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Ivory from Muziris*

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Abstract: The extant portion of the verso side of the "Muziris papyrus" (PVindob G 40822 v = SB XVIII 13617 v) contains the monetary evaluation of three-quarters of an Indian cargo loaded on the ship *Hermapollon*. Among the commodities are 167 elephant tusks weighing 3,228.5 kgs and *schidai* weighing 538.5 kgs. It is argued that *schidai* are fragments of tusks trimmed away from captive elephants. A comparison with commercial ivory lots of the early sixteenth century shows the selected quality of the tusks loaded on the *Hermapollon*.

Subjects: India--Relations--Rome, Ivory industry, Economic history--to 500.

Introduction

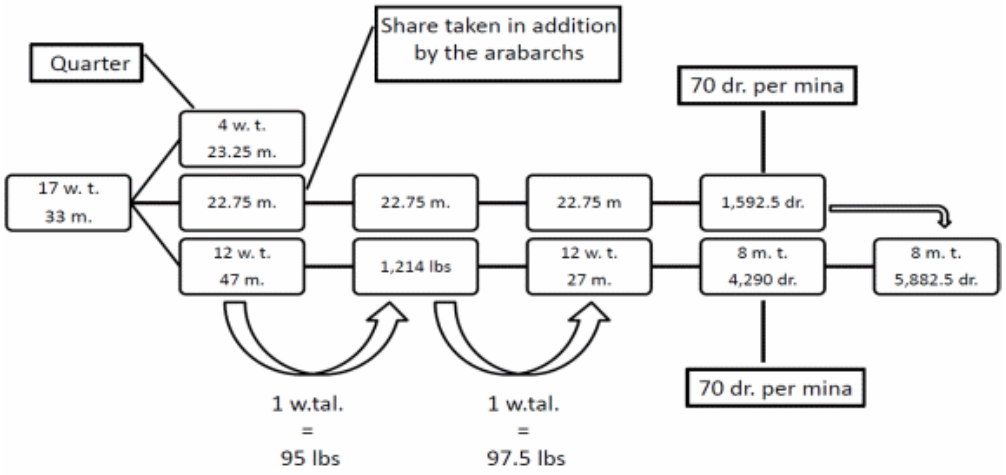
The texts on the Papyrus Vindobonensis G 40822,[1] now widely known as the "Muziris papyrus," will be remembered as among the most significant pieces of evidence related to Indo-Roman trade published in the twentieth century, and the more we understand them, the more important they become. The extant portion of the text on the verso contains the monetary evaluation of three-quarters of the South Indian cargo loaded on the ship *Hermapollon* (probably at Muziris, mentioned in the text on the recto), and two recent papers, one by Federico Morelli and the other by me, have proposed an almost complete reconstruction of the evaluated commodities. Both papers emphasized, albeit in very different measures, the predominant share of pepper and *malabathron* in the cargo, the two main exports from the Limyrike emporia.[2] Both Morelli and I came to recognize that the 771 money talents and 4,632 *drachmae* recorded at col. i, ll. 25-26[3] are the value of (almost) three-quarters of the pepper cargo, but while Morelli suggests that that value resulted from a price of 24 *drachmae* per *mina*, I contend that a price of 6 *drachmae* per *mina* is the only price that can account for the position of other numerical values in the text. Moreover, both Morelli and I interpret the weight number at col. i, l. 18 as the weight of three-quarters of the *malabathron* cargo, but while he reads the first two digits as 1,200 and assumes a price of 20 *drachmae* per *mina*, I read them as 1,800 and deduce a price of 12 *drachmae* per *mina*. Finally, I assume that the *Hermapollon*'s cargo included another commodity, evaluated at col. i, ll. 14-16, which might have been tortoise shell. In this paper I would like to focus on two other commodities exported on the *Hermapollon*: the "sound" ivory tusks and the *schidai*. As the meaning of the Greek term *schidai* in the papyrus is disputed, it makes better sense to analyze the two commodities in reverse order of their appearance in the document. Therefore, we shall start with the *schidai* and later consider the "sound" ivory.

Schidai, ivory of lower value.

As we shall see, *schidai* represent less than 1% of the entire value of the *Hermapollon*'s cargo, and their weight was little more than half a ton. Yet a correct understanding of this entry will have a significant

impact on the general interpretation of the text, and may shed some light both on the Cēra kingdom to which the ancient Muziris belonged and on the ivory trade on the ancient Indian Ocean.

In the papyrological documents, the Greek term σχίδαι (*schidai*) occurs only on the verso of the Muziris papyrus col. ii, ll. 16 and 25. In that portion of the text—col. ii, ll. 16-25—the value of three-quarters of the *schidai* brought back by the *Hermapollon* is calculated. The evaluation follows the complex pattern by which the three-quarters of "sound" ivory is assessed at col. ii, ll. 4-15. From the weight number representing the three-quarters (13 weight talents and 9.75 *minae*), a small parcel (22.75 *minae*), which is said to be "taken in addition by the arabarchs[4] for the *tetartologia*," is removed. The rest (12 weight talents and 47 *minae*) is converted twice, first into Roman pounds at the ratio of 1 Egyptian talent to 95 Roman pounds, and then back into Egyptian talents at the ratio of 97.5 Roman pounds : 1 Egyptian talent. The resulting weight number (12 weight talents and 27 *minae*), at the price of 70 *drachmae* per *mina*, leads to a value of 8 money talents and 4,290 *drachmae*. Then the 22.75 *minae* that had been "taken in addition by the arabarchs for the *tetartologia*" are multiplied for the same price of 70 *drachmae* per *mina*: the result is 1,592.5 *drachmae*. By adding the two subtotals, a value of 8 money talents and 5,882.5 *drachmae* is obtained.



From the entire quantity to the value of the three-quarters of the *schidai*

Figure 1. From the entire quantity to the value of the three-quarters of the *schidai*.

As Rathbone first understood and Morelli now confirms, 13 weight talents and 9.75 *minae* are just three-quarters of the *schidai* exported on the *Hermapollon*. The entire quantity was the weight number recorded at col. i, l. 10, that is, 17 weight talents and 33 *minae*, from which one quarter (4 weight talents and 23.25 *minae*) was removed.

Since the talent referred to here is equivalent to 95 Roman pounds, the *schidai* weighed around 538.5 kgs. But what exactly is a *schida*? Drawing on Hesychius' entry <σχίδα>· σχίδος σινδόνος, πῆγμα (*schida*: division of a garment, fabric),[5] Harrauer and Sijpesteijn, the first editors of the papyrus, understood the term as referring to "a detached piece of a larger whole σινδών, a bale of cloth."[6] Although neither σχίδαι nor σινδόνες (cloths, garments) are mentioned in the *Periplus Maris Erythraei* as Limyrike commodities,[7] Harrauer and Sijpesteijn pointed out that the *Periplus Maris Erythraei* does mention σινδόνες among the exports from the Ganges emporion,[8] and that Gangetic nard, another typical Ganges commodity[9] imported by the *Hermapollon*,[10] also appears among the commodities available in the Limyrike emporia.[11] The implicit suggestion was that both Gangetic nard and "excellent Gangetic garments" were exported from the Ganges emporion to Muziris and from there re-exported to Egypt.

Harrauer and Sijpesteijn considered the possibility that in P.Vindob. G 40822 verso col. ii, ll. 16; 25 σχιδῶν could be a misspelling for σχιζῶν,[12] but they rejected the idea that it could have meant "Holzscheit."[13] They also rejected a connection with Hesychius' lemma σχίδια· ὠμόλινα, on the grounds that "raw Flax" (ὠμόλινα), a typical Egyptian product, is unlikely to appear among the imports from India.[14]

The interpretations of Harrauer and Sijpesteijn, basically accepted or unquestioned by subsequent scholars,[15] were challenged by Rathbone. Considering σχίδα as only a variant of σχίζα (piece of wood cut off, lath, splinter), Rathbone suggested that the *schidai* were fragments of elephant tusks and thus distinct from the "sound ivory" (ἐλέφας ὑγιής) mentioned at col. ii, l. 4 of the same text, which were entire tusks.[16] Rathbone buttressed his interpretation observing 1) that the μέν at col. ii, l. 4 and a δέ to be read at col. ii, l. 16[17] structured the phrase so as to contrast the sound ivory and the *schidai*;[18] and 2) that the value of the unspecified ivory (ἐλέφας), lost with the lacuna at col. ii, l. 26, must have merged the value of the sound ivory with that of the *schidai*. To me, Rathbone's argument seems decisive on this point: if *schidai* were not ivory, the μέν at col. ii, l. 4, would be a strange μέν *solitarium*; and if *schidai* were not ivory, then we

could not explain—except as a clerical error—why the clerk records again the value of an unspecified ivory, after having already calculated the value of the *schidai*. Reasonable as it seemed at the time, the interpretation of the first editors does not accord as well with the context as does Rathbone's reading.

Fragments or imperfect tusks?

That said, the sense of the contrast between sound ivory and *schidai* still remains to be properly understood. The difference of price between sound ivory (100 *drachmae* per *mina*) and *schidai* (70 *drachmae* per *mina*) makes it clear that *schidai* were ivory of secondary quality. However, was their quality secondary because they were "accidental fragments rather than sawn pieces" of ivory, as Rathbone assumed? The question is far from trifling, not least because it is pivotal for determining the nature of the arabarchs' share.

According to Rathbone, the evaluation preserved in the papyrus concerns only three-quarters of the *Hermapollon's* cargo because one-quarter of the commodities would have been removed to pay the quarter-tax in kind. Consistently, the rationale of the share "taken in addition by the arabarchs for the quarter-tax" is seen as a way to simplify the practical division of sound ivory and *schidai,* two commodities from which an exact weight was not easy to extract.[19] In other words, since it was impossible for the arabarchs to take exactly 25% of the ivory weights without sawing the tusks or the fragments (and thereby damaging the commodity), they took a little more than 25%: 11.75 *minae* (around 6 kgs), in the case of sound ivory; as much as 22.75 *minae* (around 11.6 kgs), in the case of the *schidai*.

