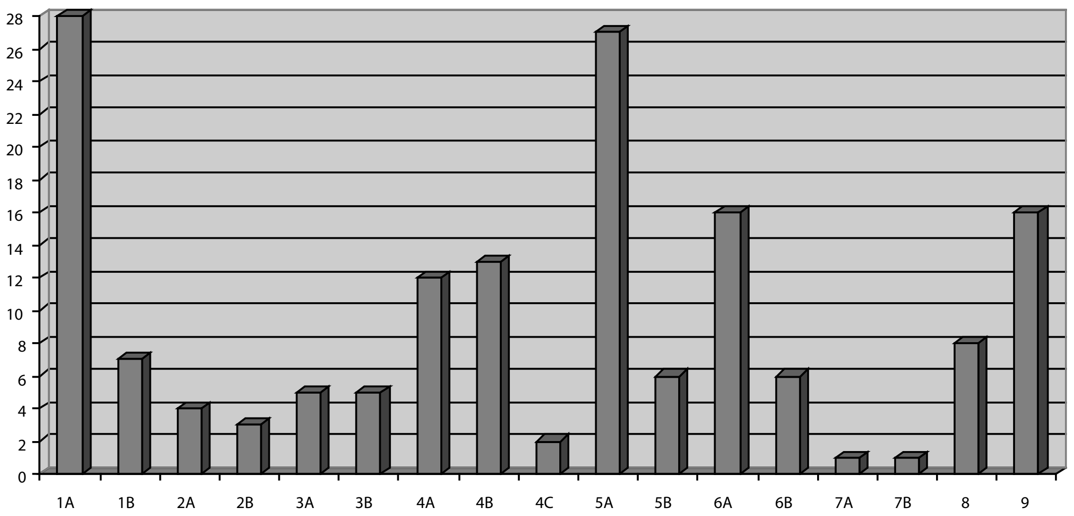

Fig. 5. Number of sounding weights by class, dated and undated.

Israel reflect the dangerous conditions in the shallow waters of this low-lying coastline, along which long-distance traders generally worked their way up from south to north, on a port tack.

The presence of an added bronze or iron suspension lug is a useful chronological indicator, but it crosses nearly all the shape classes and the statistical value is small. The Greeks and Romans were very concerned with the shapes of the objects they used to service their everyday needs—ceramic or bronze vessels, metal tools and weapons, clothing fasteners, furniture—and once an efficient and pleasing shape had arisen, change was usually a slow evolutionary process.[56] Sounding weights had to have certain characteristics in order to function properly (see above), and all but one of the shape classes (Class 4) appear in the archaeological record fairly early. I have not been able to document any marked evolutionary change in the basic shapes that appeared early on.

I have identified ten classes of weights, seven of the classes defined by body shape (Classes 1 to 7), one small class of unique or poorly defined shapes (Class 8), one class of objects published as sounding weights but that are unlikely to have served the function (Class 9), and one class of sounding weights published as ancient but that seem to be modern (Class 10). The great majority of the weights examined can be assigned easily to one of the shape classes, but deviation from the norms, poor manufacture, or deformation of the malleable lead occasionally makes classification of a weight difficult. Most of the weights of ambiguous form might be termed "gumdrop" in shape: slightly taller than a hemisphere, or more rounded at the apex than a cone. Since I have found it impossible to determine with precision the point at which a stretched hemispherical shape should be called a gumdrop and a stretched gumdrop should be called a cone, and since the sounding weights of this shape show no obvious patterns of chronology or weight, I have assigned most of these weights to Class 1 (Hemisphere). I have divided Class 4 (Tall Bell) and Class 7 (Tapering Bar) into two subclasses based on slight but consistent variations on essentially the same form. For Classes 1 to 6, in which separate bronze or iron suspension lugs are occasionally cast into the weight, I have put these weights in a separate subclass (labeled "B" or in one case "C"). The sequential numbering of these classes does not imply strict chronological or evolutionary sequence. The shape of 18 of the 177 catalogued objects is not known, so the number of weights in the classified list totals only 159 (fig. 5).

[56] For a discussion of this topic, see, e.g., Biers 1992, 17–60.

Class 1: Hemisphere. The weights in this class approximate a hemisphere (sometimes slightly stretched or flattened), without any marked articulation of the lip, shoulder, or apex.

1A. Lead suspension lug cast together with body of weight (28 examples): cat. nos. 002, 020, 031, 034, 039, 043, 046–047, 055, 060, 085–086, 096–111 (figs. 1–2).

1B. Added suspension lug (7 examples): cat. nos. 015, 021, 030, 112–115.

Class 2: Truncated Hemisphere. The weights in this class approximate a hemisphere from which a slice of the upper section has been removed, leaving a flat surface parallel to the base.

2A. Lead suspension lug cast together with body of weight (4 examples): cat. nos. 038, 116–117bis (fig. 2).

2B. Added suspension lug (3 examples): cat. nos. 007, 021, 061 (fig. 2).

Class 3: Squat Bell. The weights in this class have the shape of a squat, heavy bell, with concave sides and a marked outward curve at the base.

3A. Lead suspension lug cast together with body of weight (5 examples): 044, 048–050, 087.

3B. Added suspension lug (5 examples): 010, 025, 056, 118–119 (fig. 2).

Class 4: Tall Bell. The weights in this class are taller than those in Class 3, more cylindrical in shape, and they lack the outward curve at the base.

4A. Nearly cylindrical body, with straight sides and distinct, angular shoulder (12 examples): cat. nos. 051, 079, 080, 091, 093–094, 120–125 (figs. 2–3).

4B. Sides slightly convex, with more rounded and less distinct shoulder (13 examples): cat. nos. 052, 057, 064, 089–090, 092, 126–132 (figs. 1, 3).

4C. Tall Bell shape 4B, with added suspension lug (2 examples): 071, 133.

Class 5: Cone. The weights in this class approximate a cone, although the sides are in fact sometimes slightly concave or convex.

5A. Lead suspension lug cast together with body of weight. The tip of the cone may be formed into a distinct suspension lug or simply be pierced for attachment of a rope (27 examples): cat. nos. 013, 026bis, 029, 035–036, 040, 062, 067, 072–073, 081–082, 134–148 (fig. 3).

5B. Added suspension lug (6 examples): cat. nos. 008, 016, 026, 063, 149–150 (fig. 3).

Class 6: Truncated Cone. The weights in this class approximate a cone from which a section of the apex has been removed, leaving a flat surface parallel to the base. The sides are in fact sometimes slightly concave or convex.

6A. Lead suspension lug cast together with body of weight (16 examples): cat. nos. 027, 032, 041–042, 058–059, 066, 068, 074, 151–156 (fig. 4).

6B. Added suspension lug (6 examples): cat. nos. 006, 022, 024, 088, 157–158 (fig. 4).

Class 7: Tapering Bar. The weights in this class are long and thin, tapering from a narrow, convex base to a slightly flattened, perforated suspension lug without any intervening shoulder. They are much lighter and smaller than examples in any of the other classes, and the tallow cup is absent. At the same time, they seem too big for fishing line weights. Their atypical shape and size may result simply from their use on small coasting craft in familiar waters.

7A. Long Tapering Bar (1 example): cat. no. 160.

7B. Short Tapering Bar (1 examples): cat. no. 011.

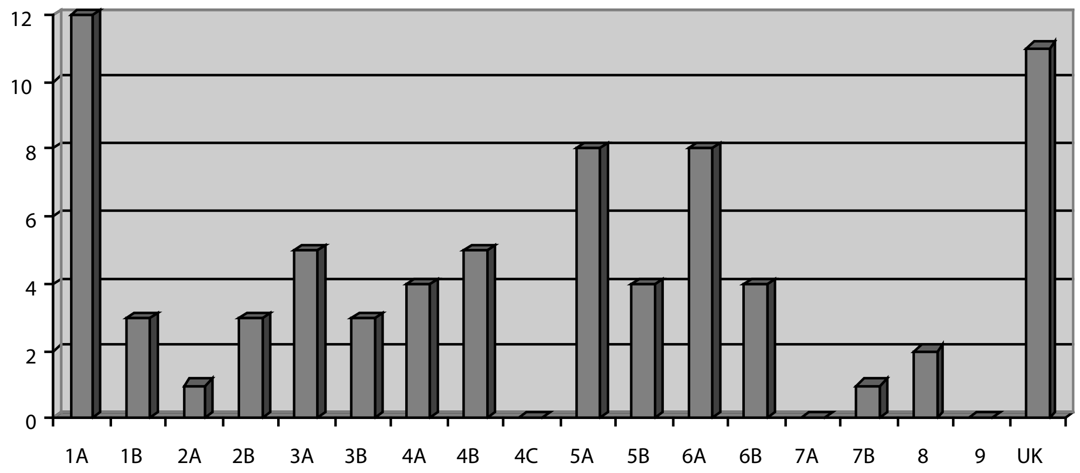

Fig. 6. Number of datable sounding weights by shape.

Class 8: Miscellaneous Shapes (described individually). Eight examples: Purse or pillow shape (2): cat. nos. 033, 069, 163–164 (fig. 4). Truncated pyramid (2): cat. nos. 001, 162. Irregular, approximately rectangular block (3): cat. no. 161. Reused steelyard weight, female bust (1): 075.

Class 9: Doubtful Examples. The weights in this class probably were not sounding weights, but they have been published as such elsewhere. Most of them are weights that lack a tallow cup or some other means of holding the tallow charge. Some may in fact have been used to test the depth for fishing, but many may simply have served as weights on fishing lines or fishing nets (16 examples, several of which are counted as well in other classes): cat. nos. 001, 003, 004, 005, 009, 011, 013, 028, 065, 070, 076, 083, 161, 165–167 (fig. 4).

Class 10: Post-Classical Examples. Most of the weights in this class were found on or near ancient shipwrecks and have been published as ancient sounding weights. A few are isolated finds assumed to be ancient. Most are long or short tapering bars, often square or octagonal in section, with small tallow cups. This shape is typical of sounding weights from the sixteenth century onward (3 examples): cat. nos. 095, 159, 168.

Approximately 74 of the objects in my expanded corpus that can be accepted more or less securely as sounding weights were associated with ancient datable wrecks or have been assigned reasonable dates from associated artifacts or by other means (46.5 percent of 159). Although some modifications to the typology may be necessary as more dated weights are discovered or published, the sample of known datable weights allows some conclusions concerning the evolution of the shape classes over time (figs. 6–7).

The earliest object published as a sounding weight, the lead object from the Ulu Burun Wreck (cat. no. 001, 1325 B.C.), is approximately the correct shape and size to have served as a sounding weight, but it lacks a tallow cup. Although it is possible that the earliest sounding weights in fact lacked this feature, the chronological isolation of the Ulu Burun weight combined with the absence of a tallow cup makes interpretation of the object as a net weight just as likely. The first identifiable sounding weight appears over 800 years later, on the Gela Wreck (cat. no. 002; 500 B.C., fig. 1). This is a squat hemispherical weight, typical of many later examples in

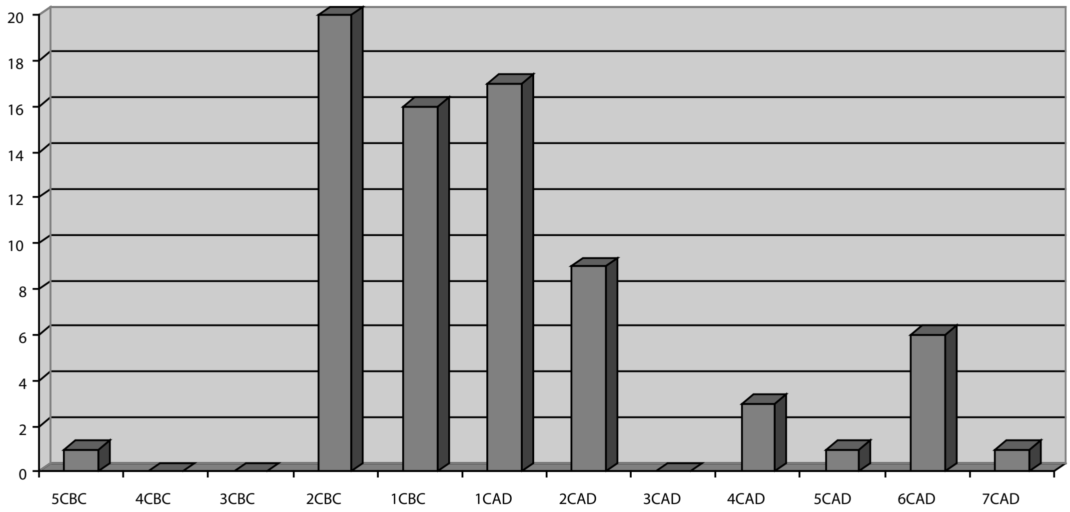

Fig. 7. Number of datable sounding weights by century.

Class 1A but smaller and lighter than the average, with slightly flattened sides and a very shallow tallow cup.

It is only in the second century B.C. that sounding leads make a substantial appearance in the archaeological record: 20 examples have been published with a date range including the second century B.C. (excluding doubtful weights) (fig. 7).[57] Classes 1A–B, 2B, 3B, 5A–B, 6A–B, and 7B are represented. A date range including the first century B.C. but not the second century B.C. has been attributed to 16 examples, including Classes 1A–B, 2A, 5A, 6A, and 8.[58] Seventeen examples have been assigned dates that include the first century A.D. but not the first B.C. (Classes 1A, 3A–B, 4A–B, 6A), and another nine have date ranges beginning in the second century A.D. (Classes 1A, 2B, 4B, 5A–B, 6A, 8).[59] Eleven have been dated from the third to the seventh century (Classes 1A, 3A, 4A–B, 5A, 6B).[60] The latest ancient weight included in the catalogue is a Byzantine (seventh-century?) weight from Dor (cat. no. 088, Class 6B), although I have also included a twelfth-century weight from Capo Lo Vito near Trapani (cat. no. 095), since it represents precious evidence for the use of sounding weights in the early medieval period.

The design of the tallow cup varies significantly from weight to weight. The Gela weight (cat. no. 002, fig. 1) has a very shallow, rough-walled tallow cup with central point. When evidence resumes in the second century B.C., there are smooth-walled, hemispherical or flat-roofed cups, often provided with iron (less often copper) nails hammered diagonally downward through the walls to hold the tallow. Fifty-one of the weights in the catalogue (32.1 percent) were provided with nails. The number of nails varies between 1 and 18, but 4, 6, and 8 are the most common figures.[61] No

[57] Weights with dates in the second century, prior to 100 B.C.: cat. nos. 006–008, 010, 012–027, 029. The published dates attributed to weights associated with scattered debris naturally are less precise and less certain than the dates for weights found on coherent, single shipwreck debris. I have omitted from figure 7 weights that appear to be Roman but whose chronology remains very uncertain.

[58] Weights with a date range including the first century B.C.: cat. nos. 026bis, 028, 030–042.

[59] Weights with a date range including the first century A.D. but not the first century B.C.: cat. nos. 43–59. Date range including the second century but not the first century A.D.: cat. nos. 060–064, 066–069.

[60] Weights with a date range starting in the third century and later: cat. nos. 078, 084–091, 093–094.

[61] For nails, see cat. nos. 007, 008, 010, 016, 021, 022, 023, 027, 029, 031, 032, 038, 040, 041, 044, 047, 051, 052, 058,

Table 1. Numbers of datable sounding weights by century and shape.

	5CBC	*4CBC*	*3CBC*	*2CBC*	*1CBC*	*1CAD*	*2CAD*	*3CAD*	*4CAD*	*5CAD*	*6CAD*	*7CAD*	
1A	1			1	3	4	1		1	1			12
1B				2	1								3
2A					1								1
2B				2			1						3
3A						4					1		5
3B				2		1							3
4A						1					2	1	4
4B						2	1				2		5
4C													0
5A				1	5		2						8
5B				3			1						4
6A				1	3	2	2						8
6B				3							1		4
7A													0
7B				1									1
8					1		1						2
9													0
UK				4	2	3			2				11
TOTAL	**1**	**0**	**0**	**20**	**16**	**17**	**9**	**0**	**3**	**1**	**6**	**1**	**74**

pattern is apparent in the number of nails used on the earlier weights as opposed to the later ones, between body shape and the use of nails, or between the use of added suspension rings and the use of nails. A few of the weights dating to the Republican period have a slight interior lip that may have been designed to hold the tallow (e.g., cat. nos. 026, 026bis, 030, fig. 3), and it seems surprising that the more effective device of septa walls does not appear until the mid-first century B.C. (cat. no. 035, fig. 3). The combination of septa walls and interior nipples appears in the first century B.C. or A.D. (cat. no. 042, fig. 4; cf. cat. no. 104, fig. 2), but smooth-walled tallow cups with nails continued to be used into the Byzantine period. Nails were sometimes hammered into weights whose cups were provided with septa walls (12 examples, 23.5 percent of the weights with nails), and in two examples (cat. nos. 092, 102) into weights with both septa walls and nipples. Some of the undated sounding weights have very elaborate patterns of tall and low septa walls alternating with nipples. Clearly it was important to ensure that the charge of tallow did not contract and fall out of the sounding weight.

