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## SB 6.9025, Cotton, and the Economy of the Small Oasis

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### Abstract

SB 6.9025 is restudied in light of the much larger amount of information now available for cotton cultivation in the oases of the Western Desert of Egypt. The goods to be sent by the writer are shown to be those characteristically produced in the oases and shipped to the Valley, and it is argued that the place of writing is probably the Small Oasis.

Of all active papyrologists, Jim Keenan is the one I have known the longest; he entered graduate school at Yale in 1965, the fall of my sophomore year. He has also been one of the most consistently stimulating of friends and colleagues, with an enviable range of reading and a serious interest in how Egypt has changed over the post-classical centuries. I hope that some reflections on the ancient background of one of modern Egypt's most important crops will interest him.

More than sixty years ago – in the year of Jim Keenan's birth, in fact – J.G. Winter and H.C. Youtie published an article called "Cotton in Graeco-Roman Egypt."<sup>1</sup> The article presents two private letters of the second century from the Michigan papyrus collection, both of unknown provenance. The editors chose these papyri because both refer to ἐρεόζυλον, cotton. Of these, the second, although of interest in various ways, merely expresses a wish for 20 drachmas' worth of good cotton thread with which the author, Areskoussa, can make new garments. Nothing in it helps explain the context in which the author, a woman, was writing.<sup>2</sup> Because most surviving private letters on papyrus of

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<sup>1</sup> *AJP* 65 (1944) 249-258. It is reprinted in Youtie's *Scriptiunculae Posteriores*, vol. 2 (Bonn 1982) 665-674.

<sup>2</sup> P.Mich. inv. 1648; the text is reprinted as SB 6.9026 and included in R.S. Bagnall and R. Criore, *Women's Letters from Ancient Egypt, 300 BC – AD 800* (Ann Arbor 2006) 356-357, where it is described as "well written in every respect."

the second century, apart from the Apollonios archive (from Hermopolis), derive from the Oxyrhynchite and the Arsinoite nomes, there is a certain *a priori* probability that this letter comes from one of those nomes, but I do not see any specific information in the letter to confirm any specific provenance; the editors tell us only that it was acquired by purchase (in 1924, according to the *APIS* record).

In the case of the other letter, inv. 3630, later reprinted as *SB* 6.9025, the editors remark that “[i]ts provenance is unknown, but the mention of Ψῶβθις in line 32 would suggest the Oxyrhynchite nome” (p. 251).<sup>3</sup> Oxyrhynchite villages called Psobthis appear in four different toparchies,<sup>4</sup> but even so they are not the only possibility here. Guy Wagner remarks, “Le toponyme Psôbthis désignerait ... la métropole de la Petite Oasis. L’expéditeur doit se trouver là-bas, car il reçoit des céréales et du poisson tandis qu’il envoie des dattes et du vin, produits bien connus de la Petite Oasis.”<sup>5</sup> He goes on (rather contradicting an earlier proposal in this same work) to suggest that the sender may be identified with Herakles son of Akous and Diogenis (also in *P.Oxy.* 40.2975). Of course, if the Psobthis in question is the metropolis of the Small Oasis, a view that I shall support, it is still very likely that the papyrus itself was found in Oxyrhynchos, its most probable destination.

Wagner showed some hesitation in identifying the Small Oasis as the origin of the letter principally because there was no other evidence for the production of cotton in that oasis.<sup>6</sup> But he raised the question in the context of pointing out (pp. 291-292) the fact that cotton is attested in the Great Oasis, both at Kysis and at Kellis. Since he wrote, the evidence from Kellis has grown and been more fully published, and botanical evidence of *Gossypium*, cotton, although not precisely attributable to a variety, has been found at Kellis.<sup>7</sup> In addition, a couple of ostraka from Trimithis (modern Amheida) have been found with amounts measured in *lith*( ) that clearly refer to cotton as well.<sup>8</sup>

<sup>3</sup> The *APIS* record shows that it was purchased from M. Nahman in 1925.

<sup>4</sup> See P. Pruneti, *I centri abitati dell’Ossirinchi* (Florence 1981) 223-226.

<sup>5</sup> G. Wagner, *Les oasis d’Égypte* (Cairo 1987) 292-293, n. 9.

<sup>6</sup> It is curious that on p. 291 he refers to the article of Winter and Youtie as publishing “deux lettres privées dont l’une au moins pourrait venir d’Oxyrhynchus.” The conditional could simply mean that he was attributing this view to the editors, but he does not make a connection to his own argument two pages later.

