A STRANGE «LINEAR A» WINE-MEASURE

I should prefer to have made a positive contribution to the study of Linear A, especially since so much progress has recently been made in the discovery and publication of the documents. But my attention is persistently drawn to a series of publications which only seem, primarily through the analysis of the accounting elements, to have advanced the explication of Linear A texts. They might even, taken as a group, gain the appearance of authority simply by their bulk, and by the prestige of the periodicals in which they continue to appear. But I find these articles, by D. A. Was, paradoxical and of little advantage to these studies. I hoped in my recent article «Linear A fractional retractation», *Kadmos* 19, 1980, 12-23, to bring Was to reconsider the texts and assumptions from which he started, and upon which he still relies, but I fear I was unsuccessful. Therefore I feel compelled to review one of his recent articles, «Two notes on Linear A», *Minos* 17, 1981, 7-17 [1], and to point out what seem to be its errors, and to suggest that similar errors inform much of what Was has written on the subject. I know Was' methods, assumptions, and conclusions only by interpreting what he has written. I shall probably misrepresent some of them, and I quickly apologize to Dr. Was for doing so, and hope for correction. For an apparent polemic I should prefer not to have written, I apologize to my readers.

[1] I shall abbreviate these articles. *BICS* 18 = D. A. Was. «Numerical fractions and symbols for measures in the Minoan hieroglyphic script», *BICS* 18, 1971, 16-25. *Kadmos* 10 = —. «Numerical fractions in the Minoan Linear Script A. I. The evaluation of the fraction signs», *Kadmos* 10, 1971, 35-51; *Kadmos* 11 = —, «— II. The measurement of dry commodities and their use in the payment of Minoan labour», *Kadmos* 11, 1972, 1-21. *Kadmos* 12 (or 12:1) = —, «— III. The measurement of liquids», *Kadmos* 12, 1973, 28-59. *Kadmos* 12 (or 12:2) = —, «— IV. The measurement by weight», *Kadmos* 12, 1973, 134-148. *Kadmos* 13 = —, «— V. Olive oil and related commodities», *Kadmos* 13, 1975, 95-116. Was '81 = —, «Two notes on Linear A». *Minos* 17, 1981, 7-17.

The text discussed is HT 9 [2]. For my purpose I would divide his exposition into three parts: 1) the conclusion, i.e. the 'kados' complex, 2) the development, i.e. the 'discovery by anarithm' of a new and strange wine-measure, and 3) the premisses of his argument, i.e. a) his reading and interpretation of the text of HT 9, b) the values he established in *Kadmos* 10 for the fractional signs E, J, and JE, and c) a premiss about the measurement and distribution of wine in Linear A texts, i.e. the 'wine-medimnos' complex.

1. THE 'KADOS' COMPLEX

His conclusions, all expressed with proper qualification, and presented in a different order, seem to me to include the following:

a) For the Linear A sign 66 a value do_2 is reasonable in several other instances, and this might support an interpretation of *ka-*do_2 for the group 29-66 in HT 9 b.2. This result depends on (b) the interpretation of *ka-*do_2 as *kadōn* (from κάδος), the value of *ka* for 29, the rejection of other values for 66, e.g. *twe* [3]. It involves but does not depend on the values of *ru* for 55 and *te* for 92, the interpretations of 66-55 as *Doura, Dōros,* of 66-92 as *dotēr, dōtēr,* and of 66

[2] I shall also abbreviate the sources of texts and variant readings. CTLA = Jacques Raison, Maurice Pope, *Corpus transnumeré du linéaire A (Bibliothèque des Cahiers de l'Institut de Linguistique de Louvain,* 18), Louvain 1980. ELB '50 = Emmett L. Bennett, Jr., «Fractional quantities in Minoan bookkeeping», *American Journal of Archaeology* 54, 1950, 207-208. GORILA = Louis Godart, Jean-Pierre Olivier, *Recueil des inscriptions en linéaire A (Etudes Crétoises,* 21), Paris, Geuthner, 1976—. IHTPC = Giovanni Pugliese Carratelli, *Le iscrizioni preelleniche di Haghia Triada in Creta e delle Grecia peninsulare (Monumenti Antichi),* 40:4, 1945, 421-610. ILA = *Inscriptions in the Minoan Linear Script of Class A,* edited by W. C. Brice, Oxford, Society of Antiquaries, 1961. IXTLA = Jacques Raison, Maurice Pope, *Index transnumeré du linéaire A (BCILL,* 2), Louvain 1977. JS '20 = J. Sundwall, «Zur Deutung kretischer Tontäfelchen», *Acta Academiae Aboensis, Humaniora,* 2, 1920, 9. JS '42 = J. Sundwall, «Minoische Kultverzeichnisse aus Hagia Triada», *AAAH* 14: 4, 1942, 5. F. Chapouthier, *Les écritures minoennes au palais de Mallia (Etudes Crétoises,* 2) Paris, Geuthner, 1930. I shall cite signs of Linear A in the transnumeration of IXTLA, 48, except where it is appropriate to employ the special transliteration Was has adopted.