5. Analysis: Development of the Ancient Sounding Weight

Although future finds of datable sounding weights may alter these statistics, some tentative conclusions about the chronology of the shapes can be proposed (table 1). The hemispherical shape (Class

059, 060, 063, 064, 066, 071, 073, 086, 087, 091, 092, 098, 102, 105, 116, 117, 118, 119, 129, 132, 133, 135, 139, 140, 141, 145, 149, 150, 151, 154, 155, 158.

1) was in use over the longest period, from 500 B.C. to the fifth century A.D. The Tall Bell shape (Class 4) only appears in the first century A.D. and remains in use longer than the other shapes, into at least the sixth or seventh century. The other shape classes appear in the second century B.C. and occur only rarely after the second century A.D. For all the shape classes, there is a marked tendency for weights with added suspension lugs to be restricted to the second century B.C. Most likely, by 100 B.C. it was determined that lead lugs cast in one piece with the weight were easier to produce and more reliable than iron or copper rings cast in. Class 2 (Truncated Hemisphere), Class 3 (Squat Bell), and Class 7 (Tapering Bar) are numerically the smallest shape classes, with 7, 10, and 2 ancient examples respectively (figs. 5–6, table 1). The weights of Class 7 may not be sounding weights at all. Seventy-three percent of the ancient sounding weights for which the shape is known can be classified as Hemispheres (35 examples), Tall Bells (27 examples), Cones (33 examples), and Truncated Cones (22 examples). These shapes are all logical choices for the intended function. The statistical results are not particularly exciting, but they represent a start and will undoubtedly be refined by further discoveries.

Lead was the typical material for sounding weights. Only eight weights in the catalogue are made of stone rather than lead (cat. nos. 013, 028, 033, 069, 070, 093, 164), and at least two of these are more likely to be diving weights than sounding weights (cat. nos. 013, 069). Two weights with swing handles (cat. no. 028) are beam-balance weights. The most convincing example, a small purse-shaped basalt weight from the first-century B.C. Jeaune-Garde Wreck A (cat. no. 033, fig. 4), has both a tethering lug and a tallow cup, but it may not belong to this wreck at all. The wreck was scattered at the foot of a reef, and the weight may predate the wreck or be a later, intrusive deposit. A very similar stone weight was found isolated on a reef near Trapani (cat. no. 164). Neither of these stone weights, however, shows any arrangements for keeping the charge of tallow attached to the tallow cup, something of great concern to the makers of most lead sounding weights. A marble weight found near Haifa was shaped like a typical Tall Bell sounding weight, but it lacked a tallow cup altogether (cat. no. 093). In any case, the use of carefully shaped stone clearly is atypical.

Presumably the earliest sounding weights, like the earliest anchors, were natural stones perforated or grooved to allow secure attachment to a rope. Weights of this simple form probably have been in use from almost the beginning of human maritime activity, and those that may have been used as sounding weights can no longer reliably be identified as such—for instance, the stone weight from Pommeroeul (cat. no. 070). It does, however, seem unlikely that any culture possessing an abundant supply of lead would have felt it worthwhile routinely to produce from stone the complex shape of a sounding weight with tallow cup. Both the Greek and Roman cultures obtained most of their lead as a byproduct of the processing of argentiferous lead for its silver content (for example, at the Laurion mines).[62] The resulting appearance of cheap lead in the fourth century B.C. has been cited as a stimulus behind the increasing replacement of stone anchor stocks with lead in the fourth century B.C.[63] Anchor stocks, of course, use much more metal than sounding leads, rendering their execution in metal more cost sensitive. It is possible that the rarity of obvious sounding weights made of stone results from the fact that they could be manufactured from lead relatively cheaply. Identifiable ancient net weights and fishing weights also tend to be made of lead.[64]

The sounding weight found at Gela (cat. no. 002, 500 B.C., fig. 1) was made of lead, and it is a reasonable assumption that the slightly later sounding weights mentioned by Herodotus were

[62] Healey 1978, 38–39, 77–80.

[63] Gianfrotta 1977, 290–291; 1980; Haldane 1985. Many of the problems involved in the study of ancient sounding leads are similar to those for lead anchor stocks: see Kapitän 1984, 33–44 and Frost 1982, 263–273.

[64] Galili, Rosen, and Sharvit 2002.

made of lead as well. Lucilius (quoted above) around 150 B.C. specifies lead as the material of a sounding weight, but at present it cannot be determined with precision how early lead sounding weights came into common use. Net weights made of folded sheets or strips of lead were in use on the Mediterranean as early as the fourteenth century B.C., as seen on the Ulu Burun Wreck, so even then the metal must have been relatively cheap.[65] The Ulu Burun Wreck also contained a lead weight the size of a later sounding lead but lacking a tallow cup. It seems logical that lead would have been applied as well to the manufacture of sounding weights soon after they had come into use, since this piece of equipment was critical for safe navigation. Such a switch would have been especially important had the innovation of the tallow cup already appeared, since this feature makes the shape markedly more difficult to produce by carving.

It is possible the introduction of a tallow-filled depression to sample the bottom appeared simultaneously with the introduction of lead as a material for sounding weights during the resurgence of Greek maritime trade and colonization in the eighth and seventh centuries B.C. Herodotus's mention of the sounding weight used to sample the seafloor in the context of navigation to Egypt may not be simply coincidence. Around 560 B.C., King Amasis granted Greek merchants their one trade concession in Egypt at the port of Naukratis, up the Canopic branch of the Nile.[66] It is possible that the difficulties of setting course for a specific point along the low-lying coast of the delta, access to which was carefully regulated by local authorities, fostered an innovation that allowed navigation by examination of depth and the character of bottom sediments at the same time. This new design may have hastened the switch from partially worked natural stones to cast lead sounding weights, assuming that the change had not already taken place. All this, of course, is only hypothesis, and the innovation of the tallow cup may simply predate its mention by Herodotus by only a few years. In any case, once the lead sounding weight with tallow cup had appeared, the circumstances of its use on board merchant ships would have fostered rapid dissemination throughout the Mediterranean world, and the development of the spreading shapes typical of most surviving examples.

Although sounding weights certainly existed by 500 B.C., 83.8 percent of the datable sounding weights fall in the period from the mid-second century B.C. to the second century A.D. (62 out of 74), the period of most intensive long-distance trade in the Mediterranean.[67] It is interesting that Parker's corpus of ancient and early medieval shipwrecks in the Mediterranean and adjacent waters provides slightly different statistics. Of the 1,054 wrecks that he dates earlier than A.D. 600, 638, or only 60.5 percent, date from the mid-second century B.C. to the second century A.D.[68] It is likely, in fact, that the statistics for the sounding weights would be even more lopsided if the many undated weights could be assigned dates. Only 4 percent (42) of the wrecks in Parker's list are undated, as opposed to approximately 46 percent of the sounding weights (73 out of 159).

The datable sounding weights are concentrated between 150 B.C. and A.D. 200, the period of most intensive trade around the Mediterranean in bulk commodities, both over long distances and as cabotage. This pattern suggests that lead sounding weights were indispensable equipment on larger trading ships rather than local traders or fishing boats, their long routes, deep draft, relative lack of maneuverability, and inability to seek refuge in smaller anchorages necessitating the use of every navigational aid and of high-quality equipment. In fact, where data are available, this seems to be

[65] For Ulu Burun, see Pulak 1988, 12, 32. For other Bronze Age net weights, see Bass 1967, 131, fig. 139; Buchholz, Jöhrens, and Maull 1973, 176–178. On the use of lead in the Mycenaean culture, see Buchholz 1972.

[66] Shenouda 1976.

[67] See the discussions in Oleson et al. 1994, 149–161 and Oleson et al. 1996.

[68] Parker 1992, 10–15.

just the sort of shipwreck on which weights are most often found. Data on approximate hull length have been published for 26 wrecks with which 35 of the weights in the catalogue were associated.[69] The minimum hull length was 6.5 m, the maximum 36 m, the median 20 m, and the average 21.6 m, with a standard deviation of 7.29. Only five of the wrecks were attributed restored hull lengths of less than 15 m, while seven were attributed lengths of 25 m or more. The goods carried were the typical bulk cargoes of Roman Mediterranean trade: building stone, oil and wine amphoras, metal ingots (particularly lead), ceramics, and miscellaneous items such as glass and sculpture. The sample is relatively small, but the results may be valid. Smaller ships engaged in local coastal trade or fishing were less likely to need sounding weights while working in familiar waters and in predictable weather, and they might simply have employed fishing weights or appropriately shaped natural rocks on a light rope when sounding was essential. Restriction of sounding weights to larger ships might explain the absence of this artifact from the Aegean. Long-distance freighters like the ship that carried St. Paul usually bypassed the Aegean entirely. In addition, the deep inshore waters and availability of precise navigation through observation of shorelines in a well-known archipelago may have made the use of sounding weights redundant in most circumstances.

It is striking that Parker mentions sounding weights in association with only 23 wrecks in his corpus (2 percent of 1,189).[70] Even if he had been aware of all 74 datable ancient sounding weights in my corpus (datable usually because they were found on wrecks), wrecks with such equipment would still constitute only 7 percent of Parker's 1,054 entries predating A.D. 600. Why are sounding weights found so seldom on apparently well-excavated shipwreck sites? A sounding weight would seem to be an indispensable item aboard any ancient ship not at work in local waters, and because of its shape and weight it is unlikely to wander far from a wreck after sinking. Multiple sounding leads have, in fact, been found on seven wreck sites: two on the La Chrétienne Wreck C (plus one doubtful example), five on the Spargi Wreck (three of these are not well documented), two on the Mahdia Wreck, two on the Mal di Ventre Wreck, two on the Dramont D Wreck, two on the Port-Vendres B Wreck, two on the Camarina A Wreck, and two on a probable wreck site off the Haifa public beach.[71] The predominance of pairs suggests that two weights may have been considered a standard set, with one reserved as a spare. Alternatively, the smaller weight might have been intended for shallow soundings, the larger for deep soundings. On three of these wrecks (Port-Vendres B, Dramont D, Haifa beach) the weights belong to the same shape class, while on the rest, where the shape of both is published, they belong to different classes. In four cases (La Chrétienne C, Mahdia, Dramont D, and Haifa beach) one weight was significantly heavier than the other, as if the one weight was intended for deep sounding, the other for shallow.

Were sounding leads less commonly used than we suppose, or did some ships run up on reefs precisely because they had already lost both sounding leads on board? It is also possible that sounding leads, as an item of working gear, were kept on deck and thus were more likely to fall overboard

[69] List of cat. nos. and hull length: cat. no. 083, 6.5 m; cat. no. 026, 13 m; cat. no. 020, 13 m; cat. no. 025, 13 m; cat. no. 058, 13.5 m; cat. no. 009, 15 m; cat. no. 007, 15 m; cat. no. 008, 15 m; cat. no. 028, 15 m; cat. no. 001, 16 m; cat. no. 002, 17 m; cat. no. 034, 18 m; cat. no. 086, 18 m; cat. no. 067, 18 m; cat. no. 026bis, > 18 m; cat. no. 060, > 18 m; cat. no. 046, 20 m; cat. no. 047, 20 m; cat. no. 035, 20 m; cat. no. 043, 20 m; cat. no. 010, 23 m; cat. no. 038, 25 m; cat. no. 044, 25 m; cat. no. 057, 25 m; cat. no. 040, 27.5 m; cat. no. 021, 28 m; cat. no. 022, 28 m; cat. no. 016, 30 m; cat. no. 015, 30 m; cat. no. 048, 30 m; cat. no. 017, 30 m; cat. no. 018, 30 m; cat. no. 019, 30 m; cat. no. 036, 36 m; cat. no. 037, 36 m. In a few cases several weights are attributed to the same wreck: cat. nos. 007–008, 046–047, 021–022, 015–019, 036–037. Most of these ships are large by ancient standards; Casson 1995, 455–459.

[70] Parker 1992, 542.

[71] La Chrétienne Wreck C, cat. nos. 007–008; Spargi Wreck, cat. nos. 015–019; Mahdia Wreck, cat. nos. 021–022; Mal di Ventre Wreck, cat. nos. 036–037; Dramont D Wreck, cat. nos. 046–047; Port-Vendres B Wreck, cat. nos. 048–049; Camarina Wreck A, cat. nos. 064, 066; Haifa public beach site, cat. nos. 089–090.

during the wrecking process and be separated from the main wreck site, or—if they remained on board—to be exposed on the surface of the wreck to immediate or later salvage. Unlike broken amphoras, lead weights represented useful salvage both to ancient salvage divers and to modern hard-hat sponge divers, who melt lead objects down for reuse as diving weights. It is easy, on the other hand, to understand why sounding weights are so often found apart from shipwrecks. Sounding weights were in significant danger of loss during a voyage. Like anchors, they were let down into the sea intentionally, often at moments of stress or danger, and they were easily lost through fouling on the bottom, parting or unintentional release of the rope, or abandonment during an emergency maneuver. Unlike many other ancient nautical artifacts, such as bilge-water pipes or heaps of amphoras, the presence of a sounding weight on the sea bottom does not necessarily imply the loss of a ship. Shipwreck may be very likely, given the shallow water or reefs on which most sounding leads are found, but it cannot be assumed.

The weight of the 60 sounding weights in my catalogue for which weight has been published (omitting 4 doubtful or modern examples) varies significantly. Analysis provides the following statistics: mean weight 5.5 kg, average 7.27 kg, minimum 1.65 kg, maximum 20.5 kg, standard deviation 4.66 kg. As the large standard deviation indicates, the figures for mean weight are the most useful, since there are relatively small groups at the high and low extremes that distort this relatively small sample. Although statistical analysis may reveal more subtle distinctions, three weight groups stand out. There is a small group of four very heavy weights: those from the Haifa area (cat. no. 141, 20.5 kg), Apollonia in Israel (cat. no. 140, 19.0 kg), Akko area (cat. no. 051, 18.75 kg), and one of the weights from the Mahdia Wreck (cat. no. 022, 16.9 kg). Since the Akko weight has a very shallow "tallow cup," and the nails pounded into its wall did not penetrate the cup, it may not be a sounding lead. The Haifa weight had a tallow cup with a cage of nails and the walls hacked to hold the tallow. The Apollonia weight was furnished with a tallow cup and cage of nails, and it was found with a sounding weight of identical form but seemingly more practical weight (cat. no. 139, 13.5 kg). The Mahdia weight was also part of a heavy pair, the second weight (cat. no. 021, fig. 2) again somewhat lighter at 12.82 kg. It is difficult to reconstruct how any of these weights could have been thrown and retrieved conveniently, although it is possible that—like the heavier modern sounding leads—they were intended for sounding in deep water and were retrieved with a winch or roller. In the seventeenth century, 7 lb. (3.18 kg) weights were used to sound up to 20 fathoms (36.6 m), and 14 lb. (6.38 kg) weights in deeper water.[72] For more recent sounding leads those weights were doubled, 14 lb. for shoal water and 28 lb. for deeper water, and some deep-sea leads weighed 60 to 70 lbs. (27.22–31.75 kg). The modern 7-lb. and 14-lb. weights correspond well with the second and third ancient weight classes defined below, but the heaviest class remains unparalleled.[73]

The second group consists of 11 weights that weigh between 13.5 and 10.0 kg: 13.5 kg (cat. no. 139), 13.4 kg (cat. no. 061), 13.0 kg (cat. no. 055), 13.0 kg (cat. no. 137), 12.82 kg (cat. no. 021, fig. 2), 12.5 kg (cat. no. 155, fig. 3), 11.48 kg (cat. no. 144), 11.3 kg (cat. no. 127, fig. 2), 11 kg (cat. no. 089), 10.1 kg (cat. no. 079, fig. 4), and 10.0 kg (cat. no. 052). The tight statistics for this group suggest that it has some basis in reality: average 12.0 kg, mean 12.55 kg, standard deviation 1.29. Nevertheless, the weights of this group still significantly exceed the range of the third group, the remaining 44 weights for which statistics are available (omitting doubtful and modern examples): minimum weight 1.65 kg, maximum 8.8 kg, average 4.76 kg, mean 3.05 kg, standard deviation

[72] Waters 1958, 19.

[73] McGrail 1987, 276, citing an Admiralty handbook. Parry 1964, 97–98 cites 7 lb. weights for shallow water and 14 lb. weights for 100 fathoms; cf. Kemp 1976.

2.08.[74] The statistics of this group are not as tight as for the two heavier classes, perhaps because they were used by a variety of inshore boats. The two groups of heavier weights are relatively small, and I can discern no obvious patterns of shape, find spot, or chronology.