<sup>7</sup> See *P.Kellis* 4, pp. 39-40, discussing the payments found in the Kellis Agricultural Account Book and making the point that cotton’s growth pattern (in the summer, irrigated) makes it suitable for the oases (but not the Nile Valley in antiquity). The two ostraka cited there have now been published as *O.Kellis* 68 and 69, with substantial quantities – payments of 20, 12, 12, 12, and 20 *lith*( ), on which see further below.

<sup>8</sup> *O.Trimithis* 1.38, 44, forthcoming.

This evidence, or as much as was available to him, led Wagner to criticize M. Hombert for seeing in *P.Iand.* 7.142 a proof that cotton was cultivated in Upper Egypt during this period.<sup>9</sup> It was not “Upper Egypt,” but the Great Oasis, that is at stake in that papyrus. Actually, Hombert was not expressing his own view, only summarizing the statement of Winter and Youtie (p. 250), “This [an entry in the Janda papyrus] proves the cultivation of cotton in Upper Egypt in the second century and confirms the statement of Pliny, *NH* 19.14: *superior pars Aegypti in Arabiam vergens gignit fruticem quam aliqui gossypion vocant, plures xylon et ideo lina inde facta xylina.*” Wagner (p. 292) notes that this is surely an error of Pliny’s, since it is the Western rather than Eastern Desert that has produced evidence of cotton cultivation.

It is hard to see why he goes on to say that “cela confirmerait l’idée que le coton était largement répandu dans l’Egypte des II<sup>e</sup>/III<sup>e</sup> s., et que c’était un produit local et non importé.” It is in fact far from proving anything of the kind. Before looking in more depth at the Michigan papyrus, it is worthwhile devoting a brief review to the other papyrological evidence for cotton to see just what we can tell about its appearance in Egypt. This turns out to be remarkably little – far from “widespread.”<sup>10</sup> Winter and Youtie mention *P.Lond.* 3.928 (p. 190), a list in which cotton is mentioned, which they described as a “customs schedule.” That identification is treated with skepticism by P.J. Sijpesteijn in his book on customs,<sup>11</sup> but in any case the fragmentary context can tell us nothing about the provenance of either the papyrus or the cotton, nor is there any external evidence for this point.

As with the letter of Areskoussa published by Winter and Youtie, so also in *P.Oxy.* 59.3991, another letter by a woman (second/third century): “Your mother made for you the cotton tunic.”<sup>12</sup> We know only the findspot, but the letter itself could have been written in any location in communication with Oxyrhynchos. The context of the mention of cotton goods in *P.Mich.* 8.500.7 is not informative either; Ioannidou remarks that “the restoration of the follow-

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<sup>9</sup> He is referring to Hombert’s review of Winter and Youtie’s article in *CÉ* 23 (1948) 204-206. This papyrus in Giessen dates to 164/5 and appears to concern land in Kysis (Douch). The cotton in this case (col. 2.8) was grown on a parcel otherwise occupied with fruit trees. This papyrus, which would be worth further study, was bought in 1912 in a village by the Giza pyramids, at the valley end of the modern road to the Small Oasis.

<sup>10</sup> “The new reference here does not change the impression that cotton was comparatively rare,” says H.G. Ioannidou, *P.Oxy.* 59.3991.14n., after citing Wagner.

<sup>11</sup> *P.Customs*, p. 25, n. 58; Sijpesteijn seems more inclined to accept the editors’ characterization of it as “an account of miscellaneous expenses.”

<sup>12</sup> Bagnall and Criore (n. 2) 355-356.

ing sentence to imply that the cotton goods were to be sent from Rome does not convince.<sup>13</sup> The text comes from the archive of Iulius Sabinus and Iulius Apollinarius, the latter of whom is the addressee here. We cannot tell where Apollinarius was at this moment, nor where the author of the letter, a certain Rullius, was located (the place where he first asked for cotton, as he says). The archive was certainly found at Karanis.

There is thus no evidence from the Nile Valley that suggests the growing of cotton or the production of cotton thread or cloth there. There are occasional indications that cotton was available in the Valley. That does not mean that we must suppose the cotton to have been imported from India (cf. *P.Oxy.* 59.3991.14n., citing bibliography in favor of this position but not adopting it). But the sum total of *P.Lond.* 3.928, *SB* 6.9025, *P.Mich.* 8.500, and *P.Oxy.* 59.3991 gives us at best a sense that in the Oxyrhynchite and Arsinoite cotton was sometimes available.

