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A Roman Steelyard with a Control Inscription from the Roman Imperial Period in the Pera Museum

YAVUZ SELİM GÜLER*

Abstract

The Suna and İnan Kıraç Foundation Pera Museum founded in 2005 stands out as an institution promoting research on the history of measurement with one of its permanent collections: the Anatolian Weights and Measures Collection. The collection holds a wide range of steelyards dating to the Roman, Byzantine, and Ottoman periods. Among these objects, a Roman steelyard comes into prominence with its unique control inscriptions dated to the reign of Emperor Commodus (AD 180-192). This article introduces an unpublished steelyard, which shows how Romans maintained the integrity of their steelyards. It evaluates the physical characteristics and metrology of the steelyard, and provides an epigraphic analysis of the inscription compared with similar control inscriptions of weighing and measuring equipment from the Roman Imperial period. The inscription contributes to our understanding of the verification process of the steelyard by the officials after its manufacture.

Keywords: Commodus, Rome, steelyard, measurement, epigraphy, inspection

Öz

2005 yılında kurulan Suna ve İnan Kıraç Vakfı Pera Müzesi, Anadolu Ağırlık ve Ölçüleri Koleksiyonu ile ölçüm tarihi üzerine yapılan çalışmaları destekleyen bir kurum olarak öne çıkmaktadır. Müze'nin koleksiyonu, Roma, Osmanlı ve Bizans dönemlerine tarihlenen geniş bir kantar seçkisine sahiptir. Bu eserler arasında, üzerindeki İmparator Commodus Dönemi'ne (MS 180-192) tarihlenen kontrol damgasıyla nadir bir Roma kantarı öne çıkmaktadır ve bu makale, Romalıların kantarlarını nasıl denetlediğini gösteren yayımlanmamış bu kantarı tanıtmaktadır. Makale, kantarın fiziksel özelliklerini ve metrolojisini değerlendirmektedir ve benzer kontrol damgalarıyla kantarın üzerinde bulunan yazıtın epigrafik analizini yapmaktadır. Yazıt, üretimden sonra kantarın resmi merciler tarafından onaylanma sürecini anlamlandırmamızı sağlamaktadır.

Anahtar Kelimeler: Commodus, Roma, kantar, ölçüm, epigrafi, kontrol

Introduction

A steelyard (Lat. *statera*, Gr. κάμπανος) is a weighing instrument with two unequal ends and works with the law of the lever. It consists of a beam scale (sg. *scapus*), suspension hooks (pl. *ansae*), a counterweight (sg. *aequipondium*), and a suspension apparatus (sg. *lancula*). The beam contains unit signs (pl. *puncta*) and pivot points (pl. *fulcra*).[1] Although the principles of a simple unequal-arm balance had been known since the late fifth century BC in Greece, the

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1 For Vitruvius' explanation of the working principles of a Roman steelyard, see his *De arch.* 10.3.4.

steelyard mechanism developed in the Hellenistic period. The earliest examples of steelyards dated to the first century BC and were found in Italy. Archaeological studies show that steelyard became widespread across the Roman Empire in the first to second centuries AD.[2]

It came into prominence as an important invention in the history of measurement because of its practical usage. The user only needs to read the graduation mark, which the counterweight shows when the steelyard is in equilibrium. In this way, the steelyard as a portable equipment enabled the users to weigh a wide range of commodities.[3] Apart from its practical usage, a complex mechanism lays behind, which should be precise in order to weigh goods and commodities accurately. Therefore, the production and assemblage processes would be monitored carefully, which is rarely verified with inscriptions.[4]

This article examines the Roman steelyard with Latin inscriptions of official control from the Pera Museum.[5] First, it describes the physical attributions of the steelyard and assesses the production process of the object. Secondly, the article discusses the metrology of the steelyard to reveal its weighing capacity. In the end, it analyzes the steelyard's inscriptions by providing an epigraphic autopsy and comparing the inscriptions with other known examples of Roman steelyards. Since there is no study focusing on steelyard control inscriptions, the article fills the lacuna in the literature by compiling all the published steelyards with the control stamp from the Capitoline Hill in Rome and evaluates the Pera Museum steelyard within the context of monitoring in the marketplace.