It is frustrating that the weight from Famagusta (cat. no. 059) is the only one that carried a proper inscription. This weight does not have a tallow cup, but several nails have been hammered diagonally downward through the body, either to form a tallow cage or to recover nets. The inscription reads something like ΑΚΚΥΡΑΠΑΕΙ/ . . .]ΡΘΑ[. . . Another conjecture for the second line is]ΥΡΝΑ[. The meaning unfortunately is obscure, but the word ἄγκυρα ("anchor") probably is intended and may indicate either a fishing weight or a sounding lead.[75] The reading might be "Anchor strikes (?)" or "Anchor of (personal or place name)." The other "inscribed" weights carry only symbols or abstract graffiti. A cross and a possible Chi-Rho appear on weights 089 and 090, which may well date to the Byzantine period, since they are both the Tall Bell shape. The only other inscriptions are a simple fishbone motif (cat. no. 051), a series of 3 X marks and 6 slashes (cat. no. 046), slashes (cat. no. 163), and two intersecting pairs of parallel lines (cat. no. 139), all executed carelessly with a chisel. It may be significant that all the inscribed weights but cat. no. 046 (from the Dramont D Wreck) were found in the eastern Mediterranean.[76] The inscriptions and symbols so commonly cast on lead anchor stocks probably were omitted on the sounding leads because they were so much smaller and cheaper.[77]

6. Conclusions

Although today the study of ancient sounding weights seems an abstruse research topic, the archaeological evidence shows that this navigation device was in widespread use in the Mediterranean during the period of Roman domination. Furthermore, the literary evidence for sounding weights during the Hellenistic, Roman, and Byzantine periods reveals a remarkable level of interest in sounding the depths of the sea and other bodies of water for both scientific and practical purposes. Pharaohs, emperors, scientists, fishermen, ships' captains, sponge and pearl divers, and *murex* hunters were all personally concerned with the topography and environment of the seafloor. It is possible that already in the Hellenistic period major efforts were made to map the floor of the Mediterranean Sea to depths of 2,000 m, and by the second century A.D. fishermen had a detailed knowledge of the topography of the continental shelf in both the eastern and western Mediterranean. The equipment, procedures, and objectives of sounding were well enough known that Greek historians and Roman playwrights and poets could assume their audience would recognize allusions to the practice.

By at least 500 B.C. sounding leads with tallow cups were in use, and it is likely the practice had begun with the expansion of Greek trade in the eighth or seventh century. As far as we can

[74] Cat. no. 059, 8.8 kg; cat. no. 126, 8.4 kg; cat. no. 029, 8.2 kg; cat. no. 044, 8.0 kg; cat. no. 092, 7.6 kg; cat. no. 081, 7.2 kg; cat. no. 026bis, 7.172 kg; cat. no. 111, 7.0 kg; cat. no. 101, 6.66 kg; cat. no. 072, 6.2 kg; cat. no. 080, 6.1 kg; cat. no. 163, 6.0 kg; cat. no. 050, 6.00 kg; cat. no. 066, 5.5? kg; cat. no. 064, 5.5? kg; cat. no. 073, 5.5 kg; cat. no. 026, 5.45 kg; cat. no. 132, 5.38 kg; cat. no. 002, 5.3 kg; cat. no. 119, 5.2 kg; cat. no. 121, 5.100 kg; cat. no. 128, 5.09 kg; cat. no. 110, 4.976 kg; cat. no. 082, 4.9 kg; cat. no. 093, 4.9 kg.; cat. no. 087, 4.82 kg; cat. no. 062, 4.3 kg; cat. no. 142, 4.3 kg; cat. no. 007, 3.557 kg; cat. no. 086, 3.550 kg; cat. no. 125, 3.53 kg; cat. no. 156, 3.325 kg; cat. no. 094, 3.1 kg; cat. no. 090, 3.05 kg; cat. no. 104, 2.975 kg; cat. no. 115, 2.6 kg; cat. no. 157, 2.42 kg; cat. no. 102, 2.1 kg; cat. no. 008, 2.026 kg; cat. no. 074, 2.0 kg; cat. no. 164, 1.8 kg; cat. no. 060, 1.79 kg; cat. no. 122, 1.65 kg.

[75] This discussion is based on photographs and information kindly supplied by G. Kapitän, A. Johnston, and J. Insley.

[76] Galili, Sharvit, and Rosen 2000 propose that the zigzag motif on the top of the lug of cat. no. 090 was a reversed reproduction of the constellation Cassiopeia, which was important for navigation, but the similarity seems too approximate to have been of any symbolic or practical use.

[77] Gianfrotta 1980.

tell, sounding leads were fairly rare until the second century B.C., but from this point until the early third century A.D. most ships that left local waters probably carried at least one sounding lead and possibly a pair differentiated by weight to serve both shallow and deep sounding. The datable finds of sounding leads wax and wane along with long-distance sea trade in the Mediterranean, and in consequence fewer leads have been dated to the third century and later. The use of sounding leads, however, continued through the medieval and early modern period, even after the invention of the compass. Samuel Clemens, whose pseudonym Mark Twain is derived from the practice of sounding, represents a striking modern manifestation of the tenacity of this technique of navigation. Only the outline of the history of this critically important Greek and Roman navigational device can be sketched at present, but the continued collection and analysis of archaeological evidence, particularly from deep-water wrecks, will undoubtedly in time allow a more nuanced discussion of their use.

7. Catalogue of Sounding Weights and Objects Published as Sounding Weights

The weights for which dates are available are arranged in chronological order (cat. nos. 001–095). Undated weights (cat. nos. 096–174) are arranged by class, then country. The following norms have been adopted for the catalogue in the interests of clarity and brevity. The headings provide (where known) catalogue number, modern country of origin, terrestrial location nearest the point of discovery, name of wreck or find spot, class, and date. The following standard terms are used for the parts of the sounding weight: suspension lug, tethering hole, apex (highest point of the body of the weight), shoulder, body (main mass of the weight), wall (side of the body), base, tallow cup, tallow cage (use of nails to form a cage for the tallow), roof (top surface of tallow cup), septa walls (separator walls projecting from sides and roof of tallow cup), nipples (narrow, roughly cylindrical projections from interior wall of tallow cup). The material of a weight is lead unless otherwise specified. The condition is not mentioned unless erosion significantly affects determination of shape or weight. Suspension lugs are cast in one piece with lead weights unless otherwise indicated. Any added nails and rings have been lost unless otherwise specified and are assumed to have been iron unless copper is specified. Only the most important bibliography is provided for a weight, particularly if it has been collected in Parker 1992. The Parker reference is cited for all wrecks for which sounding weights are catalogued, even if Parker does not mention the object. Unless there is significant disagreement with the primary literature, the dates and wreck designations given by Parker have been used, in particular the designation of multiple wrecks at one location by letters rather than numbers. The present location of the weight is given if known, along with any published inventory numbers. When more than one weight is catalogued from a single wreck, the weights are numbered 1, 2, 3, etc. for that wreck site. I have been able to examine personally only a small portion of these weights, and many of the rest have not been published in sufficient detail. As a result, the descriptions vary in detail and comprehensiveness. Three weights that came to my attention late in the preparation of this article are inserted into the numerical system as "bis" (026bis, 038bis, 117bis).

001. TURKEY. Ulu Burun. Ulu Burun Wreck. Class 8/9: Miscellaneous/Doubtful. 1325 B.C.

Truncated pyramidal body with rectangular cross-section; slightly off-center suspension hole through narrower upper end (D 0.011). Straight sides; edges seem to have been rounded by abrasion. No tallow cup. The object was found with a group of net weights, and Pulak suggests that it may have served either as the heavy foremost sinker on a net or as the ship's sounding lead. H 0.10; top 0.053 × 0.031; base 0.082 × 0.053.

Ship L 15–16 m; mixed cargo. Bodrum, Museum.

Pulak 1988, 33, no. KW 267, fig. 41; Parker 1992, 439–440.

002. ITALY. Gela. Archaic Wreck. Class 1A: Hemisphere. 500 B.C. Fig. 1.

Small, slightly flattened hemispherical body with slightly flattened sides. Small, ring-shaped tethering ring, possibly cast into the apex of the weight. Shallow, rough-walled tallow cup with central point. H 0.08; D 0.129. Ca. 5.3 kg.

Ship L 17 m, beam 6.8 m; architectural marbles and amphoras. Agrigento, Museo Nazionale.

Fiorentini 1990, 27, pl. X.4; Wilson 1996, 98; Panvini 1997.

003. ITALY. Campomarino (Taranto). La Madonnina Wreck. Class 9: Doubtful. 325–300 B.C.

Weight no. 1. Very corroded and encrusted. Roughly conical shape, with flat base and splayed apex. The apex appears to consist of two sheets or flaps of lead that splay outward from a central core or rod. No apparent suspension ring or lug. H ca. 0.14; base D ca. 0.09.

The irregular shape of this object and the splayed upper termination suggest that it may have served some other function than that of sounding weight.

McCann 1972, 182; Parker 1992, 249; McCann 1998, 237.

004. ITALY. Campomarino (Taranto). La Madonnina Wreck. Class 9: Doubtful. 325–300 B.C.

Weight no. 2. Lead object with square central hole. Roughly rectangular cross-section, tapering from a flat base (D 0.10 × 0.07) to an eroded and broken apex (D ca. 0.07 × 0.03). A regular hole, square in section (ca. 0.02) extends vertically from the apex to the base. H 0.10; base D 0.10.

This object does not resemble a sounding weight.

McCann 1972, 182; Parker 1992, 249; McCann 1998, 237.

005. CYPRUS. Kyrenia. Kyrenia Wreck. Class 9: Doubtful. 300 B.C.

Fat, cigar-shaped metallic object with longitudinal perforation. L 0.131; D 0.014–0.016. 0.863 kg. Broken. The shape seems too narrow for a sounding lead, and the supposed tallow cup too small. Probably a metallic compound that formed around a rope or iron object that has now disappeared.

Ship L 14 m, beam 4.2 m; mixed cargo. Kyrenia Museum.

M. Katzev, personal communication.

006. SPAIN. Ses Lloses, Mahon Harbor (Menorca). Lazaret Wreck. Class 6B: Truncated Cone. 200 B.C.

Wide, low, truncated conical body; straight sides tapering up to a wide, flat upper surface, into which an iron suspension ring had been cast. Deep tallow cup tapering to a smooth central boss (1.7 deep). H 0.05; base D 0.075; upper D 0.033.

Fernandez-Miranda 1977, fig. 45; Parker 1992, 241.

007. FRANCE. La Chrétienne (Marseilles). La Chrétienne Wreck C. Class 2B: Truncated Hemisphere. 2nd quarter 2nd c. B.C.

Weight no. 2. Truncated hemispherical body, with wide, flat upper surface. Iron suspension ring cast into upper surface. Shallow, flat-roofed tallow cup with 3 nail holes in roof; there are also 3 nail holes through the walls. H 0.064; base D 0.112. 3.557 kg.

Ship L 15 m; beam 5 m; amphoras.

Joncheray 1975a, 95, fig. 46.1, pl. 54; Oleson 1988, 36, no. 14; Parker 1992, 141.

008. FRANCE. La Chrétienne (Marseilles). La Chrétienne Wreck C. Class 5B: Cone. 2nd quarter 2nd c. B.C.

Weight no. 3. Irregular cone-shaped body with slightly concave sides. The slight resemblance to Squat Bell shape is probably result of wear. An iron nail was hammered straight down into the top of the cone to serve as an attachment lug. A second nail was hammered through the body of the weight at a downward slant, and the surplus folded up against the exterior. The drawing appears to show 2 nail holes penetrating through to the base, but these are not apparent in the photograph (Joncheray 1975a, fig. 46.2, photo 56b). Smooth base. H 0.08; base D 0.078. 2.026 kg.

If nails protruded through the base of this weight to form a tallow cage, this may well have served as a sounding weight. If not, it may have served as a net weight or net grappler.

Ship L 15 m; amphoras.

Fiori and Joncheray 1973, 88, pl. 5.5; Joncheray 1975a, 95, fig. 46.2, pl. 56; Oleson 1988, 36, no. 19; Parker 1992, 141.

009. FRANCE. La Chrétienne (Marseilles). La Chrétienne Wreck C. Class 9: Doubtful. 2nd quarter 2nd c. B.C.

Weight no. 1. Tapering bar; the thickest portion of the bar is square in section. 2 or 3 nails have been driven into each of the corners of this weight and left projecting upward. The design suggests use as a grappling hook for recovering nets. H 0.160; 0.046 × 0.052 sq. 1.707 kg.

Ship L 15 m, beam 5 m; amphoras.

Liou 1973, 600; Fiori and Joncheray 1973, 88, pl. 5.4; Joncheray 1975a, 95, fig. 46.3, pl. 55; Oleson 1988, 35, no. 2; Parker 1992, 141.

010. ITALY. Capo Graziano (Filicudi). Capo Graziano Wreck A? Class 3B: Squat Bell. 160–140 B.C.

Squat, bell-shaped body, with concave sides, outturned base, and rounded apex. Iron suspension ring cast into apex. Deep, hemispherical tallow cup with smooth walls. Numerous nail holes through wall into tallow cup. H 0.117; base D 0.147.

Ship L 21–25 m; amphoras and table ware.

Parker 1992, 117.

011. ISRAEL. Tel Megadim. Megadim Wreck A. Class 7B/9: Tapering Bar/Doubtful. 140–130 B.C.

Cylindrical, tapering rod flattened at one end into a rectangular suspension lug with central tethering hole. Slightly convex base. The light weight and the design suggest some purpose other than sounding weight. H 0.07; base D 0.023; 0.340 kg.

National Maritime Museum, Haifa, no. 613/127.

Kapitän 1969–1971, 61, pl. 12.21; Oleson 1988, 35, no. 1, p. 38, no. 1; Raban and Galili 1985, 354; Parker 1992, 273.

012. LIBYA. Apollonia. Apollonia Wreck A. Shape unknown. 150–120 B.C.

No information available.

Laronde 1987; Parker 1992, 57.

013. ITALY. Terrasini. Terrasini Wreck A or B? Class 5A/9: Cone/Doubtful. 310 B.C.–A.D. 50?

Roughly conical body of limestone, with rounded base. Apex pierced for suspension. Inv. no. 117. H 0.16.

Giustolisi 1975, 40, pl. xxxix, no. 117; Parker 1992, 422.

014. ITALY. Capo Sant'Andrea (Elba). Capo Sant'Andrea Wreck B. Shape unknown. 125–100 B.C.

No information available on shape or dimensions. Roman wreck, Trench 1B; amphora cargo. In *deposito* at Portoferraio.

G. Kapitän, personal communication, November 1990; Parker 1992, 124.

015. ITALY. Spargi, La Maddalena. Spargi Wreck. Class 1B: Hemisphere. 120–100 B.C.

Weight no. 1. Slightly elongated hemispherical body, the sides continuing straight down slightly past the appropriate base of a hemisphere. Iron suspension ring cast into the apex. Deep, flat-roofed tallow cup. H ca. 0.16; lower D ca. 0.12.

Ship L 30 m; mixed cargo including amphoras and table ware. Spargi Museum, La Maddalena.

Gadau 1982; Mocchegiani-Carpano 1986, 127 says 5 sounding weights from this site; Parker 1992, 410.

016. ITALY. Spargi, La Maddalena. Spargi Wreck. Class 5B: Cone. 120–100 B.C.

Weight no. 2. Straight-sided, conical body with rounded apex; iron suspension ring cast into apex. Deep, flat-roofed, smooth-sided tallow cup in base; 8 iron nails were driven diagonally upward through the walls of the weight near its base into the cup. H ca. 0.10; lower D ca. 0.09.

Ship L 30 m; mixed cargo including amphoras and table ware. Spargi Museum, La Maddalena.

Mocchegiani-Carpano 1986, 127 says 5 sounding weights from this site; Gadau 1982; Parker 1992, 410.

017. ITALY. Spargi, La Maddalena. Spargi Wreck. Shape unknown. 120–100 B.C.

Weight no. 3. No information.

Ship L 30 m; mixed cargo including amphoras and table ware. Spargi Museum, La Maddalena.

Mocchegiani-Carpano 1986, 127 says 5 sounding weights from this site; Parker 1992, 410.

018. ITALY. Spargi, La Maddalena. Spargi Wreck. Shape unknown. 120–100 B.C.

Weight no. 4. No information.

Ship L 30 m; mixed cargo including amphoras and table ware. Spargi Museum, La Maddalena.

Mocchegiani-Carpano 1986, 127 says 5 sounding weights from this site; Parker 1992, 410.

019. ITALY. Spargi, La Maddalena. Spargi Wreck. Shape unknown. 120–100 B.C.

Weight no. 5. No information.

Ship L 30 m; mixed cargo including amphoras and table ware. Spargi Museum, La Maddalena.

Mocchegiani-Carpano 1986, 127 says 5 sounding weights from this site; Parker 1992, 410.

020. SPAIN. Cap Negret (Ibiza). Cap Negret Wreck. Class 1A: Hemisphere. 110–90 B.C.?

Hemispherical body with slightly flattened sides; very tall, rectangular suspension lug. Deep tallow cup.

Almagro and Sancho 1966, 323–324, fig. 1; Parker 1992, 105.

021. TUNISIA. Mahdia. Mahdia Wreck. Class 1B: Hemisphere. 110–90 B.C. Fig. 2.

Weight no. 1. Slightly flattened hemispherical body; iron suspension ring cast into apex. Rounded base terminating on the interior with a sharp edge surrounding a deep, smooth-walled tallow cup with curving walls and flat roof. 6 nails were driven diagonally downward through the lower edge of the weight into the cup. H 0.11; lower D 0.18. 12.82 kg.