By contrast, it is in the documents from the Kharga and Dakhla Oases, and only in them, that we find amounts of cotton listed in a fashion that indicates local production. These include three ostraka from Douch. *O.Douch* 1.51 is an account of amounts of cotton measured in λιθ( ), which is the measure always found in the oasite texts. All of the names are those of women, and the amounts listed are 1 or 2 *lith*( ). Wagner in his commentary remarks that the women “sont à n'en pas douter des fileuses de coton, métier que les sources ne mentionnent pas encore.” At this point it seemed uncertain whether λιθ( ) should be seen as a misspelling for λίτ(ρα), but in *Les oasis* (p. 292, n. 5) Wagner thought not: “La lecture λίτ(ρα) pour λιθ( ) fait difficulté. Ne faudrait-il pas plutôt penser à λίθοι, les poids spéciaux nécessaires à la stabilité du métier?” Whether these weights were the origin of the measure is hard to say, but the appearance of many texts since 1987 has shown that Wagner was right not to “correct” the reading to the Roman pound. In editing the Kellis Agricultural Account Book, I reviewed the matter in detail and concluded that “stone” was indeed the meaning intended, citing a Coptic parallel. I proposed that the “stone” weighed more than ten *litrai*.<sup>14</sup> The tenants recorded in this text paid 1.75 and 3.5 *lith*( ), respectively, per indiction in rent.

Cotton has subsequently appeared in the Kellis ostraka already mentioned, and in *O.Douch* 4.381, an order to deliver 3.5 *li(th-*) of cotton, described as a payment of *annona*. Wagner’s note on the passage cites mention of occasional finds of cotton in the necropolis of Douch.<sup>15</sup> Volume five of *O.Douch* brought

<sup>13</sup> *P.Oxy.* 59.3991.14n.

<sup>14</sup> *P.Kell.* 4, pp. 50-51.

<sup>15</sup> F. Dunand et al., *La nécropole de Douch*, vol. 1 (Cairo 1992) 232. To be precise, that passage reports that cotton appears only as sewing thread. This is of course a purely

two further pieces of evidence: nos. 537, an account mentioning 6 and 1 *lith*( ) of cotton; and 634, an order to furnish 1.5 λίθιν of cotton. In the note, Wagner remarks, “C’est la seule fois que la mesure cotonnière est écrite en toutes lettres: ce serait donc le *lithion*, diminutif rarissime de *lithos* (LSJ 1048, s.v.), clairement une unité pondérale standard, et non une mesure volumétrique.” Regrettably, there is no plate to allow the reader to check this proposed text, of which every letter is dotted, and to verify whether the reading of the second *iota* is in fact compelling.

Finally, the forthcoming *O.Trimithis* 1.38 and 44, mentioned already above, offer two more indications of *lith*( ), with substantial amounts (up to more than 26 *lith*( )). Perhaps most importantly, their use of fractions makes it possible to demonstrate that the *lith*( ) was indeed at least ten Roman pounds, because the fractions are based on a system of units requiring a common denominator of 2,880, or ten times the number of grams in the Roman pound. That would make the *lith*( ) at a minimum about 3.23 kg of cotton, and one of the *Trimithis* ostraka would deal with a total of more than 200 kg of cotton – a very large amount of cotton, when considered in terms of volume.

There is a great deal to be said about the introduction of cotton into Egypt and the potential economic impact on the oasis economy of large-scale production of the crop. For the present, however, my purpose is to look more closely at SB 9026 and to try to understand it as a document. For that purpose, we will need to reproduce the text, with a few suggested changes, and a revised version of Winter and Youtie’s translation.

Ἡρακλείδης Ὀρίωνι τῷ φιλάτῳ  
χαίρειν.

- οἱ πέμποντες πάντες ἐπι[σ]τολὰς περὶ τῶν  
4 καμήλων πέμπουση. ἐπέσχα τοὺς [μ]ετὰ  
τῶν καμήλων. μετὰ τὸ γὰρ γεμίσει ἡμᾶς  
τοὺς καμήλους ὁστών, τότε ἠνέχ[θ]ῃ ἢ ἐπι-  
στολή. ἐ[δ]υνάμην γὰρ ἀγοράσειν π . . . α . λα .<sup>16</sup>  
8 τοῦ μετρητοῦ (δραχμῶν) ριβ. καὶ γὰρ ξένοι ἐλήλυθαν  
ζητοῦντες ἔλαιον. ἔδει σε πέμπων φακὸν  
ἡμεῖν καὶ σίτον πέμψαι εἰδὼς ὅτι ο[ὐ]κ ἔχο-  
μεν παρ[έ]χειν. ἐὰν δὲ μὴ νῦν θέλῃς π[έ]μψαι,

funerary context.