Physical Characteristics of the Steelyard

The copper-alloy steelyard consists of a steelyard bar square in section cast in a single mould (fig. 1).[6] Two suspension hooks with spiral-shaped links hang down from the fulcrum holes.[7] There are traces of a lead piece affixed onto the fulcrum bar to calibrate a minor error or an inaccuracy in measurement.[8] The surface of the steelyard is coated with a patina and contains traces of corrosion. Unfortunately, the original counterweight and the suspension apparatus have not been preserved.[9]

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2 For the discussion on the technical development of the steelyard mechanism and the reason why it became widespread during the Roman Imperial period, see Büttner and Renn 2016.

3 *The Book of the Prefect* compiled by Emperor Leo VI (886-912) provides a testimony stating which commodity should be weighed with a steelyard or an equal-arm balance. Although it is a later source, the account shows that steelyards continued to be used for weighing a wide range of heavier products in the marketplace; see Kolias and Chrone 2010.

4 For examples of inscribed steelyards from the Roman Imperial period, see table 3.

5 The Pera Museum acquired the steelyard in 2007 from Haluk Perk, a private collector in Türkiye. The steelyard was registered to the inventory of the Anatolian Weights and Measures Collection with the inventory number PMA 4917.

6 For the terminology about steelyard equipment used in this article, see Sams 1982.

7 The steelyard bar, weighing 141 grams in total, is composed of a bar 288 mm long with five sections:
1) Beam scale: 207 mm; thickness: 9 mm; diameter of the biconical finial: 15 mm.
2) Fulcrum bar: 81 mm; width: 13 mm; thickness: 5 mm.
3) Hole for affixing the suspension apparatus: outer diameter: 21 mm; inner diameter: 10 mm.
4) Fulcrum hole 1: outer diameter: 15 mm; inner diameter: 7 mm; suspension hook attached to fulcrum hole 2: max length: 72 mm.
5) Fulcrum hole 2: outer diameter: 14 mm; inner diameter: 9 mm; suspension hook attached to fulcrum hole 3: max. length: 74 mm.

8 For a similar example of an added lead piece on a Roman steelyard, see Zahn 1913, 7.

9 The counterweight could be made of lead with a biconical or globular shape. For examples with complete steelyard equipment, see Vincze 2019, 58-61.

The beam scale contains graduation marks on two faces and is oriented at an angle of 45 degrees with respect to the fulcrum bar, which facilitates the reading of the graduation marks.[10] The graduation marks are either incised or inscribed with punched dots. Since steelyards needed special adjustments by the producer, the calibration might have been carefully applied by inscribing minor and major increments on the beam scale after the casting of the beam scale.[11]

The steelyard in the Pera Museum can be classified as "Typus Pompeii."[12] It shares characteristics of this type such as spiral connections of the suspension hooks, a biconical finial, and a large hole for a suspension apparatus on the right side of the fulcrum bar. Since the archaeological context is not known for most of these examples, it is a challenge to understand the spread of the "Typus Pompeii" geographically. Such steelyards with a context were found in Spain and Italy, but there are many steelyards in the inventories of the museums in France, Italy, Spain, Germany, Austria, the Netherlands, Portugal and the United Kingdom.[13] Since there is no information about the context of the steelyard in the Pera Museum, it is not possible to understand its origin. There are examples of Typus Pompeii in private collections in Türkiye, but these examples do not have any archaeological context as well.

Metrology

TABLE 1 Graduation marks.