The contradiction inherent in Rathbone's argument was understood by Morelli, who follows Rathbone in assuming that the quarter-tax was paid in kind and that the function of the shares taken in addition by the arabarchs was to ease the payment in kind of the quarter-tax of commodities such as ivory tusks and *schidai*.[20] Precisely for that reason, however, Morelli is reluctant to accept Rathbone's conclusion that *schidai* were accidental fragments of tusks. His implicit reasoning is clear: if the 22.75 *minae* (= 11.6 kgs) taken in addition by the arabarchs are only a fraction of the weight of the smallest *schida* of the lot*,* the Greek term cannot refer to tusk fragments, but must refer rather to entire tusks that were imperfect in some way—spoiled or cracked or only slightly broken. In other words, the *schidai* were in fact whole tusks, but not sound.[21]

There is very little doubt that the entry of sound ivory (ἐλέφας ὑγιής) refers to entire tusks: at col. ii, ll. 12 and 13 the same commodity is mentioned as ὀδόντες, "teeth," and at col. i, l. 5 the figure 167 must be precisely the number of the tusks, as Morelli recognized.[22] It is equally unquestionable that the adjective "sound" (ὑγιής) implies an assessment of the quality of the tusks, determining which tusk is sound and which is not.[23] Nonetheless, the assumption that just two terms, sound ivory and *schidai,* could cover the entire spectrum of possible ivory classifications is unwarranted, and the fact that in this document sound ivory and *schidai* are opposed to each other does not guarantee that any tusk deemed not sound is by default a *schida*, or that a *schida*, as such, cannot be sound. In my view, the undeniable connection of σχίδα with the verb σχίζω (split, divide, cut out, tear) and the parallelism with σχίζα and σχίδαξ (piece of wood cut off) strongly favor Rathbone's translation as "fragments."[24] The fact that the arabarchs "took in addition" as much as 22.75 *minae* should not bias our understanding of the Greek term. Nor should we assume that those fragments were necessarily unsound or accidental. Indeed, many of them were made on purpose and taken from perfectly sound tusks.

The *schidai* of the Muziris papyrus can hardly be identified with what elsewhere is called περιπρίσματα or παραπρίσματα,[25] namely, waste from the ivory carvers' shops: the difference between the price of the tusks (100 *drachmae* per *mina*) and that of the *schidai* (70 *drachmae* per *mina*) is too small to address the gap in value between entire tusks and small scraps.[26]

In order to justify his translation of the term *schidai*, Rathbone recalled a passage by Pliny the Elder, in which the elephants are said to deliberately break their tusks in order to escape from hunters: 'They themselves [sc. the elephants] know that the only thing in them that makes desirable plunder is in their weapons […] and when surrounded by a party of hunters they post those with the smallest tusks in front, so that it may be thought not worth while to fight them, and afterwards when exhausted they break their tusks by dashing them against a tree, and ransom themselves at the price of the desired booty' (transl. by H. Rackham).[27]

This passage requires two clarifications. The first is that it is part of a section comprising several other *mirabilia* testifying to the quasi-human affective and cognitive capacities of the elephant[28]—a rather popular topic in Western classical literature.[29] The second is that it attributes to elephants a tactic comparable to that ascribed to beavers, when they are chased down by hunters. Just like elephants, beavers

‘ransom themselves with that part of their body on account of which they are chiefly sought for.’[30] Whatever the truth behind it, we do not need to rely on this tale to explain the ivory fragments exported from Muziris. As a matter of fact, another more prosaic explanation is at hand. I propose, in fact, to identify the *schidai* as those fragments that are regularly trimmed from the tusks of captive elephants.

Tusk trimming is a standard practice in Kerala today,[31] but it was also common in ancient India, as is shown in some Sanskrit classical texts. Regular trimming of elephant tusks is mentioned in the *Arthaśāstra*, in the lines that end the section dedicated to the duties of the *hastyadhyakṣa*, the “superintendent of the elephants”:

> *danta-mūla-parīṇāha-dvi-guṇaṃ projjhya kalpayet /abde dvy-ardhe nadī-jānāṃ pañca-abde parvata-okasām//*
>
> Leaving the double length of the circumference of the tusk at the root, he should cut [sc. the rest], every two years and a half in the case of those [sc. elephants] from river-banks, every five years in the case of those from mountainous regions.[32]

Approximately the same rules are mentioned in Varāhamihira’s *Bṛhat Saṃhitā*:

> *dantasya mūlaparidhiṃ dvirāyataṃ prohya kalpayeccheṣam/ adhikamanūpacarāṇāṃ nyūnaṃ giricāriṇāṃ kiñcit//*
>
> Having left the double length of the circumference of the tooth at its root, cut the rest; more (often) in those elephants that live in the humid places, a little less often in those that live in the mountain.[33]

If we turn to Greek authors, the sawing of Indian elephant tusks is also referenced, although only as a practice limited to the few war elephants with unusually big tusks, by Cosmas Indicopleustes:

> ὀδόντας δὲ μεγάλους οἱ ἰνδικοὶ οὐκ ἔχουσιν, ἀλλὰ καὶ ἐὰν σχῶσι, πρίζουσιν αὐτοὺς διὰ τὸ βάρος, ἵνα μὴ βαρῇ αὐτοὺς ἐν τῷ πολέμῳ.
>
> The Indian elephants are not provided with large tusks, but should they have such, they saw them off, that their weight may not encumber them in war.[34]

The practice of leaving ‘the double length of the circumference of the tooth at its roots’ addresses the need to avoid cutting into the living pulp of the tusk.[35] The fact that elephants living in the mountains may get their tusks trimmed less often than those living by the riverbanks has been taken as a proof of a slower growth rate of tusks of the mountain elephants.[36]

Figure 2. Measuring the tusk (Photos courtesy Leju Kamal)

Figure 3. Trimming the tusk (Photos courtesy Leju Kamal)

Figure 4. Tusk trimmed (Photo courtesy Leju Kamal)

Figure 5. Reshaping the trimmed tusk with the chisel (Photo courtesy Dr. C. Gopakumar)

Figure 6. Reshaping the trimmed tusk with the file (Photo courtesy Dr. C. Gopakumar)

Figure 7. Fragment of tusk trimmed away (*schida*). (Photo courtesy Leju Kamal)

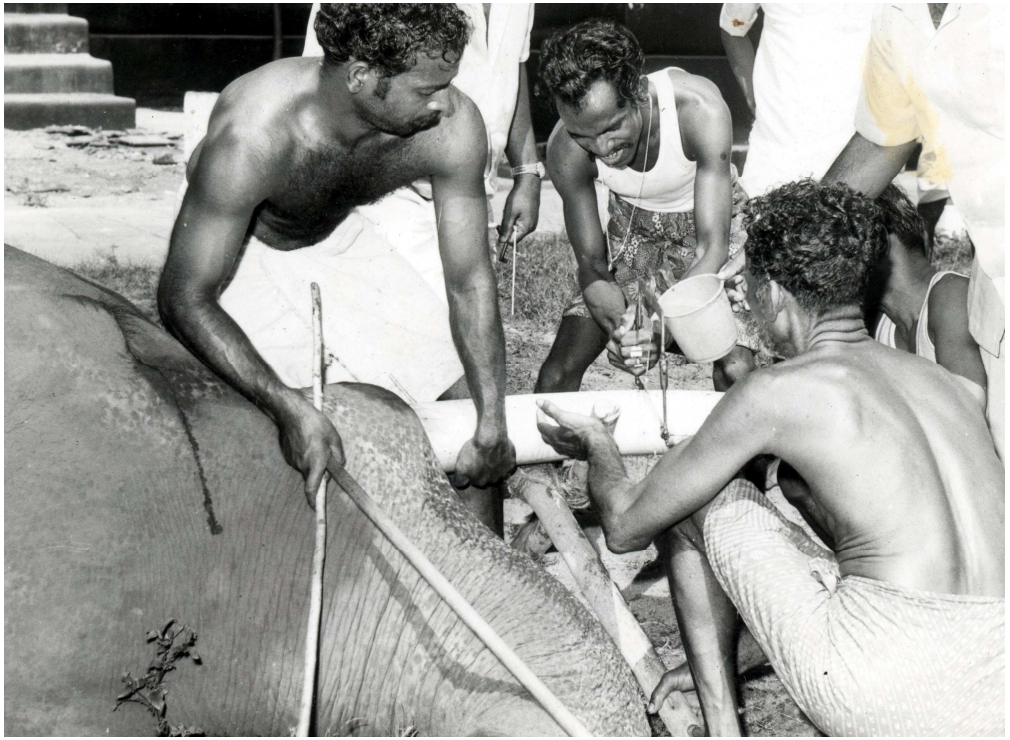


Figure 8. Tusk trimming, another example (Photo courtesy Prof. Dr. J.V.Cheeran)

Schidai and the arabarchs' share

If the above interpretation of the term σχίδα is correct, then there are consequences to be drawn related to the fiscal procedures implied in the Muziris papyrus. If the *schidai* mentioned in the text do refer to the remnants of ivory regularly trimmed away from tusks either every two and a half or every five years, then it follows that a *schida* normally weighed much less than an entire tusk, since the trimming has to leave 'the double length of the circumference of the tooth at its roots.' Therefore, the 22.75 *minae* (around 11.6 kgs) of *schidai* taken in addition by the arabarchs, far from being only a fraction of a *schida*, will equal several *schidai*. In conclusion, whatever was "taken in addition" was not randomly seized because it was impossible to do otherwise, but must have been rationally determined and deliberately "taken."

As a matter of fact, it seems that the shares of sound ivory and *schidai* taken by the arabarchs were arithmetically defined. The quota of sound ivory (11.75 *minae*) results from charging 1 *mina* for every 10

weight talents (1/600, ἑξακοσιοστή) of the total amount (105 weight talents and 13 *minae*, rounded up to 110 weight talents), plus the fraction of *mina* of the three-quarters (.75). Similarly, the quota of the σχίδαι (22.75 *minae*) results from charging 120 *drachmae* for every weight talent (1/50, πεντηκοστή) of the total amount (17 weight talents and 33 *minae*, rounded up to 18 weight talents, which makes 21.6 *minae*, rounded up to 22), plus the fraction of *mina* of the three-quarters (.75). If this explanation is correct, it follows that the share taken in addition by the arabarchs was nothing but a surcharge. Therefore, either the tax collector was able to levy in kind a quarter-tax plus surcharge based on weight and arithmetically determined—no matter the commodity—or else the calculations of the Muziris papyrus verso imply a payment of the total dues in the form of money.