<sup>16</sup> π for Winter and Youtie’s τᾱ was suggested by Rodney Ast, comparing the letter in I. 22. It is evident that some phrase is required meaning “the oil” or “all the oil,” but I have not been able to find a suitable reading.

- 12 δύνηται<sup>17</sup> προχωρήσαι το[ῦ] στ[α]τῆρ[ος] μέτρου  
 ἐνὸς ἡμίσεος. εἰ νῦν πέμψεις π[ροχ]ρείαν,  
 πέμψον πυροῦ ἀρτάβας πέ[ν]τε. ὁ φακὸς  
 πωλεῖται ἐκ δύο μ[έ]τρων τοῦ[ς] στατήρες.
- 16 ἔκομισάμην διὰ Φατρέους (δραχμὰς) ρος και  
 φακοῦ (ἀρτάβας) δ και τ[υροῦ]ς<sup>18</sup> ὀβολοαίους  
 ἰδ και ἀνά δύοβολ[ο]γ[. . .] και τοῦς ἰχθύ-  
 ας. κόμισαι παρὰ Σουή[ρο]υ σπυρίδιον
- 20 ἐν ᾧ ἐστὶν διζύφων μ[έ]τρον ἕν, ρόας λ̄,  
 και σικύδια τε. δήλωσόν μοι ἐκ πόσου  
 τὴν ἀρτάβην πειήρας ἐλαίας βούλει ὠνή-  
 σασθαί με. πάντες γὰρ ἐζήτουν σίτον και
- 24 φακ[ὸ]ν προχρείας ὅπως ἐ[τ]οιμάσωσι. κό-  
 μισαι παρὰ τοῦ αὐτοῦ σπυρίδ[ιο]ν ἐν ᾧ ἐστὶν χλ[ω-]  
 ροῦ φο[ίν]ικος μέτρα δύο και τοῦς δύο χοεῖς ἕξ  
 μετρητὰς οἴνου παλαιοῦ – μετὰ πολλοῦ
- 28 μόγου ἐὰν εὔρω – και ὁστών (ἀρτάβας) ἰβ—.  
 ἀσπάζο[υ] Ἑλένην, Θαήσιον και τὰ παιδιά, Πτολε-  
 μαῖν. ἔρρωσο. . .[. . .] μηνὸς Ἀδριανοῦ.<sup>19</sup>

In left margin:

- ἐν τάχει οὐχ εὔρον τὸν χιτῶνα τὸν ἐρεξόυλον ὡς  
 ἤθελον. εἰ δὲ θέλεις ὑφανθῆ-
- 32 ναί σοι ἐνθάδε, πέμψον στήμονα και τὰ μέτρα. φρόν' τισον'  
 τοῦ σίτου τοῦ πεμπομένου εἰς Ψῶβ-  
 θιν και τοῦ σίτου Χαιράτος. μὴ ἀμελεῖς περὶ πάντων.  
 κόμισαι παρὰ Φατρέους Χαιράτος σπυρί-  
 διον ἐν ᾧ φοινίκων μέτρα τρία και ρόας ν̄ και ἐπιστόλιον.  
 ὄρα οὖν μὴ ἀμελεῖς αὐτοῦ.

“Herakleides (?) to his dearest Horion, greetings. All who send letters send them concerning the camels. I detained the men with the camels. For it was after we had loaded the camels with date-stones that the letter was brought

<sup>17</sup> δύνεται Winter and Youtie. It is possible that it has been corrected from *alpha* to *eta* or vice versa.

<sup>18</sup> My reading and restoration; Winter and Youtie read [. . .]ς. Cf. *P.Oxy.* 4.729.10, where τυροῦς ὀβολοαίους ἑκατὸν figure in a required lease payment.