Ship L 28 m; mixed cargo including marble architectural elements and bronze statuary. Bardo Museum.

Parker 1992, 252; Päffgen and Zanier 1994, 126–127, no. H 86, figs. 34–35.

022. TUNISIA. Mahdia. Mahdia Wreck. Class 6B: Truncated Cone. 110–90 B.C. Fig. 4.

Weight no. 2. Truncated conical body with broad upper surface. A large hole in upper surface probably held iron suspension ring. Shallow, rounded, smooth-walled tallow cup. Marine encrustation covers base, but 6 or 8 nails seem to have been driven downward diagonally through the lower edge of the weight. H 0.12; lower D 0.19. 16.9 kg.

Ship L 28 m; mixed cargo including marble architectural elements and bronze statuary. Bardo Museum.

G. Kapitän, Notebook; Parker 1992, 252; Päffgen and Zanier 1994, 126–127, no. H 100, fig. 36.

023. FRANCE. Grand Congloué (Marseilles). Grand Congloué Wrecks A and B. Class 2B: Truncated Hemisphere. 180–150 or early 1st c. B.C.

Truncated hemispherical body. Suspension ring cast into apex. Deep, irregular, smooth-walled tallow cup with central, circular depression. 10 nails were driven through the walls into the tallow cup at uniform intervals around the sides. H 0.07; base D 0.125.

Benoît 1961, 180–182, fig. 97, pl. 33.b.1; 1971, 398–399, fig. 2; Oleson 1988, 36, no. 13.

024. FRANCE. Grand Congloué (Marseilles). Grand Congloué Wrecks A and B. Class 6B: Truncated Cone. 180–150 or early 1st c. B.C.

Conical body with rounded apex. Suspension ring cast into apex. The base ring carries an irregular concentric groove, framing a deep, flat-roofed tallow cup with smooth walls. H 0.115; base D 0.135.

Benoît 1961, 180–182, fig. 97, fig. 32.b.3; 1971, 398–399, fig. 2; Oleson 1988, 36, no. 18.

025. FRANCE. Cap Dramont (Saint-Raphaël). Dramont Wreck C. Class 3B: Squat Bell. Late 2nd c. B.C.

Squat bell-shaped body with outturned base, concave sides, and rounded apex. Iron suspension ring cast into apex. Shallow tallow cup (0.016 deep), gashed roughly to hold the tallow or sediment. Found near the bow, next to 2 lead anchor stocks. H 0.088; base D 0.106.

Ship L 12–13 m; mixed cargo including amphoras, iron bars, ceramics, metalwork.

Joncheray 1994, 31, 33; Parker 1992, 167.

026. FRANCE. Baie de Cavalière (Le Lavandou). Cavalière Wreck. Class 5B: Cone. 100 B.C. Fig. 3.

Conical body. Vertical perforation in apex for added suspension lug. Deep, hemispherical tallow cup in base, with a slight inner lip. H 0.108; base D 0.137. 5.45 kg.

Ship L 13 m, beam 4.6 m, mixed cargo.

Charlin, Gassend, and Lequément 1978, 51–54, figs. 25.10, 26.2; Oleson 1988, 36, no. 20; Parker 1992, 133.

026bis. TURKEY. Kizilburun. Kizilburun Wreck. Class 5A: Cone. 100–50 B.C.

Conical body. Apex flattened to form a small, square suspension lug. Shallow tallow cup with concave roof and slight inner lip; 0.015–0.025 deep. H 0.145; base D 0.14; 7.172 kg.

Found near several lead anchor collars, possibly in the bow of a ship carrying stone architectural members; L 18 m or more.

Carlson 2006, 7.

027. ITALY. Ognina (Catania). Ognina Wreck A. Class 6A: Truncated Cone. 150–25 B.C.

Conical body. Apex flattened to form a small, square suspension lug. Shallow, flat-roofed tallow cup (0.026 deep) outlined by very thin wall; deep central perforation in roof. 8 large, round nail (?) holes through lower wall into tallow cup. H 0.135; lower D 0.16.

G. Kapitän, personal communication, 29 November 1995; Parker 1992, 292.

028. SPAIN. Sant Jordi (Maiorca). Colonia de Sant Jordi Wreck A. Class 9: Doubtful. 100 B.C.

Two flat-topped and flat-bottomed oblong blocks of stone with metal swing handles set into upper surface. Clearly balance beam weights rather than sounding weights, although the author labels them “poids ou plombs de sonde.” The larger is twice the weight of the smaller. Weight 1: H 0.24; base 0.028 × 0.018; upper surface 310 × 190. 33.450 kg. Weight 2: H 0.18; base 210 × 120; upper surface 240 × 160. 16.250 kg.

Colls 1987, 66, pl. XI.B; Parker 1992, 149–150.

029. ITALY. Ognina (Catania). Ognina Wreck A. Class 5A: Cone. 150–25 B.C.

Conical body with slightly convex sides, tapering to a heavy square suspension lug with large hole (D 0.025). The thin, rounded rim is perforated with 6 large, regular round holes, most likely for iron nails to hold the tallow. The tallow cup is shallow, with a flat ceiling and small, shallow central hole. H 0.163; base D 0.14. Ca. 8.2 kg.

Probably from this wreck of a merchant ship with amphoras. No information about size.

Parker 1992, 292, no. 753; Tortorici 2002, 2285–2286, fig. 10.18.

030. FRANCE. Ile Planier (Marseilles). Planier E Wreck. Class 1B: Hemisphere. 100–50 B.C.?

Slightly elongated hemispherical body. Suspension ring cast into apex. Deep, smooth-walled, hemispherical tallow cup with slight inside lip. H 0.13; base D 0.15.

Dated on the basis of finds from the wreck, which may or may not be associated with the weight.

Benoît 1962, 156, fig. 22; Oleson 1988, 35, no. 5; Durand et al. 1989, 88, no. C 401; Parker 1992, 317.

031. ITALY. Cala Mindola (Levanzo). Cala Mindola Wreck. Class 1A: Hemisphere. 100–25 B.C.

Slightly elongated hemispherical body. Small rounded suspension lug at apex. Deep hemispherical tallow cup with smooth walls. 3 nails were driven through the walls of body into the cup.

G. Kapitän, personal communication, June 1991, connection with wreck not entirely certain; Parker 1992, 89.

032. ITALY. Punta della Contessa (Brindisi). Punta della Contessa Wreck A. Class 6A: Truncated Cone. 100–25 B.C.

Tall, narrow, truncated conical body, with slightly concave sides, marked shoulder. Heavy square suspension lug, the sides continuing the lines of the body. Shallow, flat-roofed tallow cup. 5 or 6 nails were driven through the wall into the cup. H 0.205; base D 0.132.

Museo Provinciale, Brindisi, inv. no. 5997.

G. Kapitän, Notebook, found with two lead anchor stocks; Parker 1992, 351.

033. FRANCE. La Jeaune-Garde (or Jaumegarde, Porquerolles Is.). Jeaune-Garde Wreck A. Class 8: Miscellaneous. 100–25 B.C.? Fig. 4.

Swelling, roughly rectangular, purse- or pillow-shaped basalt sounding weight. A small tethering hole (D ca. 0.013) has been cut through a narrow flange that runs along the crest. Smooth tallow cup in the base. H 0.142; W 0.13; L 0.14; cup 0.034 deep.

Cat. no. 67-E1-20.

Carrazé 1972, 84, 86; Oleson 1988, 37, no. 33; Parker 1992, 221 notes that several ancient wrecks may lie on this same site, so the weight may not belong to the 1st–c. B.C. wreck.

034. ITALY. Santa Teresa di Gallura (Sardinia). Capo Testa Wreck B. Class 1A: Hemisphere. 75–25 B.C.

Known only from a photograph taken obliquely from above. Appears to have a large, slightly elongated hemispherical body. Heavy, square lug on apex. No dimensions published; the weight is reported to have been stolen from the site after the initial survey.

Gandolfi 1986, 85, fig. 17; Parker 1992, 125–126.

035. SPAIN. Cape Rocas Negras (Bagur). Sa Nau Perduda Wreck. Class 5A: Cone. 60–40 B.C. Fig. 3.

Conical body with slightly convex walls. Rectangular suspension lug tapering slightly to a rounded apex; small tethering hole. Tallow cup marked with 4 septa walls spreading from a central boss. H 0.145; base D 0.12.

Ship L < 20 m; amphoras. Gerona Museum.

G. Kapitän, Notebook; Foerster and Pascual 1970 [1972], 285, fig. 8; Oleson 1988, 37, no. 23; Parker 1992, 285.

036. ITALY. Isola Mal di Ventre (Sardinia). Isola Mal di Ventre Wreck. Class 5A: Cone. Mid-1st c. B.C.

Two sounding leads were found on the wreck, in the cargo mound, but only one conical sounding weight is illustrated by Salvi (1995, 245, fig. 16). The hull of this large merchant ship, approximately 12 × 36 m, was well preserved. The cargo consisted of over 1,000 lead ingots (see Parker 1992, 255–256, no. 637).

Salvi 1995, 244; 1999, 82, n. 27.

037. ITALY. Isola Mal di Ventre (Sardinia). Isola Mal di Ventre Wreck. Shape unknown. Mid-1st c. B.C.

Two sounding leads were found on the wreck, in the cargo mound, but only one conical sounding weight is illustrated by Salvi (cat. no. 036). The hull of this large merchant ship, approximately 12 × 36 m, was well preserved. The cargo consisted of over 1,000 lead ingots (see Parker 1992, 255–256, no. 637).

Salvi 1995, 244; 1999, 82, n. 27.

038. FRANCE. Île du Levant (Hyères). Titan Wreck A. Class 2A: Truncated Hemisphere. 50–45 B.C.

Truncated hemispherical body. Heavy, square suspension lug with rounded top. Rounded lower rim framing a smooth tallow cup. 4 nails were driven through the walls into the cup near the base. H 0.055; base D 0.105.

Ship L ca. 25 m; amphoras.

Benoît 1961, 182, pl. 32.b.2; Kapitän 1969–1971, 57; Benoît 1971, 398–399, fig. 2; Oleson 1988, 36, no. 17; Parker 1992, 424–425.

038bis. CROATIA. Island of Pag. Vlaska Bay Wreck. Shape unknown. 2nd half 1st c. B.C.

The single weight, the shape of which is not described in the preliminary publication, was found on a ship carrying approximately 100 Lamboglia Type 2 Adriatic wine amphoras.

Radic-Rossi 2004.

039. FRANCE. Île Lavezzi (Corsica). Île Lavezzi Wreck. Class 1A: Hemisphere. End of 1st c. B.C.

Hemispherical body. No further information available. Possibly the same as cat. no. 045?

Benoît 1971, 397.

040. CROATIA. Cape Plavac (Zlarin). Plavac Wreck A. Class 5A: Cone. Late 1st c. B.C.–early 1st c. A.D.

Tall, approximately conical body, with slightly convex sides. Heavy square suspension lug on apex. 16 nails were driven through wall into tallow cup.

Ship L 25–30 m; wine amphoras and terra sigillata. In Dominican church, Bolu?

Vrsalovic 1974, 141, no. 192; Gunjaca 1976; Parker 1992, 318; Jurisic 2000, 71, no. 56.

041. ITALY. Castelsardo (Sardinia). Cala Ustina Wrecks A and B. Class 6A: Truncated Cone. Republican or Imperial.

Squat, spreading, truncated conical body, eroded by the sea. Heavy, ring-shaped suspension lug with flat crest. High septa walls forming a cross extend to the level of the base, creating 4 irregular, shallow tallow compartments. 5 nails were driven through wall into the compartments. H 0.135; base D 0.165.

Associated with two wrecks, of Republican and Imperial date.

Boninu 1986, 58, inv. 17040, fig. 4; Parker 1992, 92.

042. SPAIN. Torroella de Montgrí. Isla Medas Coastal survey. Class 6A: Truncated Cone? 1st c. B.C. or A.D.? Fig. 4.

Approximately truncated conical body. The sides are slightly convex, but the shape is closer to that of a truncated cone than truncated hemisphere. Heavy rectangular suspension ring with rounded top. Deep, hemispherical tallow cup occupies almost the entire body of the weight. 4 low, narrow septa walls radiate from center of roof; a pair of rounded nipples project from the inside within each compartment. Found together with scattered amphora sherds dating to the 1st c. B.C. and A.D. H 0.16; base D 0.14.

Perelló 1962, 315, fig. 42.3; Oleson 1988, 36, no. 15; Parker 1992, 430.

043. ITALY. Ladispoli. Ladispoli Wreck A ("Dolium Wreck"). Class 1A: Hemisphere. A.D. 1–15.

Crisp hemispherical body. Heavy square suspension lug on apex, spreading slightly toward the top (from impact?). Deep, rounded tallow cup with 6 thin, regular septa walls that extend nearly as far as the base. H ca. 0.13; base D 0.15.

Ship L 20 m; wine dolia freighter.

D'Atri 1986, 45; Parker 1992, 233; Gianfrotta 1990, 198, 205, fig. 8.

044. FRANCE. Lavezzi Reef (Corsica). Sud-Lavezzi Wreck B. Class 3A: Squat Bell. A.D. 10–30.

Squat, bell-shaped body with slightly concave sides and a rounded apex. Heavy rectangular suspension lug with neat tethering hole (D 0.018). Thin walls frame a deep, slightly off-center tallow cup (0.02–0.03 deep) divided into 5 compartments by irregular, low septa walls. 4 iron nails were driven through the walls into the tallow cup 0.02 above the base. H 0.177; base D 0.145–0.155; wall 0.02 thick; cup 0.02–0.03 deep. 8 kg. Possibly the same as cat. no. 036.

Ship L > 24 m; amphoras, lead and copper ingots.

Liou and Domergue 1990, 47, fig. 41; Parker 1992, 414–415.

045. FRANCE. Île Lavezzi (Corsica). Sud-Lavezzi Wreck C. Shape unknown. A.D. 15–25.

Inv. no. 3110. H 0.182; lower D 0.15. Possibly the same as cat. no. 039.

Anon. 1984, no. 30.

046. FRANCE. Cap Dramont (Saint-Raphaël). Dramont Wreck D. Class 1A: Hemisphere. A.D. 40–50.

Weight no. 1. Hemispherical body. Exterior marked with six low horizontal ridges. Heavy rectangular lug on apex. Top of lug marked with 3 X marks and 6 slashes. Shallow, flat-roofed tallow cup containing 8 low, irregular septa walls spreading from a central boss. H 0.156; base D 0.140.

Fiori and Joncheray 1973, 86, pl. 5.2; Joncheray 1975b, 10, pl. III; Oleson 1988, 35, no. 10; Parker 1992, 167.

047. FRANCE. Cap Dramont (Saint-Raphaël). Dramont Wreck D. Class 1A: Hemisphere. A.D. 40–50.

Weight no. 2. Elongated hemispherical body. Square suspension lug on apex. Shallow, smooth-walled, flat-roofed tallow cup. 4 nails were driven obliquely downward through the walls into the cup. H 0.114; base D 0.10.

Ship L ca. 20 m; mortaria and amphoras.

Liou 1973, 598, fig. 32; Fiori and Joncheray 1973, 86, pl. 5.1; Joncheray 1975b, 10, pl. III; Oleson 1988, 35, no. 9; Fassitelli 1990, 61 (top); Parker 1992, 167.

048. FRANCE. Port-Vendres. Port-Vendres Wreck B. Class 3A: Squat Bell. A.D. 42–48.

Weight no. 1. Liou and Domergue 1990, 47 describe as similar to cat. no. 041. Tallow cup with 8 subdivisions demarcated by 4 large and 4 small septa walls.

Ship L > 30 m; amphoras and metal ingots.

Liou and Domergue 1990, 47; Parker 1992, 330–331.

049. FRANCE. Port-Vendres. Port-Vendres Wreck B. Class 3A: Squat Bell. A.D. 42–48.

Weight no. 2. Liou and Domergue 1990, 47 describe as similar to cat. no. 041.

Ship L > 30 m; amphoras and metal ingots.

Liou and Domergue 1990, 47; Parker 1992, 330–331.

050. FRANCE. Strait of Bonifacio (Corsica). Cavallo A Wreck. Class 3A: Squat Bell. A.D. 40–60.

Squat, bell-shaped body, with outturned rim, slightly concave sides, high rounded shoulder. Heavy, ring-shaped suspension lug. Heavily eroded by the sea. Tallow cup consists of a deep furrow concentric with the base, defining a central disk marked with an indistinct pattern of furrows or dimples. The walls between the recesses extend to the level of the base. H 0.12; base D 0.155. 6.0 kg.

Bebko 1971, pl. 10, fig. 58; Parker 1992, 134.

051. ISRAEL. Offshore from Akko or Ma'agan Michael? Class 4A: Tall Bell. 2nd half 1st c. A.D.

Weight no. 1 ("A"). Tall, narrow, almost cylindrical body but tapering slightly from base to sharp, angular shoulder. Heavy, square suspension lug continues the line of the sides up to a flat top with incised fishbone pattern. The lower edge of the tethering hole (D 0.035) is recessed slightly into the surface of the flat shoulder. Shallow tallow cup with deep central dimple. 5 square (0.006 × 0.006) nail holes are visible approximately 0.032 above the base but do not penetrate the tallow cup. H 0.223; base D 0.131. 18.75 kg.