Ivory and pepper values

As mentioned, in the Muziris papyrus the *schidai* have a lower value (70 *drachmae* per *mina*) than the entire tusks of sound ivory (100 *drachmae* per *mina*).[37] Both *schidai* and complete tusks in turn have values considerably higher than pepper.[38] The contrast with the Price Edict, in which ivory and pepper have maximum prices of 150 and 800 *denarii* respectively,[39] is evident. Since the values assumed by the Muziris papyrus and the maximum prices fixed by the Price Edict are meant to remain unaffected by the short-term supply-and-demand dynamics in any particular place in the Roman empire, the overturning of the hierarchy between the values of these two commodities was not due to episodic reasons. Indeed, such a radical change is likely to have been the result of complex factors that cannot be fully explored here. Nonetheless, it may be worth pointing out that the low valuation of pepper in the Muziris papyrus is also dependent on the direct voyages to South India of ships like the *Hermapollon.* The cessation of that relatively economical pattern of trade must have contributed to the higher prices of pepper in late antiquity.[40]

The contrasting dynamics of ivory values may in part be illuminated by Pliny's claim that in his time India, where only some of the male elephants have tusks,[41] was the major supplier of ivory.[42] If Pliny is to be trusted, then neither the excellent Adulis ivory nor the abundant, if inferior, Rhapta ivory,[43] nor any other East African ivory,[44] were major Mediterranean imports in the mid-first century CE. The potential of the African continent, where both male and female elephants have tusks, was thus only marginally exploited. By late antiquity, however, the volume of African ivory exported had likely substantially

increased,[45] as suggested by the emphasis in the *Expositio totius mundi et gentium* on the countless number of elephants of *India minor* (=East Africa)[46] and, less ambiguously, Cosmas Indicopleustes' remarks about the population of *Aithiopia*'s elephants and the scope of the export of their ivory.[47]

One final observation may be made on this subject: Cosmas Indicopleustes also noted that the African elephants had bigger tusks than the Indian elephants.[48] He was probably referring to African savanna elephants (*Loxodonta Africana Africana*), which tend to develop longer and thicker tusks than either the Asian elephant (*Elephas maximus*) or the even smaller African forest elephant (*Loxodonta Africana cyclotis*).[49] It has to be emphasized, though, that Cosmas' information cannot be taken as an indication that, in the first centuries of the Christian era, the traded African ivory comprised tusks that were *on average* bigger than those of the traded Asian ivory. Aside from the varying growth potential of different species, the average weight of the traded tusks would have depended on the selection strategies of hunters and merchants; hence the average weight per tusk of commercial lots of Asian ivory could have been higher than that of some African commercial lots. Therefore, it is not impossible—indeed, it is arguable, as we shall see—that the maximum price for ivory in the Price Edict was also influenced by the import of large quantities of African tusks of rather low average weight.

Schidai and royal elephants

While several of the commodities imported by the Roman ships from the Limyrike emporia were not home products of Malabar,[50] the ivory exported by the *Hermapollon*, both the entire tusks and the trimmings, was most probably a regional product. The availability of ivory at Muziris was facilitated by the fact that the Cēra kings who controlled Muziris also controlled inland forests rich in wild elephants; it is not coincidental that Cēra coins—also found at the site of Pattanam, most likely included in the Muziris area[51]—bear an elephant on their obverse.

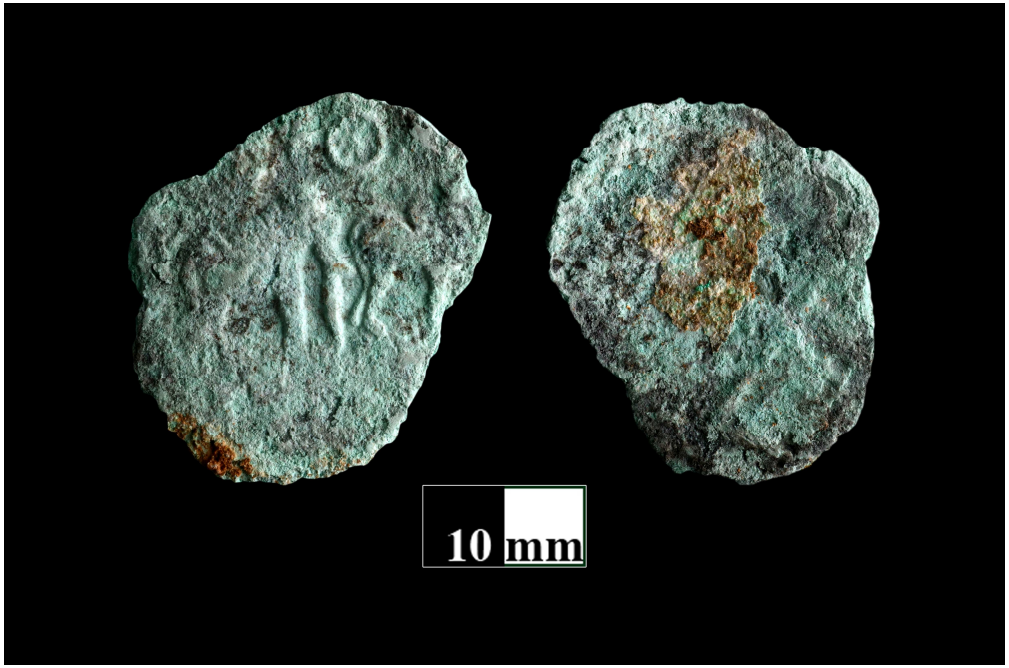

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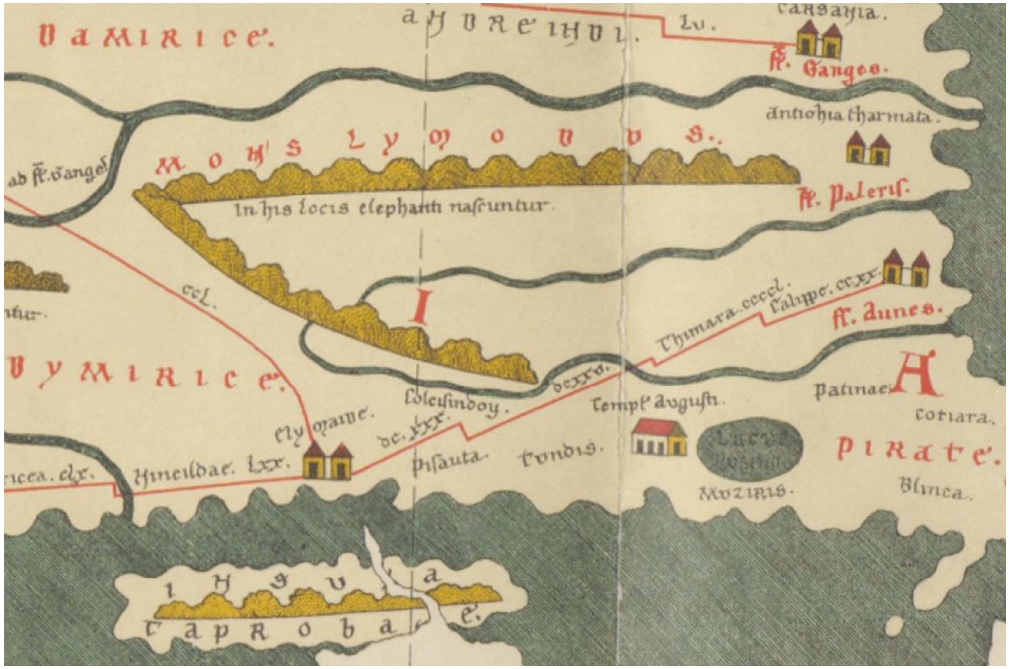
Figure 9. Cēra coins from Pattanam (Courtesy P. J. Cherian)

The abundance of elephants in the Cēra forests was the inspiration for the simile the poet Kunrukaṭpāliyātanār employed to address the Cēra king Cēramān Karuvūrēriya Oḷvāṭkōp Peruñcēral Irumporai:

> *erumai aṉṉa karuṅkal iṭai tōṟu,/ āṉiṟ parakkum yāṉaiya, muṉpiṉ,/kāṉaka nāṭaṉai*
>
> Are you the king of the forests where elephants spread to graze like cows amidst buffalo-like rocks?[52]

The conspicuous presence of elephants in the Muziris region is also reflected in the Peutinger Table, which has the caption 'in this place elephants are born,'[53] near what could be the Western Ghats (*Mons Lymodus*).



Figuere 10. Tabula Peutingeriana portion of Seg. XI as reproduced by K. Miller in 1887/8.

In ancient India, captive male elephants with big tusks[54] are a prerogative of the highest political authorities, and essential to their military strength. According to Megasthenes, only the king has the right to own horses and elephants,[55] and in the *Arthaśāstra*'s words the 'king's victory is mainly a matter of elephants.'[56] In the theory laid down by the *Tolkāppiyam*, the possession of war elephants[57] is a distinctive feature of the *aracar*.[58] It is likely that the term, a Tamilization of Skt. *rājan*-,[59] is meant to be inclusive of both *vēntar*, "kings" of the highest rank, and *vēḷir*, somewhat high dignitaries or more or less dependent chieftains.[60] At any rate, in *Caṅkam* literature many *vēḷir* are said to have (or to donate) captive elephants.[61] On the other hand, it is reasonable to assume that the regional pre-eminence of the

mūvēntar—the three major powers of the Cērar, Pāṇṭiyar, and Colar—was backed by the ownership of a higher number of war elephants. It will suffice here to quote a few lines in praise of the Cēra king Celvakkaṭuṅkōv Āliyātaṉ:

> You free the poets from poverty with the tribute that you receive from the inimical *maṉṉar*![62] The many male elephants perfect in action, who with their large rugged trunks and lifting tusks were stationed near the guarded forest of the *vēntu* (kingdom of a *vēntaṉ*, a 'king' of the highest rank), with their big necks with flower-like spots and fragrant cheeks smeared with dust, they moved dispersed here and there and destroyed the ramparts of the enemy.[63]

The 538.5 kgs of *schidai* shipped out by the *Hermapollon* were trimmings taken from captive elephants. As the tusks had to be trimmed leaving 'the double length of the circumference of the tusk at the root,' a *schida* could hardly weigh more than one-third of an entire tusk. More precisely, since the tusks of the captive elephants had to be trimmed every two and a half or every five years, the average weight of the *schidai* imported by the *Hermapollon* should have been between 1 and 7 kgs.[64] An export of 538.5 kgs of *schidai*, which must have numbered between 75 and 540 pieces,[65] could hardly have been achieved without the contribution of the trimmings from the large elephant contingent of the Cēra king, who controlled both the most famous of the Limyrike emporia and the forests where wild elephants abounded. If the quantity exported by the *Hermapollon* did not represent an exceptional peak, but was the routine annual export from Muziris or even less than that, then the Muziris export of *schidai* had to be sustained by a population of at least 380 captive adult male elephants.[66] This number is not far from the 500 or 600 elephants that Cosmas Indicopleustes attributes to several kings of the west coast of India—among them, the king of Male.[67]

Tusks, hunters and bandits

Aside from the tusks acquired from elephants that died in captivity, those exported from Muziris were largely from wild tuskers, killed by forest dwellers for their meat and their ivory:

> The hunter from the forest with mighty hands like iron, concealed behind a blooming Marāam tree, shoots choicest arrows, at the mighty chest of a tusker of speckled forehead, and plucks out the white tusks that with might destroy the foes; he plants them, in his hut thatched with

> grass […] The man from the mountain eats meat cooked on the flame of sandalwood, partying with relations, taking pleasure from toddy (transl. A. Dhakshinamurthy, with modifications).[68]

Caṅkam literature offers references to ivory trade undertaken by elephant hunters who are said to make their living by selling tusks. Quite interestingly, some of them are located in the western part of the Kolli hills, where Ōri, a minor chieftain to some extent dependent upon the Cēra kings,[69] rules:

> […]the western [side of] mount Kolli,/ [belonging to] Ōri with strong bow,/ where [people] eat by selling the tooth of the swift-eyed elephant/ when they are hungry in small homes (transl. E. Wilden).[70]

Another poem from *Caṅkam* literature records a chief of *Iḷaiyar*,[71] who keeps an elephant tusk in his home. Left with no money because his robbery business is stagnant, he trades his white tusk to satisfy his desire for alcohol.