Face	Graduation Marks
1	I S I S [X]V S I S I S I S I S X S I S I S I S I S V IIII S I
2	I . . . . . S . . . . . I . . . . . S . . . . . I . . . . . S I

The Pera steelyard has two faces with graduation marks on the beam scale. Throughout the article, the faces of the steelyard with graduation marks are referred to as "Face 1" and "Face 2" according to the order of the aforementioned fulcrum holes. On the steelyard, Roman numerals represent major increments in weight, whereas short vertical lines, indicated with "." marks, show minor calibrations in weight.[14]

"Face 1" has incised-Roman numerals on the beam scale. The letter "S," which is the abbreviation of a *semis* of a *libra*, shows in punched dots half-*uncia* increments. Discernable marks on "Face 1" show a capacity of weighing between three-*libra* and seventeen-*libra*. On "Face 2" the longer lines stand for the increments in *libra*. Shorter lines, which divide the intervals between the longer vertical lines into twelve equal intervals, represent increments in *uncia*. Therefore, every six-*uncia* was indicated with the letter "S" in punched dots, which is the abbreviation of a *semis* of a *libra*. Therefore, discernable marks on "Face 2" show a capacity of weighing between one-*libra* and four-*libra*. The steelyard, in general, has graduation marks

10 Kardyras 1998.

11 There were several stages in the production and calibration process of a Roman steelyard, which included the manufacturer and the officials for the monitoring; see Corti 2019, 156-58.

12 Norbert Franken categorized the Roman and Byzantine steelyards according to their physical characteristics. For the characteristics of the "Typus Pompeii," see Franken 1994, 77-81.

13 The topoi research project (D-5-5), "Between knowledge and innovation: the unequal armed balance," provides an extensive database of the steelyards from museum inventories and excavations. For "Typus Pompeii" examples, see Büttner et al. 2016.

14 Since the Romans hung steelyards from the right, the increments in weight were shown in retrograde numerals. For a discussion on steelyards, see Mutz 1983, 17-21.

indicating weighing capacities between one-*libra* and four-*libra* as well as three-*libra* and seventeen-*libra*. Another limitation is to calculate the real equivalence of the graduation marks in grams because of the missing equipment. These include the suspension apparatus, which was most probably a scale pan, and the counterweight. Therefore, our research can only reveal the theoretical metrology of the steelyard.[15]

Inscriptions

TABLE 2 Inscriptions.

Face	Inscription	Transliteration	Translation
1 (fig. 2)	IMP ANTONIN CAES AVG · COM	Imp(eratore) Caes(are) Antonin(o) Aug(usto) Com(modo)	During the reign of Emperor Caesar Antoninus Augustus Commodus
2 (fig. 3)	EX · AC · INCAPITOL IO	Exac(ta) in Capitolio	Examined in Capitol

Inscriptions are found on both sides of the fulcrum bar. These were inscribed with letters in punched dots. The letter heights are between 4-6 mm. The inscriptions provide information about the chronology and reveal the inspection process of the steelyard.

To date, only very few Roman steelyards with inscriptions has been published and examined in detail. Among the steelyard with inscriptions, very few contain inscriptions which help to date the steelyards.[16] These inscriptions on steelyards refer to the names of the emperors Claudius, Vespasian, Trajan, and Marcus Aurelius with their exact dates (table 3).

TABLE 3 Roman steelyards with "exacta in Capitolio" inscription.