The inconvenient weight of this weight, the shallow tallow cup, and the atypical character of the nail holes suggest that it might have been used for some other function than sounding. Projecting nails would allow it to serve as a net grabber, but the weight seems excessive for such a function. Tilley (cited in Kingsley and Raveh 1996, 24, n. 6) suggests it might have been a weight used by a sponge diver to descend quickly. It was, however, found on a Roman shipwreck along with a lighter weight that must surely be a sounding lead (cat. no. 052). The dating of the wreck, based on the shape and epigraphy of some inscribed lead ingots, is conjectural but likely.

Kingsley and Raveh 1994, 123–126; Kingsley and Raveh 1996, 24, n. 6.

052. ISRAEL. Offshore from Akko or Ma'agan Michael? Class 4B: Tall Bell. 2nd half 1st c. A.D.

Weight no. 2 ("B"). Tall, rounded body with steep shoulder sloping up to a small, square suspension lug (hole D 0.027). Smoothly rounded, shallow tallow cup (0.023 deep). 5 nails were driven through the wall of the base into the tallow cup, approximately 0.007 above the base. H 0.166; base D 0.123. 10.0 kg.

This weight was found on a Roman shipwreck along with a heavier weight (cat. no. 051) that may have been used occasionally or exclusively for some other function than sounding. The dating of the wreck, based on the shape and epigraphy of some inscribed lead ingots, is conjectural but likely.

Kingsley and Raveh 1994, 123–126.

053. ISRAEL. Caesarea Palaestinae. Caesarea South Anchorage, Area D (Sdot Yam). Shape unknown. 2nd half 1st c. A.D.?

Weight no. 1. One of two weights found with a deposit of Roman material possibly datable by coin deposit of 2nd half of 1st c.

Galili et al. 1993, 67.

054. ISRAEL. Caesarea Palaestinae. Caesarea South Anchorage, Area D (Sdot Yam). Shape unknown. 2nd half 1st c. A.D.?

Weight no. 2. One of two weights found with a deposit of Roman material possibly datable by coin deposit of 2nd half of 1st c.

Galili, Dahari, and Sharvit 1993, 67.

055. SPAIN. Ben-Afelí (Almazora). Ben-Afelí Wreck. Class 1A: Hemisphere. A.D. 85–95.

Slightly stretched hemispherical body with heavy square suspension lug (hole D 0.037). The deep, thick-walled tallow cup (0.115 deep) has a rounded ceiling from which project 4 thick, high septa walls. There are 2 lead nipples projecting into each of the 4 compartments. The compartments contained an off-white substance that may be remains of the charge of tallow or other sticky substance. H 0.168; base D 0.17. 13 kg.

The ship was carrying Spanish amphoras, mortaria, and iron bars.

Ramos, Wagner, and Fernández 1984, 128, 136, fig. 3a; Parker 1992, 71.

056. ITALY. Civitavecchia. Wreck site 8 km north of Civitavecchia, 1 km offshore, 8–9 m depth. Class 3B: Squat Bell. Late 1st c. B.C.–early 2nd c. A.D.

Squat bell-shaped body, with markedly outturned base, concave sides, and rounded apex. Iron suspension ring cast into the apex. Shallow and narrow, smooth-walled tallow cup (0.028 deep). H 0.095; base D 0.13.

G. Kapitän, Notebook includes sketch of amphoras seen in area lead was found. They look much like later Rhodian types, which Peacock and Williams 1986 have as Class 9, late 1st c. B.C. to early 2nd c. A.D. Parker 1992, 148 may refer to this wreck.

057. SPAIN. Conillera (Ibiza). Conillera Wreck. Class 4B: Tall Bell. A.D. 30–190?

Tall, bell-shaped body with convex sides tapering to a marked shoulder. Slightly rounded upper surface with heavy round suspension lug. Surface encrusted and corroded. No dimensions given, but pestle in same photo suggests that H is ca. 0.12.

Ship L 25 m; amphoras.

Falcon-Barker 1964, 105; Parker 1992, 153.

058. ITALY. Cervia. Cervia Wreck? Class 6A: Truncated Cone. 1st–2nd c. A.D.?

A very crisp, truncated conical body with broad, flat apex (D 0.075). Heavy square suspension lug with tethering hole manufactured or enlarged by pounding nails through it. Deep, flat-roofed tallow cup, with 6 septa walls cast in relief on the roof, forming an asterisk. H 0.075; lower D 0.145.

Found in association with lagoon boat L 12–15 m, beam 2–3 m, but may not belong to the wreck.

Bonino 1971, 322, fig. 7; Maioli 1986, 16, fig. 23; Parker 1992, 138.

059. CYPRUS. Cap Greco (Famagusta). Random find off lighthouse. Class 6A: Truncated Cone. 1st–2nd c. A.D.? Fig. 4.

Tall, narrow, truncated conical body, with slightly concave sides, marked shoulder. Heavy suspension lug with rounded top, the sides continuing the lines of the body. Several nails were driven downward diagonally through the wall and base. Base slightly expanded from impact. Greek inscription around body in two lines: ΑΚΚΥΡΑΠΑΕΙ/ . . .]ΡΥΑ[. . . Another conjecture for second line is . .]ΥΡΝΑ. "Anchor strikes (?)" or "Anchor of (personal or place name)." Date is based on letter forms. Ca. 8.80 kg.

Science Museum, London, inv. no. 1973-505.

A. Johnston, personal communications, June 1975, February 2000. G. Kapitän, Notebook says found by Squadron leader S. Bass (RAF) in 1964.

060. ITALY. Punta Ala (Castiglione della Pescaia). Wreck B. Class 1A: Hemisphere. Hadrianic?

Body has a slightly pointed shape but probably should be classified as hemisphere. Relatively thin and small suspension lug cast in one piece with weight. A burr surrounds one side of the hole, as if the hole was made or enlarged by hammering a nail through it. H 0.06; H of handle 0.025; Th of handle 0.01; D of base 0.104; D of cup 0.057; depth of cup 0.02–0.025. Several sections of the cup wall have been chopped at to provide rough edges and a lip. No nail holes.

Wreck B is Hadrianic. The longest surviving frame set is 4 m L, suggesting a beam of at least 6 m. Seems to have double planking, which also suggests large ship. 4 types of amphoras found on board, along with much personal (?) table ware. L >18 m?

Poggesi and Rendini 1998, 123 (this weight?).

061. ITALY. Cape Taormina (Naxos). Capo Taormina Wreck. Class 2B: Truncated Hemisphere. 2nd quarter 2nd c. A.D. Fig. 2.

Truncated hemispherical body. Bronze tethering ring cast into the upper surface. Smooth-walled, hemispherical tallow cup. The cup is off center, and the wider margin of the base carries a short slot 0.01 wide and 0.014 deep and a low projection of the same dimensions. H 0.10; base D 0.20. 13.4 kg.

The marble cargo weighed approximately 90–100 tons. Antiquario di Giardini, Naxos.

Kapitän 1961, 308, 309 fig. 2, 311 fig. 2; G. Kapitän, Notebook, drawings and photos; Bonino 1971, 305, fig. 11; Papò 1985, 51; Oleson 1988, 36, no. 12; Parker 1992, 125, no. 256.

062. FRANCE. Ile Planier (Marseilles). Épave Souquet. Class 5A: Cone. 2nd c. A.D.

Conical body. Tethering hole driven horizontally through body of weight just below apex. Very shallow, smooth tallow cup. H 0.21; base D 0.08. 4.30 kg.

Benoît 1961, 179, pl. 31.17; Gianfrotta and Pomey 1981, 288, no. 3; Oleson 1988, 36, no. 21; cf. Parker 1992, 315–316, Planier B, this wreck?

063. GERMANY. Xanten. Sporadic find in Roman bed of Rhine. Class 5B: Cone. 2nd c. A.D.? Fig. 5.

Tall, narrow, conical body with rounded apex. Iron suspension ring cast into apex. 8 iron nails (partly preserved) were driven into the flat base. Some are bent upward along the wall of the weight, others bent downward, perhaps as a tallow cage. This item is problematic as a sounding weight. Inv. no. 59.277. H 0.175; lower D 0.06–0.07.

Petrikovits 1959, 113.

064. ITALY. Camarina. Camarina Wreck A ("Column Wreck"). Class 4B: Tall Bell. A.D. 175–200.

No. 1. Tall, bell-shaped body with slightly convex sides tapering upward to a square suspension lug with large central hole (D 0.02 × 0.017). Shallow, smooth-walled tallow cup with flat roof (0.016 deep). 13 nails were driven downward diagonally through the wall into the tallow cup, 0.028 apart around the circumference of the base. H 0.16; base D 0.115. Ca. 5.5 kg?

Ship was carrying ceramics and marble columns.

G. Kapitän, personal communication, October 1996; Di Stefano 1991, 51, fig. 29; Parker 1992, 94–95; Wilson 1996, 71–72 mentions finds from this and other wrecks, but not the sounding leads; Di Stefano 1998, 36.

065. ITALY. Camarina. Wreck A (Relitto della nave delle colonne). Class 9: Doubtful. A.D. 175–200.

Di Stefano 1998, 39 reports a "Scandaglio in bronze, di forma tronco-piramidale, a base rotonda, con punta di presa forata, di forma trapezoidale. Fondo incuso." H 0.105; lower D 0.045. The dimensions are very different from those of the two lead sounding weights (which Di Stefano alludes to on p. 36). Unfortunately, this "bronze" weight is not illustrated. Given the unique material, it may in fact have been a finial on some object of bronze furniture.

Di Stefano 1998, 36.

066. ITALY. Camarina. Camarina Wreck A ("Column Wreck"). Class 6A: Truncated Cone. A.D. 175–200. Fig. 4.

No. 2. Tall, truncated conical body. Thick, heavy lug on upper surface, with large, regular suspension hole (D 0.022). The narrow sides of the lug meet the outer edges of the cone, then taper inward. Shallow, smooth-walled tallow cup with flat roof (0.019 deep). One nail was driven diagonally down through wall into tallow cup. H 0.168; base D 0.121. Ca. 5.5 kg?

Di Stefano 1991, 51, fig. 29; Parker 1992, 94–95; Wilson 1996, 71–72; G. Kapitän, personal communication, October 1996.

067. ITALY. Grado. Iulia Felix Wreck. Class 5A: Cone. Ca. A.D. 200.

Tall, narrow conical body. The heavy suspension lug, with neat central hole, is wider at the top than at its junction with the rounded apex of the body. No data on dimensions or weight.

Ship L ca. 18 m; mixed cargo including 4 types of amphoras, glass, metalwork.

Parker 1992, 197; Lopreato 1994, 30, 33; Dell'Amico 1997, 123.

068. ITALY. Capo Murro di Porco (Siracusa). Plemmirio Wreck B. Class 6A: Truncated Cone. A.D. 200. Fig. 4.

Conical body terminating in a low, rounded molding below a small, flat apex. Small, square suspension lug, leaning slightly to one side. Deep, narrow tallow cup with a cross inset into its flat base. H 0.18; base D 0.153.

Museo Nazionale, Siracusa, inv. no. PL 74/8.

Gibbins and Parker 1986, 299–301, fig. 30; Oleson 1988, 37, no. 24; G. Kapitän, Notebook; Parker 1992, 319.

069. ITALY. Capo Murro di Porco (Siracusa). Plemmirio Wreck B? Class 8: Miscellaneous. A.D. 200?

A stone weight with flat base, convex sides tapering to a narrower, flat apex. Tethering hole in upper third. H ca. 0.12.

Museo Nazionale, Siracusa, SIR A 228, inv. no. 66144.

G. Kapitän, Notebook, found by British Plemmirion expedition in 1968.

070. BELGIUM. Pommeroeul. Pommeroeul Wrecks. Class 9: Doubtful. A.D. 50–260.

A "possible sounding lead, also made of stone, with a groove for a string" (De Boe 1978, 29). Found in a deposit of wrecked boats on the Haine River.

De Boe 1978, 29; Parker 1992, 325.

071. ISRAEL. Haifa. Random find off coast, Assemblage 11. Class 4C: Tall Bell with Added Suspension Lug. Roman.

Tall body with convex sides tapering to a rounded apex, into which a metal suspension ring was cast. Thin-walled base with shallow, flat-roofed tallow cup. There is an inset line around the weight, just above the base, through which 6 nails were driven into the interior. Dimensions not given; H ca. 0.21; base D ca. 0.14. 14.9 kg.

This weight and cat. no. 133 do not fit any of the shape classes outlined in Oleson 2000. The impression is similar to that of Class 4A (Squat Bell)—because of the use of added suspension lugs—but weights of this class are far taller in comparison with their base diameter. Found in vicinity of cat. nos. 072–074. Galili and Sharvit 1999a, 17 date this context to the "Roman" period, on the basis of a find of "silver dinars." An Imperial date seems likely.

Israel Antiquities Authority no. 96-1334.

Galili and Sharvit 1999a, 17, fig. 30.2; 1999b, 173, fig. 12.3.

072. ISRAEL. Haifa. Random find off coast, Assemblage 11. Class 5A: Cone. Roman.

Tall, roughly conical body with slightly convex sides tapering to a squared-off suspension lug. Tethering hole through base of lug. Lower portion of body marked with 5 low, rounded, spiraling ridges. Thick-walled base with shallow, rounded tallow cup with sharp, projecting inner lip. H ca. 0.14; base D ca. 0.10. 6.2 kg.

Found in vicinity of cat. nos. 071, 073–074. The exterior treatment is similar to that of 073. Galili and Sharvit 1999a, 17 date this context to the "Roman" period, on the basis of a find of "silver dinars." An Imperial date seems likely.

Israel Antiquities Authority no. 96-1336.

Galili and Sharvit 1999a, 17, fig. 30.3; 1999b, 173, fig. 12.2.

073. ISRAEL. Haifa. Random find off coast, Assemblage 11. Class 5A: Cone. Roman.

Squat, conical body with slightly rounded apex carrying a heavy square suspension lug. The lug expands slightly around the tethering hole. Lower portion of body marked with 4 low, rounded, horizontal ridges. Thick-walled base with shallow, flat-roofed tallow cup with slightly projecting inner lip. 6 nails were hammered upward through the base rim into the tallow cup. H ca. 0.134; base D ca. 0.126. 5.5 kg.

Found in vicinity of cat. nos. 071–072, 074. The exterior treatment is similar to that of 072. Galili and Sharvit 1999a, 17 date this context to the "Roman" period, on the basis of a find of "silver dinars." An Imperial date seems likely. Their figure reference mistakenly assigns their cat. nos. 001 and 003 to this assemblage.

Israel Antiquities Authority no. 96-1335.

Galili and Sharvit 1999a, 17, fig. 30.4; 1999b, 173, fig. 12.4.

074. ISRAEL. Haifa. Random find off coast, Assemblage 11. Class 6A: Truncated Cone. Roman.

Squat, roughly conical body (distorted by impact on base), with flat upper surface carrying a heavy, square tethering lug. No tallow cup. Base rounded and spread from impact. H ca. 0.087; base D ca. 0.08. 2.0 kg.

Found in vicinity of cat. nos. 071–073. Galili and Sharvit 1999a, 17 date this context to the "Roman" period, on the basis of a find of "silver dinars." An Imperial date seems likely.

Israel Antiquities Authority no. 96-1337.
Galili and Sharvit 1999a, 17, fig. 30.6; 1999b, 173, fig. 12.1.

075. ITALY. Acitrezza (Sicily). Random offshore find. Class 8: Miscellaneous. Roman.
Papò suggests that a Roman steelyard weight in the shape of a female bust (Athena?) found at a depth of 25 m off the harbor of Acitrezza was used as an emergency sounding weight. The design and dimensions of the weight would make it suitable for such an application, although there would be no tallow cup. Steelyards and steelyard weights have been found on numerous Roman wrecks, so Papò's suggestion is plausible but cannot be proven. H. Tzalas (oral communication 2005) reports the find of a very similar Athena bust in the sea off Paphos.
Papò 1989, 126–129; Medas 1999, 27, n. 11.

076. ITALY. Sassari. Find spot unknown. Class 9: Doubtful. Roman?
Amphora-shaped lead object with wide central channel (D 0.05) and long neck. A circumferential channel has been cast into the shoulder, connected to the surface by 4 nail holes angled slightly upward. Although its purpose remains obscure, this object seems better designed to function as a net retriever than a sounding weight. L 0.43; max. D 0.23.
Sassari, Museo Nazionale, no. 4957.
Boninu 1986, 61, fig. 7.

077. CYPRUS. Fondana Amorosa. Fondana Amorosa Wreck. Shape unknown. Roman?
No information available.
Parker 1992, 180.

078. ITALY. Brindisi. Punta del Serone. Shape unknown. 3rd c. A.D.
Remains of a cargo of scrap bronze from statues dating from the Hellenistic period to 3rd c. A.D. were found in 15 m of water, along with a sounding lead. Also remains of a "cargo" of amphoras, which date ship to the "end of Roman empire."
Beltrame 2002, 457.