> […]the chief of the strong bow and lawless life *Iḷaiyar*, who rob the trading caravan that moves along roads lined by dry bamboo, when he is exhausted by the sun, he visits the house of broad shouldered women with tattoos on their bellies where the toddy is sold. Unable to pay for it, he pats the small head of the running son and points out the white tusk of the forest elephant in musth […].[72]

The twofold activity of the *Iḷaiyar*—bandits at the expense of the travelling traders, as well as hunters of wild elephants in the forests—puts them on or beyond the fringe of the Cēra king's control and protection. Nonetheless, they too fuelled Muziris' trade.

Tusk comparisons

The tusks imported by the Hermapollon must have been carefully selected. They were not only "sound," as attested by the text, they were also rather large, as their average weight shows.

At col. ii, l. 13, Morelli rightly rejects the editors' reading καὶ τεταρτολογουμένων. Calling for a comparison with the 2,000 three-cubit-long tusks paraded by L. Aemilius Paulus in his triumph of 167 BCE,[73] he ingeniously reads διπήχεῳν ὅλων, "entire, two-cubit-long" tusks. Apart from the ending -λων, I can neither confirm Morelli's reading nor suggest any alternative. I can however emphasize that the total

weight of the tusks imported by the *Hermapollon* shows by itself that those 167 tusks were a selected lot, just as the reading διπήχεῳν ὅλων would imply. As a matter of fact, 167 tusks weighing 105 talents and 13 *minae* (= 3,228.5 kgs) have a rather high average weight of 37.8 *minae* (= 19.332 kgs) per tusk.[74] It is not that great a stretch from the average weight of the two tusks sold to Apollo's temple in Delos by Herakleides of Tyre (46.3125 *minae* per tusk)[75] or the thirty-four tusks donated by Ptolemy Auletes to the temple of Didyma (42.94 *minae* per tusk),[76] especially since the talent(s) implied by these inscriptions must have been lighter than the one used by the quarter-tax administration to weigh the *Hermapollon*'s cargo.[77]

However, those few tusks bought by or donated to a temple were likely of exceptional quality. A commercial lot such as the *Hermapollon* cargo is thus more appropriately compared with other commercial lots. Following this perspective, documents from the early sixteenth century may provide more useful evidence:

1. In 1506, Pero Ferreira Fogaça, *capitão* of Kilwa takes notice of a *zambuco* carrying 570 tusks weighing 92 *quintaes*, 2 *arrobas*, 31 *arrates* (= 5,448.95 kgs): the average weight is 9.56 kgs per tusk.[78]
2. January 18th 1507, Nuno Vaz Pereira, *capitão* of Sofala, orders delivery of 264 tusks and two pieces weighing 73 *quintaes*, 1 *arroba*, 20 *arates* (= 4,312.39 kgs): counting the two pieces as tusks, the average weight is 16.21 kgs per tusk.[79]
3. December 20th 1514, Álvaro de Bouro reports a sale of an ivory stock in Lisbon.[80] The document details not only the number of tusks and their total weight, but also the number of tusks contained in each of the thirteen lots of 6 *quintaes* (= 352.512 kgs), plus one lot of 4 *quintaes* and 24 *arrateis* (= 246.024 kgs) in which the stock has been divided and sold. Since the total weight of the 385 tusks was 82 *quintaes* and 24 *arrateis* (= 4,828.68 kgs), the average weight per tusk was 12.542 kgs. However, the different lots have very different average weights: they range from 20.736 kgs to 4.641 kgs per tusk.

Weight	**Tusks**	**Average weight**
6 *quintaes* (= 352.512 kgs)	17	20.736 kgs
6 *quintaes* (= 352.512 kgs)	17	20.736 kgs
6 *quintaes* (= 352.512 kgs)	19	18.553 kgs

6 *quintaes* (= 352.512 kgs)	20	17.625 kgs
6 *quintaes* (= 352.512 kgs)	21	16.786 kgs
6 *quintaes* (= 352.512 kgs)	22	16.023 kgs
6 *quintaes* (= 352.512 kgs)	22	16.023 kgs
6 *quintaes* (= 352.512 kgs)	22	16.023 kgs
6 *quintaes* (= 352.512 kgs)	26	13.558 kgs
6 *quintaes* (= 352.512 kgs)	26	13.558 kgs
6 *quintaes* (= 352.512 kgs)	28	12.589 kgs
6 *quintaes* (= 352.512 kgs)	38	9.276 kgs
6 *quintaes* (= 352.512 kgs)	54	6.528 kgs
4 *quintaes* 24 *arrateis* (= 246.024 kgs)	53	4.641 kgs
Total		
82 *quintaes* 24 *arrateis* (= 4,828.68 kgs)	385	12.542 kgs

Table 1. Average weight per tusk of the lot DPMAC III, n. 104

4. February 13th 1515, Francesco Corbinelli, *feitor* in Goa, acknowledges receipt of 193 “big and small tusks” weighing 39 *quintaes* and 3 *arrobas* (= 2,335.39 kgs) from Lourenço Moreno, *feitor* in Cochin: the average weight is 12.1 kgs per tusk.[81]
5. August 27th 1517, Pero Coresma, appointed *feitor* of Cochin, acknowledges receipt in Sofala of 233 “big and small” tusks weighing 61 *quyntaes*, 3 *arrobas*, 28 *arrateis* (= 3,640.788 kgs): the average weight is 15.62 kgs per tusk.[82]
6. May 25th 1518, Pedro Jacome dies in Sofala leaving eight *dentes* weighing *duas arrobas menos quatros arrates* (= 27 kgs): the average weight is 3.37 kgs.[83]
7. July 15th 1518, Joham Afonso da Cunha *allcaide mor* and *feitor* of Mozambique receives 349 big and small tusks weighing 92 *quintaes* (= 5,405.18 kgs): the average weight is 15.48 kgs.[84]

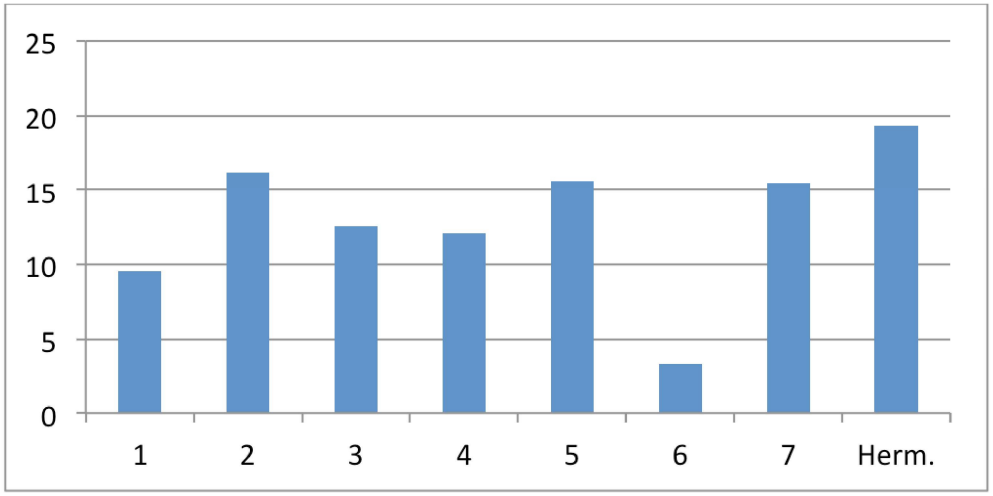


Figure 11. Average weights per tusk of seven sixteenth century lots and *Hermapollon*'s cargo (in kgs)

With the possible exception of the ivory sent to Goa by Lourenço Moreno in 1515,[85] all of these ivory lots are of certain African origin. It is therefore clear that the distinction made between big and small tusks in some of these documents cannot correspond with the contrast between tusks and *schidai*, which characterizes the *Hermapollon* cargo, if the *schidai* are, as I suggest, captive elephant tusk trimmings.

In his *Informação para el-rei* written from Goa in 1530, Jordão de Freitas distinguishes between three types of ivory: 1) the good, big, sound, and clean one (*bom grande são e linpo*), whose value in Sofala was between thirty and forty *maticais* per *bahar*; 2) the "small" one (*pequeno*), whose tusks weigh between one and one-half *faraçola* (= between 11.75 and 5.87 kgs) each, and whose value was half the price of the first type; 3) the "even smaller" one (*mays meyudo*), whose value in Sofala was ten to twelve *maticais*.[86] The small size of the second and third types in de Freitas' categorization and the low average weight of the listed African ivory lots can hardly be explained by just assuming that all of those tusks belonged to forest elephants (*Loxodonta Africana cyclotis*). Such an assumption would be inconsistent with the present geographical distribution of that species, and it would still require one to emphasize the inattention to tusk size during the elephant hunts, since tusks lighter than 5.87 kgs must have belonged to very young animals, no matter the species. Apparently, African hunters were only marginally motivated by ivory traders or influenced by the different commercial values assigned to tusks of different size. The low

average weight of those lots—all the more remarkable since the tusks must have belonged mainly to savanna elephants—shows that in Africa elephants must have been killed for reasons other than the ivory trade.