[3] J. Raison, M. Pope, «Le vocabulaire du linéaire A en translittération», *BCILL,* 14, 1978, 188 (66 = *twe*). D. W. Packard, *Minoan Linear A,* Berkeley 1974, 34-35, Figs. 5-6 (66 unidentified).

alone as an abbreviation for *doulos, dōlos,* and a reading of 66-92 in HT 63.1[4]. Cf. Was'81, 10-17.

b) The group 29-66, so interpreted, might lexically represent the classical kados, both as a vessel name, and especially as the name of a measure. It might in fact represent the kados referred to by H. Chantraine in *KP*[5] 3, 1969, 42, «In Sizilien (Tauromenion) war der K(ados) die Hälfte des att(isches), also = 19.7 l.». Further, taking the value of a 'khoinix' as 0.9 l., from Palmer[6], an identity is suggested between the capacity of 22 'khoinikes' (22 × 0.9 l. = 19.8 l.) and the capacity of that kados (19.7 l.). This result depends on the accuracy (relative if not absolute) of the quoted estimates of the capacities of the Tauromenian kados and the classical Athenian choenix. It involves (perhaps depends on?) an assumption that 29-66 is a term describing the fiscal unit represented by the numbers associated with the sign-groups which follow it on HT 9 b, and it implies the continuous existence and unchanged name of a particular standard vessel and volume, a 'kados' of ca. 19.75 l., and of 22 parts, from Linear A to the second century B.C., from Crete to Sicily. It involves also, or perhaps affects, (c) the conclusion of the 'discovery' of a new wine-measure. Cf. Was '81, 10-12, especially note 18.

c) The conclusion of the 'discovery', i.e. the existence of a unit (of whatever name) composed of 22 smaller measures on HT 9 b, of which smaller measures 120 compose the unit in HT 9 a, involves but perhaps does not depend on the identification of this common small measure as a 'Minoan khoinix', and of the large measure of HT 9 a as a 'Minoan medimnos'[7]. But it does depend upon the strength of the development by which these measures were discovered. That in turn depends upon the premisses. Cf. Was '81, 7-12.

4 «66-92» in IHTPC, ILA. «66, 92» in GORILA, CTLA, IXTLA.

5 *KP* = *Kleine Pauly,* Stuttgart 1964—.

6 *Kadmos* 11,1. L. R. Palmer, *The Interpretation of Mycenaean Greek Texts,* Oxford 1963, 13: «0.9, this last being the estimated value for the *choenix,* see *Docs.* 56 f.». Palmer found in Ventris and Chadwick, *Documents in Mycenaean Greek,* Cambridge 1956, 56: «*Classical Athens...* Dry: 1 *medimnos* (43.5 l.) = 6 *hekteis* = 48 *khoinikes* (0.906 l.)».

7 *Kadmos* 11,7, table I. Cf. *BICS* 18,23.

Having been convinced that HT 9 a represented quantities of wine measured in units equaling 120 'khoinikes', and having been led by his 'discovery' to suspect the existence of another unit measuring wine and containing 22 'khoinikes', Was sought evidence for such a unit. Since he was convinced of the value of 0.9 l. for the 'khoinix', he valued a multiple of 22 at ca. 19.8 l. In *KP* (where all the pertinent metrological articles are due to H. Chantraine), s.v. *choinix,* references lead to *medimnos* and *kotylai.* In these [8] we find the principal measures of dry volume: 1 medimnos = 48 choinikes = 192 kotylai, 1 choinix = 4 kotylai; medimnos = 52.5 (52.53) l., choinix = 1.094 l., kotyle = 0.273 (0.2736) l. S.v. *kotyle* references lead to *chus* and *metretes.* In these [9] we find the principal measures of liquid volume: 12 kotylai = 1 chus, 144 kotylai = 12 choes = 1 metretes; kotyle = 0.273 (0.2736) l., chus = 3.281 (3.283) l., metretes = 39.4 (39.39) l. S.v. *metretes* a reference leads to *kados* [10], under which we read «in Athen mass 39.3 l. ... In Sizilien (Tauromenion) war der K. die Hälfte des att., also 19.7 l. (anders Oxé)». This seemed to Was the measure he was looking for, since 19.7 is indeed aproximately 19.8. But he seems not to have noticed the discrepancy of a choinix of 1.094 l., and a choinix of 0.9 l., or that the quantity 0.9 l. belongs to a system of estimates incompatible with the system to which 19.7 l. belongs, or that the Tauromenian kados was not obviously divided into 22 parts.