<sup>19</sup> Reading by Rodney Ast, instead of Winter and Youtie's . . .νος Ἀπιαγοῦ.



to me. [This was a good thing] for I was able to buy [oil]<sup>20</sup> at the price of 112 drachmas per *metretes*. For strangers have come looking for olive oil. When you were sending us lentils, you should have sent grain also, since you know that we cannot supply it. If you do not wish to send it now, it can be obtained [here] at the price of a *stater* for one and a half *metra*. If you send an advance now send five artabas of wheat. Lentils are being sold at the rate of two *metra* for the *stater*. I received through Phatres 196 drachmas and 4 artabas of lentils and 14 one-obol cheeses and ... at the rate of two obols each, and the fish. Receive from Soueros a basket in which there are one *metron* of jujubes, 30 pomegranates, and 15 gourds. Tell me at what price for the artaba you wish me to buy succulent olives. For they were all asking for grain and lentils by way of advance in order that they might make preparation. Receive from the same messenger a basket in which there are two *metra* of fresh dates and the two *choes*, six *metretai* of old wine – it is only with much trouble that I find any – and 12 artabas of date-stones. Greet Helene, Thaesion and her children, and Ptolemas. Farewell. ... month Hadrianos. PS: In a hurry I did not find the cotton *chiton* as I should have liked. If you want to have one woven for you here, send warp thread and the measurements. Take thought about the grain which is being sent to Psobthis and the grain of Chairas. Do not neglect all these things. Receive from Phatres, the son of Chairas, a basket in which there are three *metra* of dates and 50 pomegranates and a letter. See that you do not neglect it.”

It was Guy Wagner who recognized that the pattern of the materials sent and received by Herakleides suggested his location in the Small Oasis: he is receiving wheat, lentils, and fish, and sending dates and wine.<sup>21</sup> More can be said, and indeed in a later article Wagner pointed out that the “bones,” as Winter and Youtie translated ὄστᾶ, could only be date stones.<sup>22</sup> As he remarked, “les noyaux sans autre précision ou associés à des dattes sont des noyaux de dattes. Récupérés après détritage ou consommation des fruits, ils étaient, dans tous les cas de figure, broyés et réduits en poudre. Ils servaient fondamentalement à l'alimentation du bétail. Cette pratique prévalait dans les déserts, les Oasis, chez

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<sup>20</sup> See H.-J. Drexhage, *Preise, Mieten/Pachten, Kosten und Löhne im römischen Ägypten bis zum Regierungsantritt Diokletians* (St. Katharinen 1991) 48, who lists this papyrus, despite the absence of a full reading of the text in Winter and Youtie, as referring to olive oil. He calculates the price per *kotyle* as 0.78 dr., which is in line with second-century olive oil prices but lower than average – not surprisingly if we are talking about the price in the Oasis.

<sup>21</sup> Wagner (n. 5) 293, n. 9.

<sup>22</sup> “ὄστᾶ φοίνικος,” *ZPE* 105 (1995) 161-165.

les caravaniers. Ceci explique qu'ils soient si peu présents dans la documentation papyrologique qui concerne avant tout la vallée du Nil; il y a de fortes présomptions que les rares documents où ils figurent soient en rapport avec le désert occidental et les Oasis.<sup>23</sup> The jujubes, the rarity of which inspired a long note by Winter and Youtie (p. 253, 20n.), are also an oasis fruit, common both in the documents and in the archaeobotanical finds.<sup>24</sup> Once again, the rarity of the fruit in the papyri is likely to be a reflection of the fact that our documents overwhelmingly come from the Valley.

But something more may also be said about the wheat and lentils. It is precisely the lack of availability of these in the place from which Herakleides is writing that marks this out as the Small Oasis. In the Dakhla and Kharga Oases, wheat and barley were grown in antiquity, as they are today, for local consumption. The distance from the Valley to these oases would have made their importation extremely expensive, and estates seem to have aimed at self-sufficiency.<sup>25</sup> But this is not true of the Small Oasis, where today the visitor accustomed to the agricultural patterns of the Great Oasis is struck by the utter dominance of fruit trees, to the virtual exclusion of arable cultivation. There is in fact evidence of the importation of cereals into the Small Oasis in the Roman period.<sup>26</sup>

Happily, Herakleides even tells us the current market price of wheat and lentils: wheat is selling for 1 1/2 *metra* (*matia*, at 10 to the artaba) per *stater*, or 26 2/3 drachmas per artaba. Lentils are selling for 2 *metra* per *stater*, or 20 drachmas per artaba. Although relatively few lentil prices are available for comparison, those we have do tend to suggest a relationship to wheat in line with the 3:4 ratio seen here.<sup>27</sup> A wheat price at this level would be very high for the second century, when a range of 8-12 was more normal; average prices in the mid-20s do not appear until the middle of the third century, although it

<sup>23</sup> Wagner (n. 22) 165. Cf. also *P.Kellis* 4, pp. 43 and 55.