The ivory of the "Elephant-eaters"

The relatively low average weight of the sixteenth-century African tusks[87] suggests a clue for interpreting a remark by the author of the *Periplus Maris Erythraei* about the ivory exported from Rhapta. In this "very last emporium of Azania," a great amount of ivory is said to be available. Its quality, however, was held to be inferior to that exported from the much closer Adulis.[88] The composition of the sixteenth-century ivory lots from Sofala suggests that the Rhapta export was inferior to the Adulis one, not because it was from a different species or because their tusks were always less sound than the Adulis ones, but because it resulted from a different kind of trade and perhaps a differently motivated hunt. The fine Adulis ivory came from faraway regions "beyond the Nile," it was conveyed to Axum, then to Koloe and finally to Adulis.[89] On its way to the Red Sea, the ivory was traded by foreign merchants, who wanted to be paid in Roman money;[90] it was shipped to Egypt by merchants from Roman Egypt. Such a commercial circuit necessarily required a deliberate selection of tusks based on their quality, which had to be of the "Adulis standard."[91]

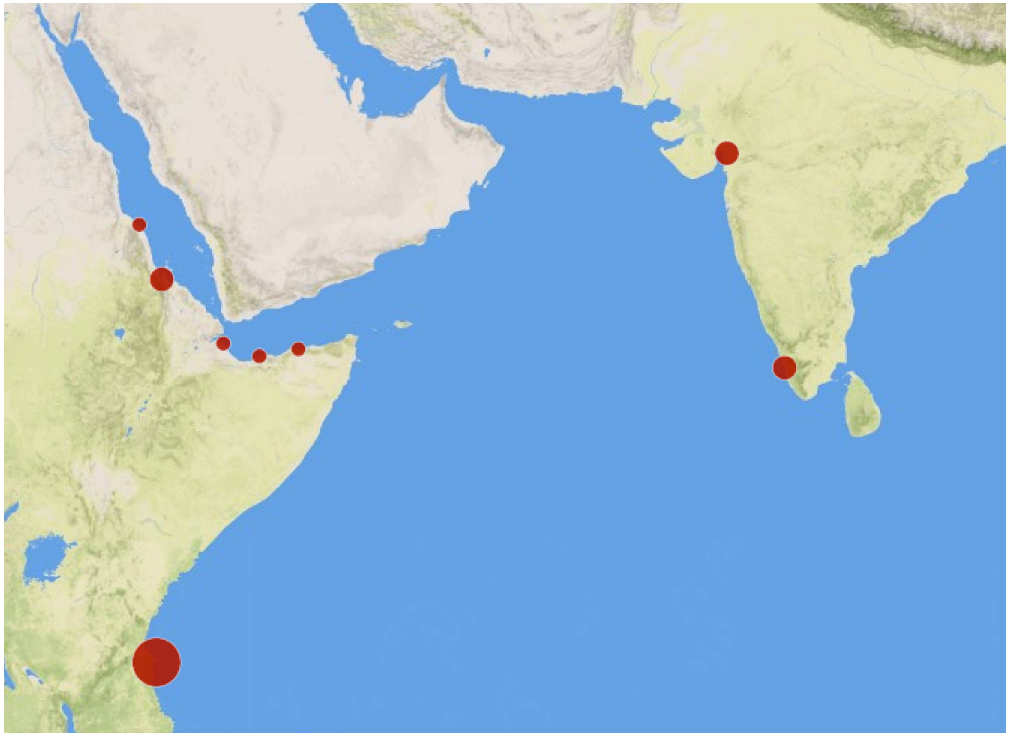


Figure 12. Availability of ivory according to the *Periplus Maris Erythraei* (small circles 'little ivory', medium circles 'ivory', big circle 'great amount of ivory'). Base map courtesy Ancient World Mapping Center and published under Creative Commons Attribution-Non Commercial license.

In contrast, the Rhapta trade had a completely different style. Ivory was imported by small Muza ships, manned by crews linked by intermarriages with the Rhapta people.[92] Together with spears, axes, knives, awls, and glass stones, they would bring large quantities of grain and wine to be used in nearby places 'not for trade, but because of extravagance, for the entertainment of the barbarians.'[93] It is therefore likely that the Rhapta ivory was "inferior" to the Adulis ivory, because it included considerable quantities of *pequeno* and *mays miudo marfim*—"small" and "even smaller" tusks. Once it arrived at Muza, the inferior but plentiful ivory from Rhapta was most likely sent to Barygaza,[94] just as in the sixteenth century enormous amounts of ivory—Garcia da Orta quantifies them in 6,000 *quintais* (more than 350 tons) per year[95]—were sent to India from the East Africa coast between Sofala and Malindi.

As mentioned above, the very small tusks included in the ivory lots show that African elephants were not killed for their ivory alone. The Greek perception of the particular human-elephant relationship in East Africa is reflected in the term *Elephantophagoi*[96] ("Elephant-eaters"), elaborated when the exploration of the African world south of Egypt inspired an ethnological taxonomy based on dietary habits. Along the lines of the much older *Ichthyophagoi* and of the new entry *Chelonophagoi* (re)discovered in Carmania by Alexander's army,[97] *Rhizophagoi*, *Hylophagoi*, *Spermatophagoi*, *Akridophagoi*, *Struthophagoi*, *Agriophagoi*, *Moschophagoi*, and *Elephantophagoi* were identified. Greek ethnographic accounts ignored the fact that elephant meat was to some extent eaten in ancient South India as well. Moreover, the Greek writings did not take into account the idea that African societies may have killed elephants not only for their meat but also to prevent them from crop raiding: in their opinion, fondness for elephant meat was the key factor. In a story repeated by Agatharchides, the *Elephantophagoi* refused to stop killing elephants and eating their meat despite Ptolemy's urging and the promise of splendid rewards.[98] They replied that they would not change their way of life, not even for all the kingdom of Egypt. The task of providing the Ptolemaic army with an Indian-style elephant division[99] thus had to accommodate the cultural traditions of Africa. The story may be fictional, but the perception that in Africa the human-elephant relations were different from India was accurate: the contrast between the African ivory carried by the Portuguese ships and the Indian ivory shipped out by the *Hermapollon* supports this distinction.

Notes

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[1] P.Vindob. G 40822 verso = SB XVIII 13167 = TM 27666 verso. First edition by H. Harrauer, P. J. Sijpesteijn, *Ein neues Dokument zu Roms Indienhandel. P. Vindob. G 40822*, "Anzeiger der phil.-hist. Klasse der Österreichischen Akademie der Wissenschaften" 122 (1985), pp. 124-155; L. Casson, *P. Vindob. G 40822 and the Shipping of Goods from India*, "BASP" 23 (1986), pp. 73-79; G. Thür, *Hypotheken-Urkunde eines Seedarlehens für eine Reise nach Muziris und Apographe für die Tetarte in Alexandria*, "Tyche" 2 (1987), pp. 229-245; L. Casson, *New Light on Maritime Loans: P. Vindob. G 40822*, "ZPE" 84 (1990), pp. 195-206; G. Thür, *Zum Seedarlehen κατὰ Μουζεῖριν. P.Vindob. G 40822*,

"Tyche" 3 (1988), pp. 229-233; F. De Romanis, *Commercio, metrologia, fiscalità. Su P. Vindob. G 40.822 verso*, "MEFRA" 110 (1998), pp. 11-60; D. Rathbone, *The 'Muziris' papyrus (SB XVIII 13167): financing Roman trade with India*, "BSAA" 46 (2000) (Alexandrian Studies II, in honour of Mostafa el-Abbadi), pp. 39-50; F. Morelli, *Dal Mar Rosso ad Alessandria: il* verso *(ma anche il* recto*) del 'papiro di Muziris' (SB XVIII 13167)*, "Tyche" 26 (2011), pp. 199-233; F. De Romanis, *Playing Sudoku on the Verso of the 'Muziris papyrus'*, "Journal of Ancient Indian History" 27 (2010/1) [2012], pp. 75-101.

[2] Morelli, *art. cit*; De Romanis, *Playing Sudoku* cit. Also noteworthy in Morelli's paper is the convincing interpretation of col. i, ll. 4-13 (pp. 210-211; 214-216).

[3] The paper is about P. Vindob. G 40822 (= SB XVIII 13167) verso. When references to columns and lines are made, one must understand they refer to columns and lines of this text. To avoid confusion, I still call the two partially surviving columns "col. i" and "col. ii." However, on the left of the so-called col. i there was one (and most likely just one) more column. Therefore, "col. i" and "col. ii" should properly be labeled "col. ii" and "col. iii" respectively: De Romanis, *Playing Sudoku* cit., p. 94, nt. 35.

[4] The arabarchs are the tax-farmers to whom the State leased the right to collect customs dues on Indian Ocean commodities: F. Burkhalter-Arce, *Les fermiers de l'arabarchie: notables et hommes d'affaires à Alexandrie*, in J. Leclant (ed.), *Alexandrie: une mégapole cosmopolite*. Actes du 9e colloque de la Villa Kérylos à Beaulieu-sur-Mer les 2 et 3 octobre 1998, Paris 1999, pp. 41-54.

[5] Hesych. s.v. (vol. III p. 399, Σ 3010 Hansen). Frisk and Chantraine suggest a correction of πῆγμα in ῥῆγμα "breakage."

[6] Harrauer/Sijpesteijn, *art. cit.*, p. 148: 'Eine σχίδα kann also 'ein von einem größeren Ganzen abgetrenntes Stück σινδών, ein Ballen Stoff' sein.'

[7] *Periplus Maris Erythraei* (hereafter PME) 56.

[8] The "very excellent garments called the Gangetic ones" (σινδόνες αἱ διαφορώταται, αἱ Γαγγιτικαὶ λεγόμεναι): PME 63.

[9] PME 63.

[10] Col. ii, ll. 1-3.

[11] PME 56. It may be observed that, according to the PME, apart from the Ganges emporion (PME 63), Gangetic nard was exported only from the Limyrike emporia, apparently because it was sent there from the Ganges emporion. By contrast, the same author records the export of garments from several places besides the Ganges emporion: Ozene (Ujjayinī); the Tamil Nadu coast after Korkai; Sri Lanka; and the Masalia region: PME 48; 59; 61; 62 respectively. If "detached pieces of σινδόνες" were exported to Muziris, they did not need to necessarily be from the Ganges emporion, even if the Gangetic garments were "very excellent."

[12] F. T. Gignac, *A Grammar of the Greek Papyri of the Roman and Byzantine Periods. I. Phonology* Milano 1976, pp. 75-76.

[13] Harrauer/Sijpesteijn, *art. cit.*, p. 149: 'Man könnte natürlich auch erwägen, ob σχιδῶν nicht für σχιζῶν steht […] Die in den Lexika attestierte Bedeutung "Holzscheit" kommt hier gewiß nicht in Betracht.' LSJ s.v. translates σχίζα as "piece of wood cut off, lath, splinter."

[14] Harrauer/Sijpesteijn, *art. cit.*, p. 149: 'Da Ägypten selbst viel Leinen erzeugte […], ist es unwahrscheinlich, daß man Flachs aus Indien über Ägypten nach Rom importierte.'

[15] Thür, *art. cit.,* p. 233 translated as "Ballen Stoff"; Casson, *New Light* cit., p. 201 translated as "lengths of fabric"; De Romanis, *Commercio* cit., p. 14 translated as "tessuti."