The kados is found in the Tauromenian inscription, *IG* XIV 422, where its parts are named and their relationships determined by arithmetical operations, additions and subtractions. These are the half = hemikadion, the sixth = prochous, the twelfth = trimetron, the thirty-sixth = metron. A smaller measure also appears, the kotyle, but its relationship must be guessed. The guess that it is a half-metron, or seventy-second of the kados, is suggested by the possibility of simultaneously equating the Tauromenian kotyle with the Attic kotyle, the prochous with the Attic chous, and the kados with the Attic half-metretes. And if Was

8 *KP,* s.v. *choinix,* 1, 1152; s.v. *medimnos,* 3, 1130-31; s.v. *kotyle,* 2, 3, 320.
9 *KP,* s.v. *chus* 1, 1, 1173; s.v. *metretes,* 3, 1279.
10 *KP,* s.v. *kados,* 3, 42-43.

had divided Chantraine's 19.7 liters by this 72 he would have found the kotyle of 0.2736, and the corresponding 'khoinix' [11] of 1.094 l., not 0.9 l. Was seems not to have noticed that the 0.906 l., referred to by Palmer and quoted in *Documents in Mycenaean Greek,* comes not only from a different estimate of the absolute values of Attic measures of volume but from a different reconstruction of their system. This is the one in which, as indicated by *Docs.* 56, 1 medimnos = 48 choenices = 192 kotylae, 1 choenix = 4 kotylae; medimnos = 43.488 l., choenix = 0.906 l., kotyle = 0.2265 l., and 12 kotylae = 1 chous, 96 kotylae = 8 choes = 1 metretes; kotyle = 0.2265 l., chous = 2.718 l., metretes = 21.744 l. Consequently, Was was not likely to notice that the relationship of 22 'khoinikes' to the 'kados', far from being ancient, was in fact the modern product of the 18 'khoinikes' into which the Tauromenians might have divided their kados, multiplied by the estimate for the absolute value of an Attic choenix in *KP,* i.e. 1.094 l., divided by the estimate of the same Attic choenix in *Docs.,* i.e. 0.906 l. That quantity is ca. 21.735, which approximates 22, as 19.7 l. aproximates Was' 19.8 l.

That one should be confused by the metrology of the ancient world deserves no rebuke. On the one hand the scholarship of *KP* makes it unthinkable that the Tauromenian kados should not be ca. 19.7 l. On the other the agreement of Ventris and Chadwick's *Documents* with Palmer's *Interpretation* gives preponderant authority to an Attic choenix of 0.9 l. Yet in all three works there are cautions which ought to have been noticed. *Documents,* 56, has «The following comparative data for weights and measures are subject to controversy and should be used with caution». *KP,* s.v. *kados,* has «19.7 l. (anders Oxé)», and s.vv. *choenix, kotyle, medimnos, chus,* and *metretes,* indications that, while the estimates of Hultsch were accepted, those of Viedebantt and Oxé were different, and not to be dismissed without reference.

The system of a 52.53 l. medimnos and a 39.39 l. metretes adopted by Chantraine comes directly or indirectly from Hultsch, *Griechische und Römische Metrologie,* Berlin 1862, Tafel X (ed. 2,

[11] Such a measure, for oil at least, is not named 'khoinix' in the inscription, is not named at all. By the pattern of the *trimetron* which does occur, it might have been called a 'dimetron', if a *kyathos* was half a *metron.*

1882) [12]. The competing system of a 43,488 medimnos and a 21.744 l. metretes comes directly or indirectly from Viedebantt, «Das Attische Hohlmasssystem», 60 [13]. His innovation was to combine with an interpretation of ancient literary and comparative evidence the apparent volume of an official Athenian measure, which he thought to be a choenix, published in 1867-1872, and known to, but dismissed by, Hultsch [14]. The reference to Oxé leads to still a different rival system, which for the Tauromenian measures offers a medimnos of 52.1856 l. (= 96 kotylae of 0.5436 l.) and a kados of 39.1398 l. (= 72 kotylae of 0.5436 l.), abandoning the equations of name and capacity of prochous and kotyle with the Attic chous and kotyle [15]. A much larger body of ancient official measures is now available, and has been presented by Mabel Lang as essentially compatible with Hultsch's system [16].