079. ISRAEL. Caesarea Palaestinae. Harbor basin of Sebastos. Class 4A: Tall Bell. 3rd c. A.D.? Fig. 2.
Weight no. 1 (C89.0000.M1). Tall, narrow body with slightly convex sides tapering to a rounded shoulder. Tall, heavy, rectangular suspension lug with central hole (D 0.022). Deep tallow cup with very irregular roof (0.015 deep). Base of weight has spread slightly, probably from impact with bottom. H 0.20; base D 0.11. 10.1 kg.
Found with cat. nos. 080–081.
CMS News no. 77, April 1990, 6.

080. ISRAEL. Caesarea Palaestinae. Harbor basin of Sebastos. Class 4A: Tall Bell. 3rd c. A.D.? Fig. 2.
Weight no. 2 (C89.0000.M3). Tall, narrow body with slightly convex sides tapering to a rounded shoulder. Tall, heavy, rectangular suspension lug with central hole (D 0.024). Narrow, shallow tallow cup (0.015 deep) with thick cross walls projecting from roof. Base of weight has spread slightly, probably from impact with bottom. H 0.16; base D 0.092. 6.1 kg.
Found with cat. nos. 079, 081.
CMS News no. 77, April 1990, 6.

081. ISRAEL. Caesarea Palaestinae. Harbor basin of Sebastos. Class 5A: Cone. 3rd c. A.D.? Fig. 3.
Weight no. 3 (C89.0000.M2). Squat, slightly irregular conical body tapering to a wide, rounded suspension lug with large tether hole (D 0.03). Shallow tallow cup with irregular roof (0.015 deep) rising to a deep, narrow dimple. H 0.168; base D 0.12. 7.2 kg.

Found with cat. nos. 079–080.
CMS News no. 77, April 1990, 6.

082. ISRAEL. Caesarea Palaestinae. Southern Breakwater of Sebastos. Class 5A: Cone. 3rd c. A.D.?

Short, conical body. Very heavy, square suspension lug with large tethering hole. Tallow cup marked with 4 heavy septa walls springing from a central boss. H 0.12; base D 0.105. 4.9 kg.

Found on surface of the inner face of Southern Breakwater, at Area N. University of Haifa CAHEP storeroom, cat. no. C83-N2-3. Should belong to the period after the breakwater sank, probably during the period of relatively active trade in 3rd c. A.D.

Oleson 1988, 37, no. 25, p. 38, no. 3; Oleson et al. 1994, 73, 152, no. M30.

083. FRANCE. Strasbourg. Wantzenau Wreck. Class 9: Doubtful. Late 3rd c. A.D.

Roughly hemispherical lead weight with a central socket into which a stick was inserted (H 0.26; D 0.03). Benoît assumes that this is a sounding lead with a handle to assist throwing. Parker terms it "leaden end of a sounding pole." Base D 0.11.

There is no reason to assume that this object functioned as a sounding weight. The boat was a small river craft (L 6.5 m) moved by poling.

Benoît 1961, 180, fig. 96; Oleson 1988, 37, no. 34; Parker 1992, 452.

084. ITALY. Imera. Imera Wreck. Shape unknown. A.D. 285–305?

No information available.

Parker 1992, 215.

085. ITALY. Punta del Serrone (Brindisi). Punta del Serrone Wreck ("Scrap metal wreck"). Class 1A: Hemisphere. 3rd–6th c. A.D.?

Hemispherical body becoming cylindrical just above the base, which is marked off by a groove on the exterior. A heavy, rectangular suspension lug with wide central hole. Deep central tallow cup without subdivision walls. No data on dimensions or weight.

Found near a wreck of the 3rd to 6th c. A.D. that was carrying scrap bronze, but not necessarily related to the wreck.

G. Kapitän, personal communication, October 1992; Mazzatenta 1995, 90.

086. FRANCE. Cap Dramont (Saint-Raphaël). Dramont Wreck E. Class 1A: Hemisphere. A.D. 420–425.

Slightly flattened hemispherical body, with heavy rectangular lug carrying large tethering hole (D 0.022). Lug has been bent backward slightly on the axis of the hole. Shallow tallow cup divided by 4 heavy septa walls flush with lower surface of the weight. Nails were hammered slightly downward through the outer walls into each section of the tallow cup. Surface encrusted, lug bent slightly to one side. H 0.10; base D 0.113. 3.550 kg.

Ship L estimated at 15–18 m; cargo of amphoras.

Santamaria 1995, 106, fig. 124; Parker 1992, 168.

087. ITALY. Marzamemi (Siracusa). Wreck B (Church Wreck)? Class 3A: Squat Bell. A.D. 500–540.

Squat, bell-shaped body, with outturned rim, slightly concave sides, high rounded shoulder. Fine, ring-shaped suspension lug. Surface badly eroded by the sea. The deep, flat-roofed tallow cup is nearly as wide as the surviving portion of the body, leaving a very narrow foot. 2 nails were driven diagonally downward through the wall into the tallow cup. H 0.12; base D 0.145. 4.82 kg.

Siracusa, Museo Nazionale, no. A147.

G. Kapitän, personal communication, October 1990, found in 1963 (?) in area of the Marzamemi II wreck; Gibbins and Parker 1986, fig. 17; Parker 1992, 267.

088. ISRAEL. Dor. Byzantine Wreck, South Bay. Class 6B: Truncated Cone. A.D. 520–625. Fig. 6.

Tall, narrow, truncated conical body. Iron tethering ring cast into apex, consisting of a rod bent to form a loop (D ca. 0.02), with a long foot, much like a modern screw eye (H ca. 0.05). Small circular tallow cup in base. H ca. 0.18; base D ca. 0.072.

Raveh and Kingsley 1991, 202; Kingsley and Raveh 1996, 25 mention the discovery of a weight "almost identical" to the Dor South Bay weight no. PB04 (our cat. no. 149) on the Byzantine wreck excavated at Dor in 1985.

089. ISRAEL. Haifa. Haifa public beach; Byzantine wreck. Class 4B: Tall Bell. 6th–7th c. A.D.?

Tall, bell-shaped body with inward-sloping sides curving gently to a rounded shoulder. Very heavy, rectangular suspension lug. Shallow tallow cup with 4 thick, low septa walls, surrounded by a sharp, inturned lip, in part bent inward by impact. There are low bosses at the termination of each arm, at their intersection, and in the 4 wedge-shaped spaces they mark off. A cross with expanded terminations has been engraved on one side, the letter *rho* or *P* on the other, and there is a pattern of crosshatched chisel gashes on the upper surface of the suspension lug. H 0.225; base D 0.10. 11.0 kg.

Found in the area of a scattered Byzantine wreck, at the public beach south of Haifa, where cat. no. 090 was found, along with coins of the early 6th c. Galili, Sharvit, and Rosen 2000 say the cross is of a type found only in the 6th–7th c. A.D. and suggest that the 2 weights formed a set for shallow and deep water.

Israel Antiquities Authority, Marine Archaeology Branch, no. 98/2465.

Galili and Sharvit 1999a, 17, fig. 30.1; Galili and Sharvit 1999b, 172–173, fig. 12.5; Galili, Sharvit, and Rosen 2000.

090. ISRAEL. Haifa. Sporadic find off northern Israeli coast. Class 4B: Tall Bell. 6th–7th c. A.D.? Fig. 1.

Tall, bell-shaped body with inward-sloping sides curving gently to a rounded shoulder. Very heavy, rectangular suspension lug. Shallow tallow cup with 4 thick, low septa walls, surrounded by a sharp, inturned lip, in part bent inward by impact. There are low bosses at the termination of each arm, at their intersection, and in the 4 wedge-shaped spaces they mark off. A Maltese cross has been engraved on one side, the letter *rho* or *P* on the other, and 4 chisel gashes making an *M*, *W*, or *S* on the upper surface of the suspension lug. H 0.14; base D 0.065. 3.050 kg.

Galili, Sharvit, and Rosen 2000 suggest that this weight formed a set with cat. no. 089.

National Maritime Museum, Haifa.

Oleson 1994; Galili, Sharvit, and Rosen 2000.

091. ISRAEL. Dor. Disturbed wreck site, South Bay. Class 4A: Tall Bell. 7th c. A.D.

Nearly cylindrical body, tapering slightly upward to a flat suspension lug. The sides of the lug continue the profile of the body, while both faces are inside, leaving a marked shoulder. There is a small, smooth-walled, flat-roofed tallow cup in the base (depth 0.027). Traces of tallow from a bovine animal were found in the base. H 0.145; base D 0.085. 6.410 kg.

Found 30–40 m off shore in the South Bay, along with copper nails, a steelyard, and coins of the mid-7th c. A.D. No remains of the hull were found.

Rosen, Galili, and Sharvit 2001.

092. ISRAEL. Kfar Samir. Random offshore find. Class 4B: Tall Bell. Byzantine?

Tall bell-shaped body with slightly convex walls curving gently to a very heavy, square suspension lug. The exterior wall just below each face of the suspension hole has been engraved with a Latin cross with slightly spreading terminations. Deep, hemispherical tallow cup with 4 low septa walls. At the intersection of the walls, and at regular intervals around the interior of the cup, are large, projecting lead nipples. Nails were hammered into 3 of these. H 0.165; base D 0.115. 7.6 kg.

National Maritime Museum, storeroom.

Oleson 1988, 37, no. 32, p. 38, no. 10.

093. ISRAEL. Haifa. Random find off coast. Class 4A: Tall Bell. Byzantine? Marble.

Tall, bell-shaped body with slightly convex sides below a marked shoulder. Very heavy, rectangular suspension lug. No tallow cup. Carved from white marble. Dimensions not given; H ca. 0.21; base D ca. 0.11. 4.9 kg.

In the absence of a tallow cup, it is not certain that this stone object is a sounding weight rather than a balance weight. Found in vicinity of cat. no. 094. Galili and Sharvit 1999a state that the context cannot be dated, while in 1999b they assign the weight to a Byzantine assemblage.

Israel Antiquities Authority no. 96-1333.

Galili and Sharvit 1999a, 18, fig. 30.7; Galili and Sharvit 1999b, 173, fig. 12.7.

094. ISRAEL. Haifa. Random find off coast, Assemblage 17. Class 4A: Tall Bell. Byzantine?

Tall, straight-sided, octagonal body tapering slightly to a marked shoulder. The edges separating the 8 side facets are sharp. The heavy suspension lug continues the lines of the 2 side facets to a rounded apex. The tethering hole is cut close to the shoulder. No tallow cup. Dimensions not given; H ca. 0.15; base D ca. 0.063. 3.1 kg.

Given the absence of a tallow cup, it is not certain that this object is a sounding weight. The faceted sides are suggestive of recent sounding leads, but the ratio of thickness to height is much greater. Found in vicinity of cat. no. 093. Galili and Sharvit 1999a state that the context cannot be dated, while in 1999b they assign the weight to a Byzantine assemblage.

Israel Antiquities Authority no. 96-1332.

Galili and Sharvit 1999a, 18, fig. 30.5; Galili and Sharvit 1999b, 173, fig. 12.6.

095. ITALY. Vito Lo Capo (Trapani). S. Vito Lo Capo Wreck. Class 10: Post-Classical. 12th c. A.D.

Truncated pyramidal body; heavy square suspension lug.

G. Kapitän, personal communication, October 1996.

096. FRANCE. Agde. Site de la Roquille. Class 1A: Hemisphere. Date unknown.

Hemispherical body; heavy, ring-shaped suspension lug cast together with body of weight. Lug half lost to erosion. Very deep, hemispherical tallow cup with 4 projecting cross walls that extend to the level of the base. H 0.125; lower D 0.11.

Musée d'Archéologie Sous-Marine, Agde, no. 423.

Berard 1987, 42, no. 423.

097. FRANCE. Agde (Musée d'Archéologie Sous-Marine). Coastal survey? Class 1A: Hemisphere. Date unknown.

Hemispherical body. Heavy, ring-shaped suspension lug on apex. Deep, hemispherical cup containing 4 projecting cross walls inset slightly from the level of the base. H 0.16; lower D 0.17.

Musée d'Archéologie Sous-Marine, Agde, no. 424.

Berard 1987, 42, no. 424.

098. FRANCE. Agde (Musée d'Archéologie Sous-Marine). Coastal survey? Class 1A: Hemisphere. Date unknown.

Hemispherical body. Fine, ring-shaped suspension lug on apex, badly eroded. Deep, very rough hemispherical tallow cup with slightly projecting lip on interior. 7 nails were driven through the thin walls into the cup. H 0.13; lower D 0.16.

Musée d'Archéologie Sous-Marine, Agde, no. 426.

Berard 1987, 42, no. 426.

099. FRANCE. Agde. Coastal survey? Class 1A: Hemisphere. Date unknown.

Hemispherical body. Wide, thin, ring-shaped suspension lug cast together with body of weight. Deep tallow cup occupies most of the body, the domed roof marked by 2 low, rounded septa walls. H 0.13; base D 0.15.

Musée des Docks Romains, Marseilles, no. C 128.

Bouscaras 1964, 286, fig. 33; Benoît 1971, 397–398, fig. 1.2; Oleson 1988, 35, no. 8; Durand 1989, 89, no. C 128.

100. ISRAEL. Dor. South Bay. Class 1A: Hemisphere. Date unknown.

Weight no. 8 (PB08). Hemispherical body. Heavy square suspension lug with wide tethering hole (D 0.027). Shallow, flat-roofed tallow cup (0.018 deep). Badly eroded. H 0.09; base D 0.098.

Kingsley and Raveh 1996, 25, figs. 23–24.

101. ITALY. Arcipelago di Panarea (Aeolian Islands). Random offshore find. Class 1A: Hemisphere. Date unknown.

Slightly elongated hemispherical body. Small rectangular suspension lug on apex. Shallow, flat-roofed tallow cup with a recessed X mark in the roof. H 0.132; base D 0.117. 6.660 kg.

Inventory no. 6727.

Bernabò-Brea and Cavalier 1985, 79, fig. 72; G. Kapitän, Notebook.

102. ITALY. Caulonia. Sporadic find. Class 1A: Hemisphere. Date unknown.

Slightly elongated hemispherical body with tall suspension lug framing large square suspension hole (ca. 0.025 × 0.025). The shape resembles the Squat Bell shape, but the lip does not curve outward. The walls are thin, and a deep tallow cup with 4 low, thin septa walls occupies most of the body. Nipples project inward from the walls of each quadrant. There are 9 nail holes or corrosion holes through at least one side of the weight. The dimensions and scales are completely mixed up in the publication, but dimensions of this weight may be H 0.09; base D 0.082. 2.1 kg.

Deposito della Soprintendenza Archeologica, Monasterace Marina (RC), no. 78663.

Medaglia 2002, 167–168, pl. III.

103. ITALY. Gonnesa. Sporadic find. Class 1A: Hemisphere. Date unknown.

Salvi reports that Ignazio Sanna, a technician with the Soprintendenza Archeologica di Cagliari, found a hemispherical sounding lead “nelle acque di Gonnesa” not long before 1999.

Salvi 1999, 82, n. 27.

104. ITALY. Syracuse. Random offshore find near Syracuse. Class 1A: Hemisphere. Date unknown. Fig. 2.

Hemispherical body. Very heavy, tall, rectangular suspension lug. There is a slight ridge around the lug, just below the oval tethering hole. Deep, hemispherical tallow cup occupies nearly entire body of the weight. 4 thick septa walls extend to the base of the weight; a single, toothlike prong projects from the wall of each of the 4 sections marked off by the septa walls. H 0.115; base D 0.099. 2.975 kg.

Siracusa, Museo Nazionale, no. A86.

Gargallo 1961, 35, fig. 13; Gibbins and Parker 1986, fig. 17; Oleson 1988, 35, no. 7.

105. ITALY. Lampedusa. Lampedusa harbor, sporadic find. Class 1A: Hemisphere. Date unknown. Fig. 2.

Slightly elongated hemispherical body. A groove near the top sets off a slightly irregular rounded collar around the base of the heavy suspension lug. The tall lug flares outward from its junction with the weight; the lug and suspension hole are asymmetrical. The wide, shallow tallow cup has a flat roof with a cross in relief and a raised dot in each of the 4 fields demarcated by the septa walls. Slightly protruding interior lip. 5 or 6 iron nails were driven downward through the walls of the weight into the tallow cup at irregular intervals. H ca. 0.118; base D ca. 0.125.

Museo Nazionale, Agrigento.

G. Kapitän, Notebook.

106. ITALY. Arbus, Sardinia (Piscinas). Sporadic find. Class 1A: Hemisphere. Date unknown.

Hemispherical body carrying a very thick, heavy lug (W 0.063, H 0.04, Th 0.021) with small suspension hole (D 0.024). H 0.134; base D 0.13. The tallow cup (depth 0.045) is subdivided by 4 septa walls.

In 2000, the object was on display in the Hotel le Dune, Piscinas (Arbus).

Salvi 1999, 78, 82, fig. 3; Galasso 2000, 95–96, fig. 39.