[16] Rathbone, *art. cit.*, p. 45: 'I take the *schida* of ii 16-25 to mean "fragments" of ivory, rather than 'Ballen Stoff' (Harrauer & Sijpesteijn; Thür) or "lengths of fabric" (Casson 1990). *Schida* is a variant spelling of *schiza* (other cognates spelled with delta are known), meaning 'splinters, lathes, fragments,' as distinct from the preceding *elephas hugies* (ii 4), which means "healthy, sound, unbroken ivory," that is, complete tusks (the *odontes* of ii. 12, 13).'

[17] Rathbone, *art. cit.*, pp. 44; 45; see also Morelli, *art. cit.*, p. 213, 44.

[18] Rathbone, *art. cit.*, p. 45: 'The two sections (ii 5-15, 16-25) are carefully structured using *men* and *de* ('first' and 'then') […], and culminate in ii.26 in the total price for both categories of ivory.'

[19] Rathbone, *art. cit.,* p. 46.

[20] Morelli, *art. cit.*, pp. 218-220. Moreover, Morelli (pp. 221-222) observes that the entry σχιδῶν (col. ii, l. 16) is not in *ekthesis* as those of Gangetic nard and sound ivory (col. ii, ll. 1; 4), which offers further

support for the argument that *schidai* were a particular kind of ivory. As for verso col. i, l. 14, I would not follow Morelli (p. 222) in assuming that the total amount of ivory (both ὑγιής and σχίδαι) and its quarter were specified there: that information would have been pointless. Col. i, l. 14 is better connected with col. i, ll. 15-16: De Romanis, *Playing Sudoku* cit., p. 86.

[21] Morelli, *art. cit.,* pp. 219-220: '[...] 22 ¾ mine sono uguali a c. 11,94 kg: il che significa che non si trattava propriamente di frammenti, ma di zanne in qualche modo danneggiate, incrinate, o solo parzialmente spezzate.'

[22] Morelli, *art. cit.*, p. 209.

[23] Remarkable is the lexical coincidence with the 1530 *Informacão de Jordão de Freitas para el-rei*, in *Documentos sobre os Portugueses em Moçambique e na África Central, 1497-1840* (hereafter DPMAC) VI 27, p. 428: 'marfym [...] bom grande *são* e linpo.' (emphasis mine) Morelli, *art. cit.*, p. 213, 41 refers to *Merck's Warenlexikon*, Leipzig 1920[7], p. 107: 'Die Zähne werden nach der Größe sortiert und bewertet, außerdem richtet sich der Preis danach, ob sie schwach oder stark gekrümmt, rissig, frisch oder alt sind und ob die Höhlung sich von der Wurzel weit in das Innere erstreckt.' An evaluation of the ivory quality is also implied by PME 3: ἐλέφας ὀλίγος, ὅμοιος τῷ 'Αδουλιτικῷ (ivory from Ptolemais ἡ τῶν θηρῶν λεγομένη, similar to the one from Adulis) and PME 17: ἐλέφας πλεῖστος, ἥσσων δὲ τοῦ 'Αδουλιτικοῦ, (the ivory from Rhapta, inferior to that from Adulis).

[24] H. Frisk, *Griechisches etymologisches Wörterbuch,* Heidelberg 1973[2], pp. 838-839; P. Chantraine, *Dictionnaire étymologique de la langue grecque: histoire des mots*, Paris 1968-1980, p. 1081.

[25] IG II/III[2] 2 1408, ll. 13-14; 1409, ll. 6-7; 1414, ll. 17-18; 1412, ll. 32-33; ID 298 A, l. 181; 300 B, l. 30.

[26] The probable 3 talents and 60 *drachmae* of ivory sold off for 1,309 *drachmae* in IG I[3] 449, 392-394 are taken to be waste by K. D. S. Lapatin, *Chryselephantine Statuary in the Ancient Mediterranean World*, Oxford, 2001, p. 14.

[27] Plin., *n.h.* VIII 8: *praedam ipsi in se expetendam sciunt solam esse in armis suis* […] *circumuentique a uenantibus primos constituunt quibus sint minimi, ne tanti proelium putetur, postea fessi inpactos arbori frangunt praedaque se redimunt*.

[28] Plin., *n.h.* VIII 1-8.

[29] Plin., *n.h.* VIII 1: *proximum* […] *humanis sensibus,* 'the nearest to human intelligence'; Arr., *Indic.* 14, 4: […] θυμόσοφον γὰρ εἴπερ τι ἄλλο θηρίον, 'an intelligent animal, if any there is.' For other sources, cfr. M. Wellmann, R.E. V 2252 [1905].

[30] Cic., *pro Scauro* 1p. Cfr. M. Denecka, *The Traffic in Glands*, "JRS" 103 (2013), pp. 88-91. I thank Prof. R.S. Bagnall, who pointed out to me both the parallelism between the behavior of elephants and beavers and the bibliographic reference.

[31] As Prof. Dr. J. V. Cheeran, Former Professor of the Veterinary College at Trichur (Kerala, India) informed me via e-mail on October 7th 2012, elephants in Kerala usually get their tusks trimmed once every 18-20 months. Fragments 20 to 25 cms long and weighing 1 to 1.5 kg are then normally removed. Longer intervals (three years) are also reported by Dr. C. Gopakumar, veterinary surgeon in Tiruvalla, Kerala (personal communication). Longer and heavier fragments (cfr. below, nt. 64) have been trimmed away in operations performed by him: *Tusks of Two Temple Elephants Trimmed* in *The Hindu* June 9th 2012, available online at http://www.thehindu.com/todays-paper/tp-national/tp-kerala/article3507798.ece?textsize=large&test=1. Tusk trimming prevents or reduces elephant's aggressiveness, cfr. *Killer elephant loses tusks in Nepal* available online at http://www.nbcnews.com/id/15796526/ns/world_news-south_and_central_asia/t/killer-elephant-loses-tusks-nepal/#.UgrapJKxUYc; S. Jiamjarernporn, *Tusks trimmed after fatal attack*, in *The Nation* August 14th 2013, available on line at http://www.nationmultimedia.com/national/Tusks-trimmed-after-fatal-attack-30207030.html. In Kerala, tusk trimming is now strictly controlled by the Government, see Government of Kerala, *Kerala Captive Elephant (Management and Maintenance) Rules*, 2003, available online at http://117.239.77.10/~forusr/tcthrissur/images/New-Rule/91kce.pdf. Captive elephants are usually cooperative and the operation does not require sedation: see, e.g., the video available at http://www.youtube.com/watch?v=WYMPtTdzhCc.

[32] *Arthaśāstra* II 32, 22.

[33] Varāhamihira, *Bṛhat Saṃhitā*: 78, 20 ab = 93, 1 ab.

[34] Cosm. Indic. XI 23.

[35] Another method is to replicate the distance between the beginning of the exposed tusk and the elephant's eye: see Fig. 2.

[36] R. Sukumar, *The Story of Asia's Elephants*, Mumbai 2011, p. 66.

[37] For sound ivory, cfr. col. ii, ll. 10;14; for *schidai*, cfr. col. ii, ll. 20; 24.

[38] Whose value is 6 *drachmae* per *mina* by my calculations: De Romanis, *Playing Sudoku*, cit. With a value of 24 *drachmae* per *mina* (Morelli, *art. cit.*, pp. 223-225) the distance, if less striking, remains nonetheless remarkable.

[39] Edictum de pretiis 16a: {d}eboris libra I (denariis) CL; 34, 68: piperis p. I (denariis) DCCC.

[40] F. De Romanis, *Cassia, cinnamomo, ossidiana. Uomini e merci tra Oceano Indiano e Mediterraneo*, Roma 1996, pp. 198-200.

[41] In female Asian elephants, tusks are either only vestigial or totally absent, cfr. J. Poole, *Elephants*, Stillwater 1997, p. 32.

[42] Plin., *n.h.* VIII 7*:* [...] *etenim rara amplitudo iam dentium praeterquam ex India reperitur; cetera in nostro orbe cessere luxuriae*, '[…] inasmuch as an ample supply of tusks is now rarely obtained except from India, all the rest in our world having succumbed to luxury' (transl. by H. Rackham).

[43] See below, nt. 88.

[44] PME 3 (Ptolemais Theron); 7 (Aualites); 10 (Mosyllon).

[45] In general, for ivory sources and availability in antiquity, cfr. A. Cutler, *Prolegomena to the craft of ivory carving in late Antiquity and the early Middle Ages*, in X. Barral i Altet ed., *Artistes, artisans et production artistique au Moyen Age*, II, Paris 1987, pp. 431-443.

[46] Expositio totius mundi 18: […] *post hos India minor* […] *et ad eos elephantorum innumerabilis multitudo, et Persae ab ipsis accipiunt propter multitudinem,* '[…] after them, there is India minor […] they have countless number of elephants, and the Persians receive (elephants? ivory?) from them because of their large number.' The comparison with Cosmas' text quoted below, nt. 47 suggests that the *India minor* of that passage of the *Expositio* is in East Africa rather than in Arabia or in the real India. Cfr. P.

Schneider, *L'Éthiopie et l'Inde: interférences et confusions aux extrémités du monde antique (8. siècle avant J.-C - 6. siècle après J.-C.)*, Rome 2004, p. 29 with previous bibliography.

[47] Cosmas Indicopleustes XI 23: οἱ δὲ Αἰθίοπες οὐκ ἴσασιν ἡμερῶσαι ἐλέφαντας, ἀλλ' εἰ τύχοι θελῆσαι τὸν βασιλέα ἕνα ἢ δεύτερον πρὸς θέαν, μικροὺς πιάζουσι καὶ ἀνατρέφουσιν· ἔχει γὰρ ἡ χώρα αὐτῶν πλῆθος καὶ μεγάλους ὀδόντας ἔχοντας· ἐκ τῆς γὰρ Αἰθιοπίας καὶ εἰς Ἰνδίαν πλωΐζονται ὀδόντες καὶ ἐν Περσίδι καὶ ἐν τῷ Ὁμηρίτῃ καὶ ἐν τῇ Ῥωμανίᾳ, 'The Ethiopians do not know how to tame elephants, but should the king wish to have one or two for show, they capture them when young and raise them. The country abounds with them, and they have large tusks. From Ethiopia they are exported by sea into India, Persia, the Homerite country and the Roman dominion.'

[48] Cosm. Indic. XI 23: ὀδόντας δὲ μεγάλους οἱ ἰνδικοὶ οὐκ ἔχουσιν […] ἔχει γὰρ ἡ χώρα [sc. Αἰθιοπία] αὐτῶν πλῆθος καὶ μεγάλους ὀδόντας ἔχοντας. Cosmas' remark about the tusks of the African elephants does not support the thesis put forth by H. H. Scullard, *The Elephant in the Greek and Roman world*, New York 1974, pp. 60-63, that the elephants captured in East Africa by the Ptolemies were actually forest elephants (*Loxodonta Africana cyclotis*).