The acceptance of one or the other system of liquid measures in Attica or Tauromenion or of one or the other estimate of their absolute values is immaterial here, but surely one must take as a working hypothesis only one at a time. Was inadvertently has

12 Also from articles in *RE,* s.v. χοῖνιξ (Hultsch), 3, 1899, 2356-58; s.v. χοῦς (Hultsch), 3, 1899, 2526-27 (the aberrant figure in *KP,* s.v. *chus,* «3.281 l.», obviously derives from crowded typography on *RE* 3, 2527.36); s.v. κάδος (Viedebantt), 10, 1919, 1477; s.v. μετρητής, 3 (Becher), Suppl.-Bd. 7, 1940, 448.

13 O. Viedebantt, in «Forschungen zur Metrologie des Altertums», IV, 56-66 (*Sächsische Akademie der Wissenschaften zu Leipzig, Phil.-Hist. Classe,* 34:3, *Abhandlungen,* 1917). Also from articles in *RE,* s.v. *kotyle,* 2 (Viedebantt), 11, 1922, 1546-48; s.v. μέδιμνος (Viedebantt), 15, 1931, 86-91. Was knew that this was the source of the system he adopted (*BICS* 18,25, note 32), but he did not know it well. He was unaware that Viedebantt's metretes was composed of 8 choes. His confusion of Viedebantt's and Hultsch's systems was already established. On *BICS* 18,24, Table VIII, he offers not Viedebantt's 8-chous metretes of 21.744 l., but Hultsch's 12 times Viedebantt's «classical» chous, for a 'metretes' of 32.6 l. His comment on this, p. 22: «another difference with respect to the classical system is the subdivision of a metretes into eight instead of into twelve khoes». The note on this, p. 25, note 26: «For unstated reasons the ratio 1 : 8 is, inserting a question-mark, quoted in *Docs.,* 56, as applying to the classical system». It seems clear that a 32.6 l. 'metretes' is a hybrid, and Was' own discovery. Similarly, in *Kadmos* 12,32 (with note 10), he claims: «the lowest [Minoan] sub-unit, the kyathos, corresponds with that of the classical unit». His 'kyathos' is 1/20 of Viedebantt's choinix = 0.0453 l. But Viedebantt's own kyathos is 0.03775 l. Chantraine's in *KP,* to which Was refers in note 10 as «45 millilitres», is 1/24 of Hultsch's choinix = 0.04558 l.

14 A. Dumont, *Revue Archéologique* 16, 1867, 292; 24, 1972, 297. Hultsch, *Metrologie*^{2}, 1882, 109, note 4.

15 A. Oxé, «Kor und Kab», *Bonner Jährbucher,* 147, 1942, 121-122.

16 M. Lang, *Weights, Measures and Tokens (The Athenian Agora,* 10), 1964, 39-55.

violated this rule. Having based his analysis in Viedebantt's system [17], he should use no other. Still, had he not insisted on finding a relationship of 22 parts to 1 in modern estimates of absolute value, but instead been content with similar relationships reported in ancient metrological literature, he might have found measures fitting his requirements, and with the highest authority, in the modius of 22 xestae presented by Epiphanius 9-10 [18], or in the modius reported by Epiphanius 8 among the Cypriotes, which held 17 xestae. I add this because the factor 17 was suggested to Was in the same calculations which suggested 22, though 17 was rejected as «a trifle odd» (Was'81, 10).

My conclusion is that there may indeed have existed a Minoan measure with a name aproximaterly 'kados', with an abolute value of ca. 19.7 l., and divided into 22 parts, each the equivalent of Palmer's 'choenix'. Yet nothing in the little but confusing metrological literature I have examined supports it. The evidence for it seems to come entirely from Was' interpretation of HT 9, and depends entirely upon the conclusion of his development. Thus instead of confirming by the 'kados' complex the 22:1 ratio of the wine measure he discovered, the 'kados' complex may fall if the 'discovery' is found to be fragile. Let me therefore now examine this discovery of the relationship of the 120:1 'medimnos' in HT 9 a to the 22:1 new measure in 9 b.