Museum/Collection	Context	Length	Date	Inscription	Reference
Museo archeologico nazionale di Napoli (Inv. no: 74039)	Herculaneum (Naples, Italy)	N/A	AD 47	TI(berio) CLAVD(io) CAES(are) AVG(usto) IIII, L(ucio) VITEL(lio) III CO(n)S(ulibus) EXACTA AD ARTIC(uleiana) CVRA AEDIL(ium)	*DarSag* 3(2), 1228; *ILS* 3(1), 965.
Musée du Petit Palais (Inv. No: DUT 96)	Campania (Italy)	N/A	AD 47	TI CLAV CAS IIII L VITEL COS	*ILS* 3(1), 965-66.
La Colección de Pesas y Medidas del Ayuntamiento de Valencia (Inv. no: N/A)	Vicinity of El Saler Beach (Valencia, Spain)	690 mm	AD 74-75	IMP(eratori) CAESARI VESPASIANO AVG(usto) PON(tifice) MAX(imo) TRI(bunicia) P(otestati) VI IMP(erator) XIIII P(ater) P(atriae) CO(n)S(ule) DES(ignato) EXACTA IN CAPITOLIO	Izquierdo and Ramón 1998.

15 See Sams 1982 for the discussion on Yassıada steelyards.

16 For an overview of Roman steelyards, see Franken 1994. See Corti 2019 for steelyards stamped with inscriptions of their producers.

Museum/Collection	Context	Length	Date	Inscription	Reference
Museo archeologico nazionale di Napoli (Inv. no: 74056)	Herculaneum (Naples, Italy)	N/A	AD 77	IMP(eratore) VESP(asiano) AVG(usto) IIX T(ito) IMP(eratoris) AVG(usti) F(ilio) VI CO(n)S(ulibus) EXACTA I(n) CAPITOLIO	*DarSag* 3(2), 1228; *ILS* 3(1), 965.
Museo Archeologico di Sagunto (Inv. no: N/A)	Maritime archeological find (Valencia, Spain)	545 mm	AD 112	IMP(eratore) CAE(sare) NERVA TRAIANO AVG(usto) GER(manico) DAC(ico) CO(n)S(ule) VI EX A(cta) IN CAPITOLIO	Aranegui Gascó 1989.
Staatliche Museen zu Berlin (Inv. no: 30218)	Vicinity of Tiber (Rome, Italy)	204 mm	AD 161	IMP(eratore) CAES(are) M(arco) AVREL(io) ANTONIN(o) IMP(eratore) CAES(are) L(ucio) AVRELIO VERO AVG(usto) CO(n)S(ule) II EX(acta) INCAPITOLIO	Zahn 1913, 1-10.

On Face 1 is found the inscription giving the date of the Pera steelyard. The inscription in the ablative case gives the meaning "during the reign of," and the titles in the inscription belong to Emperor Commodus. In contrast to the steelyards with the names of the emperors, the inscription on the Pera steelyard does not mention the exact year of inspection. This could be understood by the reference to the *consul designatus* and the *tribunicia potestas*. However, it was not a unique case for weighing equipment because there are bronze weights examined in the temple of Castor and Pollux in Rome without the consular year of the emperor.[17] Nevertheless, it is a challenge to determine the exact year of the monitoring of the steelyard. For this reason, only a relative chronology can be given. Commodus received the title IMP CAES (*imperator caesar*) before July 17, AD 180 and since died in December 31, AD 192,[18] the inscription can be dated between AD 180-192.

Face 2 refers to the place where the equipment was controlled. The word "*exacta*" is the perfect passive participle of "*exigo*" in the ablative. It has a special meaning "to control" for the verification of weighing equipment in Latin.[19] "*In Capitolio*" indicates the place where the steelyard was inspected, which was the Capitoline Hill in Rome. This location was one of the places where weighing equipment was kept, and *aediles* supervised and carried out the examination of weights.[20] Another location mentioned on the steelyards was Articuleianum, which can be seen in table 3. It was most probably located near the Capitoline Hill and used by the *aediles*.[21]

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17 One of the locations for weighing equipment was the Temple of Castor and Pollux in the Forum. The weights from the first and second century AD contain control inscriptions indicating that they were inspected in the temple of Castor and Pollux. The weighing equipment were kept and money exchange services were conducted in the temple. There were also accounts referring to senators depositing money during the Imperial period; see Juv. 14.259-60; Cic. *Quinct.* 17; Luciani and Lucchelli 2016, 267-68.