[49] Tusks from a fifty-year-old male African savanna elephant can easily weigh more than 50 kgs (R. M. Laws, *Age Criteria for the African Elephant*: *Loxodonta A. Africana*, "East African Wildlife Journal" 4 (1966), pp. 27-28), while the tusks from an Asian elephant of the same sex, age and weight barely reach 30 kgs (R. Sukumar, *The Asian Elephant: Ecology and Management*, Cambridge 1989, p. 225).

[50] In the list at PME 56, pearls come from Korkai on the Tamil Nadu coast, malabathron and Gangetic nard are from the Ganges valley, silk comes from China via the Ganges valley, tortoise shell was in part from Chryse (either Malay peninsula or Sumatra: L. Casson, *The Periplus Maris Erythraei*. *Text with Introduction, Translation and Commentary*, Princeton 1987, pp. 235-236) and in part from the Laccadive Islands. Diamonds were not an indigenous product either.

[51] K. P. Shajan, R. Tomber, V. Selvakumar and P. J. Cherian, *Locating the Ancient Port of Muziris: Fresh Findings from Pattanam,* Journal of Roman Archaeology 17 (2004), pp. 312-320.

[52] *Puṟanāṉūṟu* 5, 1-3.

[53] Tab. Peut., *seg*. XI: *in his locis elephanti nascuntur*.

[54] Small tusk elephants are not supposed to be captured for the king's army, cfr. *Arthāśastra* II 31, 10: *vikko moḍho makkaṇo vyādhito garbhiṇī dhenukā hastinī cāgrāhyāḥ*, 'a cub, an elephant with small tusks, one male without tusks, one diseased, a female elephant with young and a suckling female elephant are not to be caught.'

[55] Strab. XV 1, 41 = FGrHist 715 F 19b: ἵππον δὲ καὶ ἐλέφαντα τρέφειν οὐκ ἔξεστιν ἰδιώτῃ· βασιλικὸν δ' ἑκάτερον νενόμισται τὸ κτῆμα, καὶ εἰσὶν αὐτῶν ἐπιμεληταί, 'No private person is permitted to keep a horse or elephant. The possession of either is a royal privilege, and there are men to take care of them.' Nearchus had been less exclusive: Arr., *Ind.* 17, 1-2 = FGrHist 133 F 11: ὀχήματα δὲ τοῖς μὲν πολλοῖς Ἰνδῶν κάμηλοί εἰσιν καὶ ἵπποι καὶ ὄνοι, τοῖς δὲ εὐδαίμοσιν ἐλέφαντες. βασιλικὸν γὰρ ὄχημα ἐλέφας παρ' Ἰνδοῖς ἐστι, 'Most of the Indians have camels, horses and asses as mounts, but the rich have elephants. For among Indians the elephant is a royal mount'; Strab. XV 1, 43 = FGrHist 133 F 22: […] μέγιστόν τε νομίζεσθαι κτῆμα ἐλεφάντων ἅρμα· ἄγεσθαι δ' ὑπὸ ζυγὸν <ὡς> καὶ καμήλους· γυναῖκα δ' εὐδοκιμεῖν εἰ λάβοι παρὰ ἐραστοῦ δῶρον ἐλέφαντα. οὗτος ὁ λόγος οὐχ ὁμολογεῖ τῷ φήσαντι μόνων βασιλέων εἶναι κτῆμα ἵππον καὶ ἐλέφαντα, '(Nearchus says) that an elephant chariot is considered the grandest of possessions; they are driven beneath the yoke just like camels; that a woman is highly honored if she receives an elephant as a gift from a lover. But this statement is not in agreement with that of the man who said that horse and elephant were possessed by kings alone.'

[56] Arthaśāstra II 2, 13: *hastipradhāno vijayo rājñaḥ.*

[57] In *Caṅkam*-age South India, captive elephants are almost by default war elephants: cfr. E. S. Varadarajaiyer, *The Elephant in the Tamil Land*, Annamalai 1945, *passim*.

[58] Tolkāppiyam III 9, 72: *paṭaiyum koṭiyum kuṭaiyum muracum / naṭai navil puraviyum kaḷiṟum tērum / tārum muṭiyum nērvaṉa piṟavum / terivu koḷ ceṅkōl aracarkku uriya*, 'weapon, flag, umbrella, drum, horse of studied pace, elephant, car, garland, crown, and such others be-fitting the kings (*aracar*) of sceptre, well-versed in judgment' (trad. S. V. Subramanian). However, the term *paṭai* may here have the alternative meaning of "army," rather than "weapon."

[59] T. Burrow/ M. B. Emeneau, *A Dravidian Etymological Dictionary*, Oxford 1961, p. 15, n. 167.

[60] Cfr. K. D. Thirunavukarasu, *Chieftains of the Sangam age*, Madras 1994, pp. 33-35.

[61] Varadarajaiyer, *op. cit.*, pp. 4-6.

[62] 'Kings', but not of the highest rank.

[63] *Puṟanāṉūṟu* 387, 5-13: *māṟu koṇṭōr matil iṭaṟi,/nīṟu āṭiya naṟuṅ kavuḷa,/ pūmpoṟip paṇai eruttiṉa,/ vēṟu vēṟu parantu iyaṅki,/vēntuṭai miḷai ayal parakkum,/ ēntu kōṭṭu irumpiṇart taṭakkait,/tiruntu toḻiṟ pala pakaṭu/pakaippula maṉṉar paṇitiṟai tantu, niṉ/ nacaippula vāṇar nalkuravu akaṟṟi.* In the translation by G. L. Hart and H. Heifetz, *The Four Hundred Songs of War and Wisdom*, New York 1999, p. 227 ('You drove away poverty from your musicians who bring you joy, giving them tribute humbly offered by kings who opposed you and who own many elephants skilled at their work of war etc.'), the war elephants belong to inimical "kings." But, since they were stationed "near the guarded forest of the *vēntu*," they must belong to a *vēntaṉ*, not to *maṉṉar,* "kings" of lower rank. Moreover, such a long praise would be strange, if it addressed the enemy's war elephants. The interpretation accepted here is also in the Italian translation of E. Panattoni, Puṟanāṉūṟu. *Quattrocento poesie di Guerra*, Milano 2002, p. 331.

[64] The weights of the four fragments of tusk mentioned from *The Hindu* article quoted above, nt. 31 were 5.4, 5.6, 4.3, and 2.54 kgs, respectively. The average weight is 4.46 kgs. The lengths of the trimmings were 44, 43, 47, and 43 cm, respectively—approximately double the ones indicated as the norm by Prof. Dr. Cheeran after 18-20 months.

[65] At col. ii, l. 16 previous editors had read σχιδῶν ϟδ ("of 54 *schidai*"). The reading has been rightly rejected by Rathbone, *art. cit.,* p. 44, and Morelli, *art. cit.*, p. 213. It is unlikely that the three-quarters of *schidai* were recorded also as a number of fragments. The number of tusks of the three-quarters of sound ivory is not given (col. ii, l. 4). Only the entire cargo of sound ivory (col. i, l. 5) is recorded both by number of tusks (167) and by weight (105 weight talents and 13 *minae*).

[66] For elephants between 10 and 30 years of age, the average growth pace of ivory is 1.4 kgs per year per elephant. Before and after, the pace is slower: Sukumar, *The Asian Elephant*, cit., pp. 82; 225.

[67] Cosm. Indic. XI 22: οἱ δὲ κατὰ τόπον βασιλεῖς τῆς Ἰνδικῆς ἔχουσιν ἐλέφαντας, οἷον ὁ τῆς Ὀρροθᾶ καὶ ὁ Καλλιανῶν καὶ ὁ τῆς Σινδοῦ καὶ ὁ τῆς Σιβὼρ καὶ ὁ τῆς Μαλέ, ὁ μὲν ἑξακόσια, ὁ δὲ πεντακόσια, ἕκαστος πλέον ἢ ἔλαττον, 'The kings of various places in India keep elephants, such as the King of Orrhotha, and the King of Calliana, and the Kings of Sindu, Sibor, and Male. They may have each six hundred, or five

hundred, some more, some fewer' (transl. J. W. McCrindle). Greek and Latin authors often number the elephants of the Indian kings or nations: Diod., II 37, 3; XVII 93, 2; Curt. Ruf. IX 2, 4; Plut., *Alex.* 62; Plin., *n.h.* VI 66-68. Herds range from a minimum of 10 to a maximum of 9,000. These numbers may be inclusive of the female elephants. Although smaller and less courageous, female elephants were used for war by the Indians, according to Aristotle: Arst., *h.a.* 610a. The size of Porus' elephant wing in the battle against Alexander varies according to the authors between 130, 85, and 200: Diod. XVII 87, 2; Curt. VIII 13, 6; Arr., *an*. V 14, 4. In general, for the armies of ancient India, cfr. R. Thapar, *Army and Exercise of Power in Early India*, in A. Chaniotis/ P. Ducrey, *Army and Power in the Ancient World*, Stuttgart 2002, pp. 25-37. For the Indian elephants in the Seleucid army, cfr. B. Bar-Kochva, *The Seleucid Army: Organization and Tactics in the Great Campaigns*, Cambridge 1976, pp. 76-84.

[68] *Akanāṉūṟu* 172, 6-10: *irumpuvaṭittaṉṉa karuṅkaikkāṉavaṉ/ virimalar marāam poruntik kōlterintu/varinutal yānai aruniṟat taḻutti/yikalaṭu muṉpiṉ veṇkōṭu koṇṭutaṉ/ pulvēy kurampai pulara ūṉṟi*; 12-14: […] *piḻimakiḻ uvakaiyaṉ, kiḷaiyoṭu kaliciṟantu,/ canta ñekiḻiyiṉ ūṉpuḻukku ayarum/ kuṉṟa nāṭa*. Evidence for eating elephant meat also in *Naṟṟinai* 114, on which cfr. Varadarajaiyer, *op. cit.*, pp. 22-23.

[69] Thirunavukarasu, *op. cit.*, p. 49.

[70] *Kuṟuntokai* 100, 3-5: *ciṟu kuṭi pacippiṉ / kaṭum kaṇ vēḻattu kōṭunoṭuttu uṇṇum / val vil ōri kolli kuṭa varai*.

[71] The term is taken to refer either to "young apprentices of war" or to a particular tribe: M. A. Dorai Rangaswamy, *The Surnames of the Caṅkam Age Literary and Tribal*, Madras 1968, p. 120.

[72] *Akanāṉūṟu* 245, 5-12: *maḻai peyaṉ maṟanta kaḻai tiraṅku iyavil /cel cāttu eṟiyum paṇpu il vāḻkkai/valvil iḷaiyar talaivar, el uṟa,/varikiḻar paṇaittōḷ, vayiṟu aṇi titalai/ariyal āṭṭiyar alkumaṉai varaippil /makiḻ noṭai peṟāarāki, naṉai kavuḷ /kāṉa yāṉai veṇkōṭu cuṭṭi/maṉṟuōṭu putalvaṉ puṉtalai nīvum.*

[73] Diod. XXXI 8, 12.