<sup>24</sup> *P.Kellis* 4, p. 44, with references. See now *O.Kellis* 90.2.

<sup>25</sup> On this point see *P.Kellis* 4, pp. 78-80.

<sup>26</sup> Mainly from customs receipts; a good example is *P.Grenf.* 2.50(b), of AD 145, a receipt for Harpagathes, who is exporting 20 artabas of wheat to the Small Oasis on 2 camels.

<sup>27</sup> Drexhage (n. 20) 34-35, discusses lentil prices briefly and gives a table. The evidence largely comes from *SB* 8.9699, with 5-7 dr./artabas; the comparable range for wheat in this document is 8-11 dr., the lower figure in transactions with the state, the higher in private transactions; see D.W. Rathbone, "Prices and Price Formation in Roman Egypt," in *Économie antique: Prix et formation des prix dans les économies antiques* (Saint Bertrand-de-Comminges 1997) 183-244 at 217 and 221. See also R.S. Bagnall, *Currency and Inflation in Fourth Century Egypt* (Atlanta 1985) 8, arriving at an average ratio of just under 3:4.

must be remembered that we have nothing approaching a continuous series of data.<sup>28</sup> The tone of the letter does suggest a situation of shortage, of course. But another explanation should be considered, namely that the cost of transportation from Oxyrhynchos to the Small Oasis, about 200 km by camel, would have increased the cost of bulk commodities like wheat and lentils considerably.

We can be more precise about this. We know from a papyrus of AD 145 (*W.Chr.* 321 = *BGU* 3.697) that the charge for carrying a “metallic talent” of alum, weighing 21 kg, for 270 km from the Small Oasis to the Fayyum was 7 1/2 drachmas. We may calculate that 21 kg x 270 km = 5,670 kgkm; that is, the sum in question was sufficient to pay for 5,670 kilogram-kilometers (1 kg carried 1 km).<sup>29</sup> Dividing that by 7.5 (drachmas) indicates that 1 drachma paid for 756 kgkm/dr. Now 1 artaba of wheat weighs some 30.3 kg. Transporting an artaba from Oxyrhynchos to Psobthis, a distance of about 200 km, entails 6,060 kgkm, which would have cost just about exactly 8 drachmas. Of course, as always, we should not push matters too far; such costs will have varied for reasons we cannot know in particular cases. Still, we may suppose that not much short of a third of the cost of the artaba in the Small Oasis will have represented transport costs. That would mean that the cost of the goods apart from transport was 18 2/3 dr. per artaba in this case, still a very high price if it comes from the second century.<sup>30</sup> At all events, the transportation penalty is clear. That the Small Oasis continued to grow fruit crops – and, as we see, cotton – instead suggests that the high profitability of such crops paid for the extra cost of supplying the Oasis with cereals.

Such a conclusion fits well with the view of land transportation that has gradually been emerging from more recent scholarship, particularly in the case of Egypt from Colin Adams’s study (see n. 29). In place of the often repeated but overly simplistic view that long-distance land transportation was essentially prohibitively expensive in normal market operations, it has become clear that the economy of the oases responded to the cost of transportation as one might expect in a market economy. Only those products were exported to the Valley for which the oases had a cost advantage sufficient to outweigh the cost of transport by camel, mainly fruit crops which had a high value relative to bulk and in the production of which the oases had an advantage over the

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<sup>28</sup> See Rathbone (n. 27) 217-220, for a table of these prices. He suggests on 197 that there was normally a fluctuation, owing to a variety of factors, on either side of the median; anything more than that band would be the product of exceptional disturbances.

<sup>29</sup> The papyrus is cited by C.E.P. Adams, *Land Transport in Roman Egypt* (Oxford 2007) 231, but without an attempt to calculate kgkm rates.

<sup>30</sup> See Rathbone (n. 27) for the comparable prices.

Valley because of the availability of perennial irrigation. There were also non-agricultural products uniquely or principally available in the oases, like alum, but these do not figure in the Michigan papyrus. In all likelihood, the camels had less to carry back to the oases than to carry from them, a circumstance which may have made it economically feasible to carry grain the 200 km to Bahariya or to carry raw metals to Kharga and Dakhla.

Finally, it is clear that the presence of cotton in the oases, for which our late antique evidence has grown so dramatically in the last two decades, is not something new in the fourth century, but goes back at least to the second century. The oases had a decisive advantage in cotton growing under ancient conditions, but we have as yet hardly any idea of when cotton was introduced or on what scale it was grown. That is a subject for another study.

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