107. ITALY. Punta Licosa (Cilento). Random offshore find. Class 1A: Hemisphere. Date unknown.

Hemispherical body. Heavy square suspension lug on apex. Tallow cup. H 0.045 (incomplete?); base D 0.073.

G. Kapitän, Notebook; Gianfrotta 1974, 107; Parker 1992, 355 mentions a wreck at this spot dating to 150–25 B.C.

108. ITALY. East coast of Sardinia. Class 1A: Hemisphere. Date unknown.

Slightly elongated hemispherical body. Heavy, slightly irregular or worn suspension lug on the rounded apex. Circumferential groove in base. Base slightly dimpled, possibly by corrosion, but no tallow cup. H 0.145; base D 0.132.

Found by Mr. Freidling of Keil (Peter Winterstein, oral communication, April 2001).

109. MALTA. Qawra Point, St. Paul's Bay. Random find. Class 1A: Hemisphere. Date unknown.

Slightly elongated hemispherical body. Small square suspension lug at apex. Deep hemispherical tallow cup (0.055 deep). 2 low septa walls form an X; one dot in relief in each of the 4 compartments. H 0.13; base D 0.126.

Archaeological museum, Valletta.

G. Kapitän, Notebook; Parker 1992, 363 notes a fragmentary wreck of A.D. 200–275, south of Qawra Point.

110. PORTUGAL. Portimão. Careanos beach. Class 1A: Hemisphere. Date unknown.

Squat hemispherical body. Very wide, thick, heavy suspension lug. Wide, deep tallow cup. 2 low, raised lines cross the roof of the cup, intersecting more or less at the center, and 12 thick, irregular fins project from the inside of the rim but do not continue up to the roof. H 0.145; lower D 0.175. 4.976 kg.

Found in dredge spoil from harbor.

De Castro and Rodrigues 1995; J.-Y. Blot, personal communication, 7 July 1995, reports that it was found in the spoil from a dredge in Portimão harbor; Francisco Alves, personal communication, 31 January 2000, provided dimensions and weights; António Cabrita, personal communication, 28 February 2000.

111. SPAIN. La Caleta, Isola di San Sebastian coastal survey. Class 1A: Hemisphere. Date unknown.

Slightly elongated hemispherical body. Ring-shaped suspension lug. Deep tallow cup divided by 8 low, regular septa walls radiating from central boss. H 0.10; base D 0.11. 7 kg.

Vallespin 1985, 67–68, fig. 4.13; Oleson 1988, 36, no. 11.

112. CROATIA. Hvar. Sporadic find. Class 1B: Hemisphere. Date unknown.

Slightly elongated hemispherical body with a dimple at the top in which there are 2 holes that held an iron suspension ring. The flat base carries 4 shallow recesses marked out by 4 low, thick septa walls that meet at a central circle. H 0.14; base D 0.14.

In the archaeological museum at Hvar.

Marinko Petric, personal communication, May 2001.

113. CROATIA. Palagruza. Sporadic find near Palagruza Island. Class 1B: Hemisphere. Date unknown.

Squat hemispherical body with a small, worn suspension lug at the crest. There is a slightly off-center, flat-ceilinged, smooth-walled tallow cup in the base. The weight appears to be badly worn. H 0.14; base D 0.14.

In a private collection in Hvar.
Marinko Petric, personal communication, 8 May 2001.

114. FRANCE. Île Jarre (Marseilles). Coastal survey? Class 1B: Hemisphere. Date unknown.
Hemispherical body, badly eroded by the sea. Suspension ring cast into apex. Very deep, smooth-walled tallow cup. H 0.13; base D 0.175.
Benoît 1962, 164, fig. 37; Oleson 1988, 35, no. 6.

115. ISRAEL. Newe Yam. Random offshore find. Class 1B: Hemisphere. Date unknown.
Slightly elongated hemispherical body with rounded apex. Iron ring cast into the apex. Flat base with inturned edge. No tallow cup. H 0.07; base D 0.095. 2.6 kg.
Given the absence of a tallow cup, this weight may not have served as a sounding weight.
National Maritime Museum storeroom, no inventory number.
Oleson 1988, 35, no. 4, p. 37, no. 2.

116. FRANCE. Cap Taillat (Saint-Tropez). Cape Taillat anchorage. Class 2A: Truncated Hemisphere. Date unknown. Fig. 2.
Truncated hemisphere. Ring-shaped suspension lug with heavy, square crown. Deep tallow cup with 4 thin, even septa walls. 7 or 8 iron nails were driven through the exterior wall into the cup. H 0.181; base D 0.205. Cat. no. 117bis is very similar.
Found in a refuge anchorage that also had many lead anchor stocks (Santamaria 1995, 106).
G. Kapitän, Notebook; Fiori and Joncheray 1973, 88, pl. 5.3; Gianfrotta and Pomey 1981, 288, no. 2; Oleson 1988, 36, no. 16; Fassitelli 1990, 61 (bottom); Santamaria 1995, 106.

117. ITALY. Fiumincino. Find spot unknown. Class 2A: Truncated Hemisphere. Date unknown.
Truncated hemispherical body; sides only slightly curving. Tall, heavy, suspension lug with flat top. Flat lower rim framing a smooth, flat-roofed tallow cup (ca. 0.05 deep). 4 large iron nails were driven through the walls into the cup near the base. H ca. 0.18; base D ca. 0.15.
In Museo delle Nave Romane at Portus (Fiumincino); provenience listed as unknown. Profile drawing in case, by G. Boetto. Label indicates "traces of pitch on interior," but only concretions are visible at present. Dimensions are estimated.
Unpublished?

117bis. MALTA. "Cove on SE coast." Class 2A: Truncated Hemisphere. Date unknown.
Truncated hemispherical body. Ring-shaped suspension lug with heavy, square crown. Deep tallow cup with rounded roof. There are several deep oval impressions in the lower rim, possibly intentional. H ca. 0.14; base D ca. 0.16. Shape very similar to cat. no. 116 but apparently without septa or nails in the cup.
Found by a local individual and shown to Cornuke.
Cornuke 2003, pl. 16.

118. ISRAEL. Dor. South Bay. Class 3B: Squat Bell. Date unknown. Fig. 2.
Weight no. 5 (PB05). Squat, bell-shaped body with slightly concave sides and wide, rounded apex. Iron suspension ring cast into the apex. Flat base. 9 iron nails (D 0.007) were driven diagonally downward through the walls ca. 0.01 above the base to form a tallow cage below it. H 0.092; base D 0.111.
Kingsley and Raveh 1996, 25, figs. 23–24.

119. ISRAEL. Haifa. Coastal survey south of Haifa. Class 3B: Squat Bell. Date unknown.
Squat bell-shaped body, with strongly outturned base, concave sides, and rounded apex. Iron suspension ring cast into apex. Shallow, smooth-walled tallow cup. 6 iron nails were driven diagonally downward through the edge of the base into the cup. H 0.10; base D 0.127. 5.2 kg.

National Maritime Museum, Haifa, no inventory number.
Oleson 1988, 37, no. 27, p. 38, no. 5.

120. ISRAEL. Caesarea. Random find off coast. Class 4A: Tall Bell. Date unknown.

Tall, straight-sided, octagonal body tapering slightly to a marked shoulder. The edges separating the 8 side facets are sharp. The heavy suspension lug continues the lines of the 2 side facets to a rounded apex. The tethering hole is cut close to the shoulder. No tallow cup. Dimensions not given; H ca. 0.12; base D ca. 0.07.

In the absence of a tallow cup, it is not certain that this object is a sounding weight. The faceted sides are suggestive of recent sounding leads (such as cat. nos. 159–160), but the ratio of thickness to height is much greater. Very similar to cat. no. 094.

Galili and Sharvit 1999b, 173, fig. 12.10.

121. ISRAEL. Haifa. Coastal survey south of Haifa. Class 4A: Tall Bell. Date unknown.

Tall, nearly cylindrical body, with straight sides tapering only slightly inward toward the sharply defined shoulder. Flat upper surface, carrying a wide, flat suspension lug that springs from the outer edges of the shoulder. Shallow, smooth-walled tallow cup with a deep central dimple and slightly projecting inner lip. H 0.145; base D 0.085. 5.100 kg.

National Maritime Museum, no. 4813/820.

Oleson 1988, 37, no. 28, p. 38, no. 6.

122. ISRAEL. Shikmona. Random offshore find. Class 4A: Tall Bell. Date unknown.

Nearly cylindrical body with well-defined, rounded shoulder and rounded apex. Heavy square suspension lug with wide tethering hole. Deep tallow cup with a slight inward lip and 4 thick, low septa walls radiating from a central boss, carrying 5 symmetrically placed knobs. H 0.10; base D 0.06. 1.65 kg.

National Maritime Museum, Haifa, no. 4194/600.

Kapitän 1969–1971, 60, pl. 10.8; Oleson 1988, 37, no. 29, p. 38, no. 7.

123. ISRAEL. Dor. South Bay. Class 4A: Tall Bell. Date unknown. Fig. 3.

Weight no. 2 (PB02). Tall, nearly cylindrical body, walls tapering in a straight line to a marked shoulder. Heavy square suspension lug with neat tethering hole (D 0.021) continues lines of the body to a flat upper surface. Very shallow tallow cup with a flat roof marked with irregular depressions. H 0.152; base D 0.08.

Kingsley and Raveh 1996, 25, figs. 23–24.

124. ISRAEL. Dor. South Bay. Class 4A: Tall Bell. Date unknown.

Weight no. 3 (PB03). Tall, nearly cylindrical body, the walls tapering in a straight line to a marked shoulder. Heavy square suspension lug with neat tethering hole (D 0.02) continues lines of the body to a flat upper surface. Base slightly concave with a small central hole (D 0.013). H 0.125; base D 0.084.

Kingsley and Raveh 1996, 25, figs. 23–24.

125. ITALY. Punta Torre S. Gennaro (Brindisi). Random find. Class 4A: Tall Bell. Date unknown.

Cylindrical body tapering slightly toward the rounded shoulder. Heavy square suspension lug, slightly wider at top than at base. Shallow, smooth, flat-roofed tallow cup (0.025 deep). H 0.14; base D 0.078. 3.530 kg.

Museo Provinciale, Brindisi.

G. Kapitän, Notebook, found 27 August 1970.

126. ISRAEL. Haifa. Random find off coast. Class 4B: Tall Bell. Date unknown.

Tall, bell-shaped body with slightly concave sides curving inward gently to a rounded shoulder. Very heavy, rectangular suspension lug. No tallow cup. Base has been rounded and spread by impact. Dimensions not given; H ca. 0.19; base D ca. 0.106. 8.4 kg.

In the absence of a tallow cup, it is not certain that this object is a sounding weight, but the distortion of the base suggests repeated contact with a hard surface.

Galili and Sharvit 1999b, 172, fig. 12.8.

127. ISRAEL. Haifa. Coastal survey south of Haifa. Class 4B: Tall Bell. Date unknown.

Tall, bell-shaped body with high, rounded shoulder. Heavy square suspension lug. Shallow tallow cup, with 4 slight, irregular indentations around a central boss. H 0.205; base D 0.11. 11.3 kg.

National Maritime Museum, Haifa, no. 4814/820.

Oleson 1988, 37, no. 30, p. 38, no. 8.

128. ISRAEL. Shikmona. Random offshore find. Class 4B: Tall Bell. Date unknown.

Tall, bell-shaped body with slightly concave sides curving gently to rounded shoulder. Heavy, rectangular suspension lug with wide, slightly off-center tethering hole. Deep, flat-roofed tallow cup with 4 thin, regular septa walls that extend as far as the base. The edge of the base carries a shallow circumferential groove. H 0.16; base D 0.09. 5.09 kg.

National Maritime Museum, Haifa, no. 695.7.

Kapitän 1969–1971, 60, pl. 10.7; Oleson 1988, 37, no. 31, p. 38, no. 9.

129. ISRAEL. Dor. South Bay. Class 4B: Tall Bell? Date unknown. Fig. 3.

Weight no. 7 (PB07). Wide, bell-shaped body with convex sides tapering upward to a marked shoulder. The heavy, square suspension lug is pierced by a wide tethering hole (D 0.028). Slightly irregular, shallow tallow cup (0.023 deep) with smooth, rounded roof. Several nails were driven through the base into the tallow cup. H 0.119; base D 0.124.

Kingsley and Raveh 1996, 25, figs. 23–24.

130. ISRAEL. Haifa antiquities dealer (1990). Off north coast of Israel. Class 4B: Tall Bell? Date unknown.

Relatively short, almost conical body, but with markedly convex walls. Heavy square suspension lug with wide, neat hole. Shallow tallow cup with slightly domed roof crossed by 2 thin, low septa walls. A rounded knob projects from the wall of the cup in 2 of the compartments delineated by the septa walls. H ca. 0.18; base D ca. 0.15.

L. Vann, personal communication, 1990, reported on display in antiquities shop in Haifa; said to be a sporadic offshore find.

131. ITALY. Brindisi area. Class 4B: Tall Bell? Date unknown.

Cylindrical body with slightly convex sides, tapering slightly to a heavy, flat suspension lug. The shoulder is poorly defined. The photograph does not reveal whether or not a tallow cup is present. H ca. 0.21; base D ca. 0.10.

Gianfrotta 1999, fig. 10.

132. TURKEY. Bodrum. Find spot unknown. Class 4B: Tall Bell. Date unknown.

Tall, bell-shaped body with inward-sloping sides curving gently to a rounded shoulder. Very heavy, rectangular suspension lug. Shallow tallow cup with 4 thick, low septa walls inset slightly from the base. 4 nails were driven downward through the walls into the 4 sections of the cup. H 0.16; base D 0.123. 5.380 kg.

G. Kapitän, Notebook, measurements sent by F. Carrazé, 7 October 1971.

133. ISRAEL. Haifa. Random find off coast. Class 4C: Tall Bell with Added Suspension Lug. Date unknown.

Tall body with convex sides tapering to a rounded apex, into which a metal suspension ring was cast. No tallow cup. Dimensions not given; H ca. 0.13.4; base D ca. 0.12.

In the absence of a tallow cup and nail holes, the function of this weight is uncertain. Nevertheless, the design is similar to that of cat. no. 071, and the base is deformed by impact.

Galili and Sharvit 1999b, 173, fig. 12.9.

134. CROATIA. Adratic. Sporadic find. Class 5A: Cone. Date unknown.

Tall, steep-sided conical body, terminating in a thick, heavy suspension lug. The apex of the cone is flattened to form the front and back of the lug. The base carries a thin-walled, shallow, flat-roofed tallow cup with smooth walls. A horizontal groove circles the weight just above the base. H 0.21; base D 0.135.

Vrsalovic 1979, 80, no. 1.

135. CROATIA. Adratic. Sporadic find. Class 5A: Cone. Date unknown.

Tall, steep-sided conical body, terminating in a thick, heavy suspension lug that projects above the apex of the cone. The base carries a thin-walled, shallow, flat-roofed tallow cup with smooth walls. 12 nail holes pierce the tallow cup walls at regular intervals just below the roof. H 0.215; base D 0.145.

Vrsalovic 1979, 80, no. 2.

136. FRANCE. Agde. Coastal survey? Class 5A: Cone. Date unknown.

Conical body with slightly concave sides. Apex pierced and slightly flattened to form a ringlike suspension lug. Tallow cup offset slightly to one side and heavily concreted. Possibly no cross walls, but a slightly inturned lip. H 0.165; base D 0.14.

Musée d'Archéologie Sous-Marine, Agde, no. 425.

Berard 1987, 42, no. 425.

137. FRANCE. Carro, Cap Monguilan. Coastal survey. Class 5A: Cone. Date unknown.

Conical body with slightly concave sides. Apex pierced to form a narrow suspension lug, 0.09 sq. Flat-roofed tallow cup with 4 thick septa walls forming a cross. H 0.20; base D 0.155. 13 kg.

Benoît 1961, 179–180, fig. 95; Benoît 1971, 397–398, "C 123," fig. 1.1; Oleson 1988, 36, no. 22; Durand 1989, 88, no. C 123.

138. FRANCE. Cros-de-Cagnes (or Cagnes-sur-Mer). Coastal survey. Class 5A: Cone. Date unknown.

Straight-sided conical body. The apex is slightly flattened to form an irregularly rectangular suspension lug. Slightly projecting, rounded rim around base, probably resulting from impact. Shallow, flat-roofed tallow cup marked by 4 low septa walls that intersect at a low, round boss. A thick, sharp-edged rim projects inward.

Benoît 1971, 398, fig. 1.3.

139. ISRAEL. Apollonia. Coastal survey. Class 5A: Cone. Date unknown.

Weight 2 ("b" "93-70"). Conical body, tapering upward from rounded lower edge to heavy suspension ring with projecting, rounded outline. Very worn or eroded. Tethering hole D ca. 0.027. Shallow, rounded, smooth-walled tallow cup ca. 0.015 deep. 22 nails were driven through the lower edge, 18 of them penetrating into the tallow cup. Two intersecting pairs of parallel lines were cut into one side, at an angle of 30 degrees to the base. H 0.18; lower D ca. 0.137. 13.5 kg.