18 For a discussion on the chronology of the Roman emperors, see Kienast et al. 2017, 140-42.

19 For a discussion on "*exigo,"* see Luciani and Lucchelli 2016, 267-68.

20 Aranegui Gasco 1989; Zahn 1913, 7-8.

21 Articuleianum had a connection with the gens Articuleius from the Augustan period. For a discussion see Berrendonner 2009, 355.

A Prototype Sent to the Provinces?

The Roman steelyard in the Pera Museum was controlled by the officials in the Capitoline Hill during the reign of Commodus (AD 180-192). However, it is important to consider that the control by the state also showed that steelyards were a public instrument.[22] Steelyards, which were part of *intrumenta publica* such as weights and equal arm balances, were controlled by local authorities such as *aediles*, *agoranomoi*, and *metronomoi*.[23] There are examples of equal arm balances[24] as well as weights, which mention both the emperor and the official authorities including the *agoranomos*.[25] For this reason, it is necessary to consider the steelyard as an object belonging to the state and showing the standards adjusted by its officials.

If we consider the steelyards with archaeological context, we arrive at certain conclusions. On one hand, most of the examples with the *exacta in Capitolio* inscription have an archaeological context in Italy. On the other hand, there are examples found in a maritime context in Spain.[26] These examples may be prototypes sent by the capital to the provinces for local authorities to duplicate weighing equipment in correct measure. Later accounts from the fourth and fifth centuries AD refer to weights shipped to the provinces from the capital to set out the reference weights.[27] For this reason, the steelyard might have been a "reference" equipment sent to the provinces that may have become a symbol for assuring the quality of equipment across the empire. Since there are very few published examples of Roman steelyards with control inscriptions, this article has aimed to contribute to the understanding of how Roman officials might have handled fraudulent activities in weighing. New discoveries in museums and excavations will provide new evidence for "certified" steelyards in the Roman Imperial period.

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22 Berrendonner 2009.

23 For a discussion on the officials in the market place in antiquity, see Tekin 2016, 29-34.

24 See a discussion of the BANNAF equal arm balance pan, see Güler 2022. For a general overview of these stamped pans, see Krier 2008.

25 For Late Roman lead weights from Pontus and Bithynia with the names of *agoranomoi*, see Dönmez-Öztürk et al. 2008.

26 Franken 1993. For examples of the steelyards with *exacta in Capitolio*, see table 3.

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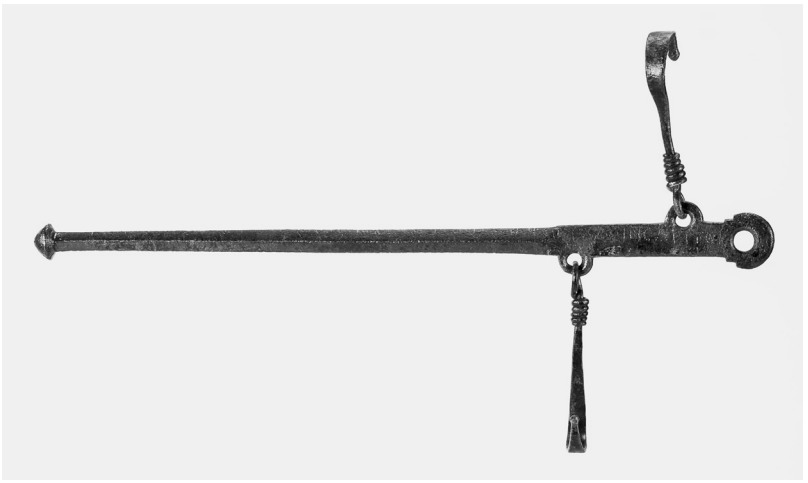

FIG. 1
General view of the steelyard.

FIG. 2
Inscription on the fulcrum bar of face 1.

FIG. 3
Inscription on the fulcrum bar of face 2.