[74] Asian elephant tusks reach that weight when the elephant is around thirty-five years old: Sukumar, *The Asian Elephant*, cit., p. 225.

[75] IG XI ii 203 A, l. 71: two tusks weighing one talent and 32.625 *minae*.

[76] IDidyma I 394, ll. 16-18: thirty-four elephant tusks, weighing 24 talents and 20 *minae*.

[77] The weight unit of the quarter-tax administration at the time of the Muziris papyrus is a talent of 95 Roman pounds: col. ii, ll. 6-7. The Delos inscription may refer to the Attic/Euboic standard (1 talent = either 62.5 or 80 Roman pounds). The Didyma inscription may refer either to the same Attic/Euboic standard or to the Egyptian or Ptolemaic standard (1 talent = either 80 or 90 Roman pounds): MSR 233, 22-25-234, 1-3; 236, 23-24.

[78] DPMAC I, n. 85, p. 618: 'marfim 92 quintaes 2 arrobas 31 arrates per 570 demtes.' I have assumed that the unit of measure used in this and the next documents is the *quintal* of *peso novo* (= 58.752 kgs), which is explicitly mentioned in DPMAC V, n. 28, p. 184 (below, nt. 82).

[79] DPMAC II, n. 19, p. 64: 'satemta e tres quimtaes e huma aroba e vimte arates de marfym por duzemtos e sasemta e quatro demtes e dous pedaços.'

[80] DPMAC III, n. 104, pp. 572-579.

[81] *Cartas de Afonso de Albuquerque seguidas de documentos que as elucidam,* VII, CCXXXV, pp. 136-137: 'trinta e nove quintaes e tres arrobas de marfim per cento e novemta e tres dentes grandes e pequenos.'

[82] DPMAC V, n. 28, p. 184: 'sasemta e hum quyntaes e tres arrobas e vymte e oyto arrateis de marfym per duzentos e trymta e tres demtes grandes e pequenos que foram pesados pelo peso novo que tem mays duas omças que ho peso velho.' This lot of ivory was weighed again with the weights that Pero Coresma brought to Cochin. At a first measurement with the weights of Sofala "eaten away by rust," this same lot of ivory, plus four tusks that are missing, was declared to weigh 68 quintaes, 3.5 arrobas, and 4 arrates: DPMAC V, n. 28, pp. 182-189.

[83] DPMAC VII, n. 1, p. 68.

[84] DPMAC V, n. 72, p. 536: 'noventa e dous quintais de marfim per trezemtos e corenta e nove dentes antre grandes e pequenos.'

[85] The Portuguese quickly recognized the business opportunities proffered by the Malabar ivory. As early as 1503 Afonso de Albuquerque was said to be trafficking in ivory in Cananor: P. Pinto, *Índice analítico das cartas dos governadores de África na Torre do Tombo*, "Anais de história de além-mar" 11 (2010), p. 253 (I thank P. Pinto for this reference).—Two *cartas de quitacão* for *feitores* in Cochin mention ivory

lots of unspecified origin: 111 *quintaes*, 2 *arrobas*, 12 *arrateis* mentioned in the *quitação* issued for Lourenço Moreno after his first stint as *feitor* in Cochin in the years 1506 and 1507 (ANTT Chancel. de D. Manuel I, Liv. III, f. 17^{r}, transcribed in A. Braamcamp Freire, *Cartas de Quitacão del Rei D. Manuel*, "Archivo Histórico Portuguez" 4 (1906), p. 288) and 55 *quintaes* and 6 *arrobas* recorded in the *quitação* for André Dias, *feitor* in Cochin from the end of 1507 to 1509 (ANTT Chancel. de D. Manuel I, Liv. III, f. 46^{v}, transcribed in A. Braamcamp Freire, *Cartas de Quitacão del Rei D. Manuel*, "Archivo Histórico Portuguez" 1 (1903), pp. 278-279). These two lots may be of either Indian or East African origin, since the shipment of African ivory from Sofala to Cochin in 1517 (DPMAC V n. 28, pp. 182-189) may be just an episode of a recurring and preexisting pattern.

[86] DPMAC VI, n. 27, p. 428: 'Item, ho paga[mento das mer]cadorias que o seu feytor ahy conprar a de ser em marfym como he costume o quall vall em Çofala se he bom grande são e linpo a trinta e a corenta maticais ho baar. [...] Item, ho marfym pequeno que não chega cada dente a faraçola—a saber—de dous dentes pouco mais ou menos em faraçola este vall dous baares por hum [...] Item, ho outro mays meyudo este vall a dez e a doze maticaais ho baar maticall de Çofala em Çofala e em Melynde a 25 e a 30 maticaaes maticall de Melynde do preço que ja dise.'

[87] The average weights of the lots listed here range from 9.56 to 16.21 kgs per tusks. Small tusks comprised the overwhelming majority of the huge lot (number of tusks unknown) mentioned in DPMAC VII, n. 11, p. 175: in 1547, the Sofala factory received 56 *bahar* (approximately 14,240 kgs) of ivory, 14 of which (around 3,560 kgs) were of *grosso* ("large") and 42 (approximately 10,680 kgs) of *miudo* ("small") kind. It may be interesting to note that in 1978 and 1980, estimates on two lots of more than 200 tons each gave average weights of 9.65 and 16.00 kgs, respectively: I. S. C. Parker/ E. B. Martin, *How many Elephants are Killed for the Ivory Trade?*, "Oryx" 16 (1982), pp. 235-239.

[88] PME 16: [...] τὸ τελευταιότατον τῆς Ἀζανίας ἐμπόριον κεῖται, τὰ Ῥάπτα λεγόμενα [...], ἐν ᾧ καὶ πλεῖστός ἐστιν ἐλέφας καὶ χελώνη, '[...] the very last port of trade on the coast of Azania, called Rhapta […], where there are a great amount of ivory and tortoise shell'; 17: […] ἐκφέρεται δὲ ἀπὸ τῶν τόπων ἐλέφας πλεῖστος, ἥσσων δὲ τοῦ 'Αδουλιτικοῦ, 'from the places a great amount of ivory is exported, but inferior to that from Adulis.' PME 16 locates Rhapta two "runs" from Menuthias Island (either Pemba or

Zanzibar): cfr. Casson, *The Periplus Maris Erythraei*, cit., pp. 141-142; G. Fiaccadori, *Teofilo l'Indiano*, Ravenna 1992, pp. 77-79.

[89] PME 4. Casson, *The Periplus Maris Erythraei*, cit., pp. 105-106 takes the expression ἀπὸ τοῦ πέραν τοῦ Νείλου to refer to the region beyond either the Tekazze or the Mareb.

[90] PME 6: […] δηνάριον ὀλίγον πρὸς τοὺς ἐπιδημοῦντας, 'a little Roman money for the resident foreigners.'

[91] Cfr. above, nt. 23.

[92] PME 16.

[93] PME 17: […] οἶνός τε καὶ σῖτος οὐκ ὀλίγος, οὐ πρὸς ἐργασίαν ἀλλὰ δαπάνης χάριν εἰς φιλανθρωπίαν τῶν βαρβάρων.

[94] For Muza relations with Barygaza, cfr. PME 21.

[95] G. De Orta, *Colóquios dos simples e drogas da India*, XXI: 'Aveis de saber que da Etiopia, scilicet, de Çofala até Melinde vem cada anno á India seis mil quintaes, afóra o que vem de Portugal, que he muito pouco respeito destoutro,' 'You must know that from Ethiopia, that is from Sofala and Melinde, there comes to India every year 6000 quintals besides what goes to Portugal, which is very little in comparison.'

[96] Agatharchides 53-56; Strab. XVI 4, 10; Plin., *n.h.* VI 191; Ptol., *geogr.* IV 8, 34.

[97] O. Nalesini, *History and Use of an Ethnonym:* Ichthyophágoi, in L. Blue, J. Cooper, R. Thomas, J. Whitewright, *Connected Hinterlands. Proceedings of Red Sea Project IV*, Oxford 2009, pp. 9-18.

[98] Agatharchides 56: ὅτι τούτους τοὺς κυνηγοὺς Πτολεμαῖος ὁ Αἰγύπτου βασιλεὺς ἀποσχέσθαι τοῦ φόνου τῶν ἐλεφάντων παραινῶν, ἵν' ἔχοι αὐτὸς ζῶντας, καὶ πολλὰ καὶ θαυμαστὰ αὐτοῖς ὑπισχνούμενος, οὐ μόνον οὐκ ἔπεισεν, ἀλλ' οὐδ' ἂν τὴν ὅλην ἀλλάξασθαι βασιλείαν πρὸς τὸν ἐνεστῶτα βίον εἰπόντων ἀπόκρισιν ἤκουσεν, 'Ptolemy, the king of Egypt, urged these hunters to refrain from slaughterin the beast in order that he might have them alive. Although he promised them many wondrous things, he not only did not persuade them but he heard that their reply was that they would not exchange his whole kingdom for their present way of life' (transl. S.M. Burstein); *Aristophanis historiae animalium epitome* II 54-55: ὅτι Πτολεμαῖος ὁ βασιλεὺς πολλὰ τοῖς ἐλεφαντοφάγοις ὑποσχόμενος οὐκ ἔπεισεν ἀποσχέσθαι τῆς

βρώσεως αὐτῶν. ὅτι τούτους τοὺς κυνηγοὺς Πτολεμαῖος ὁ Αἰγύπτου βασιλεύς, ἀποσχέσθαι τοῦ φόνου τῶν ἐλεφάντων παραινῶν ἵν' ἔχῃ αὐτοὺς ζῶντας καὶ πολλὰ καὶ θαυμαστὰ αὐτοῖς ὑπισχνούμενος, οὐ μόνον οὐκ ἔπεισεν, ἀλλ' οὐδὲ ἂν τὴν ὅλην ἀλλάξασθαι βασιλείαν πρὸς τὸν ἐφεστῶτα βίον εἰπόντων ἀπόκρισιν ἤκουσεν, 'Although he promised many things to the Elephant-eaters, Ptolemy the king did not persuade them to abstain from their meat. Ptolemy king of Egypt, despite his recommendation to refrain from killing elephants (so that he have them alive) and despite his many and wonderful promises, not only he did not persuade them, but he heard them reply that they would not exchange the entire kingdom for the present way of life.'

[99] P. Schneider, *De l'Hydaspe à Raphia: rois, éléphants et propagande d'Alexandre le Grand à Ptolémée IV*, "Chronique d'Égypte" 83 (2009), pp. 310-334.

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