Found together with the identically shaped, but larger, cat. no. 140.

Galili, Dahari, and Sharvit 1993, 63–64; Grossman 1994, 247–248, figs. 1.b, 2.b.

140. ISRAEL. Apollonia. Coastal survey. Class 5A: Cone. Date unknown.

Weight 3 ("c" "93-71"). Conical body, tapering upward from rounded lower edge to heavy suspension ring with projecting, rounded outline. Tethering hole D ca. 0.03. Body worn or eroded. Shallow, rounded, smooth tallow cup ca. 0.015 deep. 12 nails driven into the lower edge may have penetrated into the tallow cup, but the details are obscured by concretions. H 0.23; lower D ca. 0.175. 19.0 kg.

Found together with the identically shaped, but smaller, cat. no. 139. This weight is extraordinarily heavy, but the presence of nail holes in the base suggests that it was in fact used for taking soundings.

Galili, Dahari, and Sharvit 1993, 63–64; Grossman 1994, 247–248, figs. 1.b, 2.b.

141. ISRAEL. Haifa? Random offshore find. 5A: Cone. Date unknown.

Tall conical body; apex flattened and expanded to form a heavy rectangular suspension lug with central tethering hole. Shallow, hemispherical tallow cup with many thin, random septa walls produced by chopping at the mold. There are 10 nail holes through the rim. H ca. 0.26; base D 0.22. 20.5 kg.

Donated to the Israel Antiquities Authority by R. Wirtheim.

Publication under preparation by U. Galili, J. P. Oleson, and B. Rosen.

142. ISRAEL. Palmachim. Random offshore find. Class 5A: Cone. Date unknown.

Tall, narrow conical body; apex flattened and expanded to form a heavy rectangular suspension lug with central tethering hole. Shallow, flat-roofed tallow cup with horizontally ridged wall. H 0.165; base D 0.086. 4.3 kg.

National Maritime Museum storeroom, no. 175-T.

Oleson 1988, 37, no. 26, p. 38, no. 4.

143. ITALY. Arbus, Sardinia (Piscinas). Sporadic find. Class 5A: Cone. Date unknown.

Conical body with straight sides sloping steeply to a very thick, heavy lug (W 0.065, H 0.045, Th 0.02) with small suspension hole (D 0.012). There are 2 nail holes in the wall of the shallow (depth 0.015) tallow cup. H 0.19, base D 0.14–0.13.

In 2000, the object was on display in the Hotel le Dune, Piscinas.

Salvi 1999, 77, 82, fig. 3; Galasso 2000, 95–96, fig. 39.

144. ITALY. Brindisi area. Class 5A: Cone. Date unknown.

Thin, tall conical body with slightly concave sides, tapering to a rounded suspension lug. Photograph does not show whether a tallow cup is present. H ca. 0.20; base D ca. 0.10.

G. Kapitän, Notebook. Recovered 25 August 1970 by Luigi Zongoli (librarian at Biblioteca communale) from scrap metal shop run by Mr. Rigattiere.

145. ITALY. Brindisi region. Sporadic find. Class 5A: Cone. Date unknown. Fig. 3.

Conical body. Apex flattened to form a small, square suspension lug, pierced by a tethering hole (D 0.03) set slightly into the top of the body. Shallow, flat-roofed tallow cup (0.02 deep) with central dimple. H 0.185; base D 0.138. 11.480 kg.

Museo Provinciale, Brindisi.

G. Kapitän, Notebook. Recovered 25 August 1970 by Luigi Zongoli (librarian at Biblioteca communale) from scrap metal shop run by Mr. Rigattiere.

146. ITALY. Isola di Lido (Venice). Coastal survey. Class 5A: Cone. Date unknown.

Tall, conical body with slightly irregular sides. The apex is flattened slightly and pierced to form a heavy suspension lug. Deep tallow cup. Found with Roman Imperial material in survey of waters close to Isola di Lido.

Malnati and Fozzati 1997, 33.

147. ITALY. Marsala (Palermo). Marsala, sporadic find. Class 5A: Cone. Date unknown. Fig. 2.

Conical body with slightly concave sides. Apex flattened and pierced to form a suspension lug. Deep, hemispherical tallow cup with 8 thin, high septa walls. H 0.148; lower D 0.12.

Private collection in Palermo.

G. Kapitän, Notebook, drawing and photo, taken 1968.

148. PORTUGAL. Portimão. Careanos beach. Class 5A: Cone. Date unknown.

Approximately conical body, with slightly convex sides and slightly rounded apex. Approximately square suspension lug. Very deep, conical, thin-walled tallow cup; the thin walls have bent inward slightly at several points, probably from impact. 5 thin, low septa walls spread outward symmetrically from a central dot to the base of the weight. 2 thin lead nipples project inward from the walls of the cup near the top and the bottom of each section delimited by the septa walls.

Francisco Alves, personal communication, 24 January 2000, found in spoil from harbor dredging; António Cabrita, personal communication, 28 February 2000, says that he has "one other Roman and one possibly Carthaginian sounding-weight" from rivers along the coast of Portugal.

149. ISRAEL. Dor. South Bay. Class 5B: Cone. Date unknown. Fig. 3.

Weight no. 4 (PB04). Slightly irregular conical body with rounded apex. Bronze suspension ring (partly preserved; D 0.034, Th 0.006) cast into apex. Flat base. 9 iron nails (one surviving) were driven through the wall just above the base to form a cage for the tallow. Traces of rope or flax were found within the holes, and rope was found wound around the one surviving nail. H 0.144 (without ring); base D 0.111.

Kingsley and Raveh 1996, 25 mention the discovery of a weight "almost identical" to this weight on the Byzantine wreck excavated at Dor in 1985.

150. ISRAEL. Haifa. Random find off coast. Class 5B: Cone. Date unknown.

Conical body with rounded apex into which a metal tethering lug has been cast. Shallow, rounded tallow cup. 14 nails were driven downward through the wall near the base, into the tallow cup. Dimensions not given; H ca. 0.18; base D ca. 0.18.

Galili and Sharvit 1999b, 173, fig. 12.11.

151. FRANCE. Agde. Coastal survey? Class 6A: Truncated Cone. Date unknown.

Truncated conical body, straight sides sloping inward to a marked shoulder. Heavy, square, flattened suspension lug. Shallow, flat-roofed tallow cup. 4 nails were driven downward through the walls from the exterior into the cup. Foot expanded slightly by impact. H 0.17; lower D 0.15.

Musée d'Archéologie Sous-Marine, Agde, no. 427.

Berard 1987, 42, no. 427.

152. FRANCE. Agde. Coastal survey? Class 6A: Truncated Cone. Date unknown.

Worn and possibly distorted by bending and denting. Marked, rounded shoulder above a spreading body that seems originally to have been conical, with straight sides. At present, part of the circumference of the base is bent inward, below a portion of the wall that has taken a dished shape, giving this portion of the body a slight bell shape. Heavy, square, flattened suspension lug. Very deep, smooth-walled, hemispherical tallow cup, with a sharp, inward projecting lip. H 0.12; lower D 0.13.

Musée d'Archéologie Sous-Marine, Agde, no. 428.

Berard 1987, 42, no. 428.

153. FRANCE. La Chrétienne. La Chrétienne M Wreck? Class 6A: Truncated Cone. Date unknown.

Badly corroded, portion of lower rim missing. Truncated conical body, slightly distorted by corrosion or mechanical damage. Traces of iron ring. Upper surface slightly convex and marked off from outer wall by groove. H ca. 0.08; base D ca. 0.088.

Found with scattered material from 3 shipwrecks dating 5th c. B.C.–1st c. A.D. The weight does not have to belong to any of these wrecks.

Joncheray and Joncheray 2002, 126.

154. ITALY. Cagliari area. Waters off headland between Nora and S. Margherita. Class 6A: Truncated Cone. Date unknown. Fig. 4.

Squat, truncated conical body, with straight sides tapering upward to a marked shoulder. Heavy, flat square suspension lug, the sides of which are set slightly inside the shoulder, on the flat upper surface (D 0.082).

Circumferential groove in base. Very deep (0.065 deep), flat-roofed tallow cup with 8 high, narrow septa walls extending two-thirds of the way to the base. One nail hole in wall of cup. H 0.168; base D 0.196. 12.5 kg.

G. Kapitän, Notebook.

155. ITALY. Isole Pedagne (Brindisi). Random find. Class 6A: Truncated Cone. Date unknown.

Squat, truncated conical body, with slightly concave sides; flat-topped apex, slightly flattened and pierced with tethering hole. Deep, conical, smooth-walled tallow cup (0.058 deep). 4 nails were driven through the wall into the cup. H 0.10; base D 0.08–0.10.

Museo Provinciale.

G. Kapitän, Notebook, says weight found near wreck "with stamped Roman oil amphoras"; Parker 1992, 305 and Gianfrotta 1974, 107 may refer to this wreck.

156. LEBANON. El-Mina (Tripoli). Offshore survey? Class 6A: Truncated Cone. Date unknown.

Squat, truncated conical body, straight sides tapering upward slightly to a marked shoulder. Heavy, square, flat suspension lug, the sides of which roughly continue the line of the body walls. Flat base. Lead badly eroded by the sea. H 0.10; base D 0.086. 3.325 kg.

G. Kapitän, Notebook; Amadouni 1973, 11, inv. no. T 58.

157. ITALY. Caulonia. Sporadic find. Class 6B: Truncated Cone. Date unknown.

Steep-sided truncated conical body, the top surface slightly rounded by corrosion. There is a hole—"S-shaped in section"—in the top surface left by decay of the iron suspension lug. The lower rim is rounded, framing a flat-topped tallow cup with smooth walls. There is a small notch in the inside face of the tallow cup wall at one point. H 0.112; base D 0.11. 2.42 kg.

Deposito della Soprintendenza Archeologica, Monasterace Marina (RC), no. 78662.

Medaglia 2002, 167–168, pl. III.

158. ITALY. Procida (Naples). Random offshore find? Class 6B: Truncated Cone. Date unknown.

Badly eroded, truncated conical body. Narrow vertical hole from upper surface to tallow cup, probably to hold suspension ring. Shallow, dished tallow cup with at least 4 low septa walls. Several nails were driven diagonally downward through base of wall into cup. H ca. 0.09; base D ca. 0.14.

G. Kapitän, Notebook, with information provided by Gianfrotta.

159. FRANCE. Agde. Wreck G. Class 7A/10: Tapering Bar/Post-Classical. Modern?

Long, tapering, barlike body is worn on exterior but seems originally to have been octagonal in section. Lead suspension lug cast together with body of weight. Shallow cup in base, with central hole possibly intended for nail. H 0.305; lower D 0.07.

The wreck dates 5th–2nd c. B.C., but the shape of the sounding lead is modern.

Musée d'Archéologie Sous-Marine, Agde, no. 429.

Berard 1987, 42, no. 429; Parker 1992, 45.

160. FRANCE. Grand Congloué (Marseilles). Grand Congloué Wrecks A and B. Class 7A/10: Tapering Bar/Post-Classical. Modern?

Tapering bar with roughly rectangular cross-section; the thickest portion of the bar is round in section. H 0.255; lower D 0.06. 5 kg.

Benoît 1961, 179, pl. 31.16; Benoît 1971, 397; Kapitän 1969–1971, 57, n. 15; Oleson 1988, 35, no. 3.

161. CROATIA. Adratic. Sporadic find. Class 8/9: Miscellaneous/Doubtful. Date unknown.

The weight appears to be badly corroded, making determination of the shape class difficult. The squat, flat-topped body has an oval base, convex sides, and a flat crest with 2 holes connected by a semicircular tunnel. The tunnel appears to have a diameter of 0.02, so it may have held a rope suspension loop rather than an iron ring. This feature, and the absence of a tallow cup in the base, suggest that the object served some other purpose than that of a sounding weight—perhaps a diving weight. H 0.095; base D 0.20 × 15.5.

Vrsalovic 1979, 80, no. 3.

162. CROATIA. Palagruza. Sporadic find near Palagruza Island. Class 8: Miscellaneous. Date unknown.

Most likely a truncated pyramidal body with rectangular cross-section; two off-center suspension holes through narrower upper end. Straight sides; edges seem to have been rounded by abrasion. No tallow cup. H 0.13; base D 0.12.

Given the absence of a tallow cup, this is unlikely to have been a sounding weight. The object seems heavy for a fishing weight, so it may have served as a diver's weight.

In a private collection in Hvar.

Marinko Petric, personal communication, 8 May 2001.

163. ISRAEL. Apollonia. Coastal survey. Class 8: Miscellaneous. Date unknown.

Weight 1 ("a"). Irregular body. Viewed on the axis of the tethering hole (D ca. 0.014), the sides are straight, sloping inward slightly to the angular shoulder, and continued by the sides of the heavy suspension lug. The lug has a flat upper surface. Seen from the side, the body has a tall, rounded shape with a step cut or cast into its upper third to form the apparent shoulder and suspension lug. 5 slashes (L 0.004–0.005) have been cut into the exterior on one side, 3 in a row, and one above and one below the central slash. Shallow, rounded, smooth tallow cup ca. 0.015 deep. H 0.13; lower D ca. 0.084. 6.0 kg.

Galili, Dahari, and Sharvit 1993, 63–64; Grossman 1994, 247–248, figs. 1.a, 2.a.

164. ITALY. Sola di Lévanzo (Trapani). Random find. Class 8: Miscellaneous. Stone. Date unknown.

Swelling, roughly oval, purse- or pillow-shaped basalt (? "pietra vulcanica") sounding weight. Covered with marine encrustation. A small tethering hole (D ca. 0.015) has been cut through a narrow flange that runs along the crest. Smooth tallow cup (D 0.045) in the base. H 0.14; W at crest 0.065; W at base 0.09. Cup 0.02 deep. 1.800 kg.

This weight is very close in design and dimensions to cat. no. 033. Unfortunately, like 033, it was found without context on the seafloor at a depth of 20 m.

Medas 1999.

165. FRANCE. Agde. La Souillère Wreck. Class 9: Doubtful. Date unknown.

Long, tapering, barlike body is worn on exterior but seems originally to have been octagonal in section. Very thick suspension lug cast together with body of weight and not flattened. Shallow tallow cup in base. Approximately 10 nails were hammered into the sides at an upright angle. Possibly a modern net retriever? H 0.30?; lower D 0.06.

Musée d'Archéologie Sous-Marine, Agde, no. 430.

Berard 1987, 42, no. 430.

166. ISRAEL. Dor. South Bay. Class 9: Doubtful. Date unknown. Fig. 4.

Weight no. 1 (PB01). Tall, narrow, barlike body tapering from a circular base to an approximately rectangular cross-section. The apex has been pierced for a tethering hole (D 0.012). Convex base without tallow cup. H 0.154; base D 0.079.

The absence of any mechanism for holding tallow suggests that this weight may have been used for some other purpose than sounding.

Kingsley and Raveh 1996, 24–25, figs. 23–24.

167. ISRAEL. Dor. South Bay. Class 9: Doubtful. Date unknown. Fig. 4.

Weight no. 6 (PB06). Approximately cylindrical body, tapering upward slightly to a heavy, flattened suspension lug with rounded apex. Neat suspension hole (D 0.02). Convex base below bulge. H 0.125; base D 0.082.

The excavators suggest that this may have been a steelyard weight rather than a sounding weight. The absence of a tallow cup suggests some function other than sounding.

Kingsley and Raveh 1996, 25, figs. 23–24.

168. TURKEY. Ulu Burun. Later contamination near Ulu Burun Wreck. Class 10: Post-Classical. Date unknown.

During metal detector search of 200 m^2 around the wreck site, a "small sounding lead" was found, along with other "ancient contaminants such as net and fish-line sinkers." The weight was elongated, biconical, with a square tethering lug at one end. It may be a weight used by recent fishing boats to "feel" the bottom. L 0.08; max W 0.018.

Pulak 1993, 11; Pulak, personal communication 30 December 1999.

169. CROATIA. Dubrovnik, Pomorski musej JAZU. Find spot, shape, chronology unknown.

Only wide base visible in photo. Deep tallow cup with 4 or 5 septa walls.

Vrsalovic 1974, 141, no. 194.

170. FRANCE. Golfe de Fos. Find spot, shape, chronology unknown.

No information on shape. H 0.11; D 0.09.

Musée des Docks Romains, Marseilles, no. C 646.

Durand 1989, 88, no. C 646.

171. FRANCE. Marseilles. Find spot, shape, chronology unknown.

H 0.15; base D 0.15.

Musée des Docks Romains, Marseilles, no. C 331.

Durand 1989, 87, no. C 331.

172. FRANCE. Niolon. Find spot, shape, chronology unknown.

H 0.28; base D 0.28.

Musée des Docks Romains, Marseilles, no. C 144.

Durand 1989, 88, no. C 646.

173. FRANCE. Baie de Cavalière (Le Lavandou). Random find? Shape and chronology unknown.

H 0.12; lower D 0.125.

Location unknown, no. 3519.

Anon. 1984, no. 149.

174. ITALY. Marina di Ragusa. Random find. Shape and chronology unknown.

G. Kapitän, personal communication, 20 November 1997.

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