2. Discovery by anarithm

This discussion must proceed in a different vein. I shall not try to reproduce his actual methods or his exposition of them, but I shall illustrate by an independent analysis procedures which lead to results similar to those of Was. For this purpose I should use a different but similar text, and fortunately HT 9 itself offers a sufficient variety.

The text in Table I is obviously not the whole text of HT 9, but only those parts lending themselves to arithmetical manipulation. Column I, ELB, gives a convenient, radically arbitrary transcription of the sign-groups which precede the numbers, and

17 Per Palmer, *Interpretation,* and Ventris and Chadwick, *Documents.*

18 F. Hultsch, *Metrologicorum scriptorum reliquiae,* 1, Leipzig 1864, 261-262.

TABLE 1. PARTIAL TRANSCRIPTIONS FROM THE TEXT OF HT 9

Sign-groups:			Quantities:		
I	II	III	IV	V	VI
ELB	CTLA	Was '81	ELB	CTLA	IPHTC
	HT 9 a:				
adid	2-102a	pa-de	AD	5 JE	5 Lm11
uvew	83a-6	83-tu	UV	10	10
ivisew	51-26-97	di-na-u	IV	4	4
ayin	91-64	k^we-pu	AY	2	2
isivij	7-51-53	7-di-ra	IS	2 J	2 Lm9
anenyn	74-100a-65	ta-no-65	AN	2 J	2 Lm9
igeh	52-55	a-ru	IG	4 E	4 Lm1
esac	98-22	ku-ro	ES	31 JE	31 Lm11
	HT 9 b:				
adid	2-102a	pa-de	ad	3	
igeh	52-55	a-ru	ig	3	
uvew	83a-6	83-tu	uv	8	
isivij	7-51-53	7-di-ra	is	2	
ayin	91-64	k^we-pu	ay	2	
anenyn	74-100a-65	ta-no-65	an	2	
ivisew	51-26-97	di-na-u	iv	4	
esac	98-22	ku-ro	es	24	

Variant readings: AD: JS '20: 6 Lm9, Lm1. JS '42: 5 Lm9, Lm1. ES: JS '20: 31 Lm9, Lm1. JS '42: 30 Lm9, Lm1. ad: ELB '50: 3[+ 1]. ay: ELB '50: [1].

IV gives the symbols by which I shall refer to the numerical quantities which follow the sign-groups on the two faces. Columns II and V, CTLA, show the transnumeration of Raison and Pope. Column VI, IHTPC, adds Pugliese Carratelli's original numeration for the signs for 'fractional' quantities. Column III, Was '81, shows Was' syllabic transcription, which does not entirely agree either with Packard's or with Raison and Pope's transliteration [19]. The text I shall work with is that given by CTLA. Was, however, adopts the variant readings of JS '42 for AD and ES. The variety

[19] D. A. Packard, *Minoan Linear A*, 1974, 34, fig. 5; J. Raison, M. Pope, «Le vocabulaire du linéaire A en translittération», *BCILL* 14, 1978, 188.

of readings in AD and ES can be enhanced by the use in IS, AN, IG of different interpretations of the signs E, J, and JE. Was uses his own, from *Kadmos* 10. I shall use (only e.g., for I would not endorse them) those of IHTPC, 483-489. This interpretation therefore appears in Table 2.

TABLE 2. A LIKELY TEXT, AN UNLIKELY INTERPRETATION, AND EXPANSIONS. CTLA, *per* IHTPC, 483-489

	VII	VIII	IX	X	XI	XII	XIII
	Ω	Φ	ΦA	ΦB	ΦΓ	ΦΔ	ΦE
AD	5¼	21	504	504	21	525	42
UV	10	40	960	960	40	1000	80
IV	4	16	384	384	16	400	32
AY	2	8	192	192	8	200	16
IS	2¾	11	264	264	11	275	22
AN	2¾	11	264	264	11	275	22
IG	4½	18	432	432	18	450	36
ES	31¼	125	T = 3000	U = 3000	V = 125	W = 3125	Z = 250
	ω	φ	φα	φβ	φγ	φδ	φε
ad	3	3	375	75	750	78	378
ig	3	3	375	75	750	78	378
uv	8	8	1000	200	2000	208	1008
is	2	2	250	50	500	52	252
ay	2	2	250	50	500	52	252
an	2	2	250	50	500	52	252
iv	4	4	500	100	1000	104	504
es	24	24	T = 3000	V = 600	U = 6000	X = 624	Y = 3024
Assumptions: Ω ≠ ω, Φ = φ, and							
ES:es		125:24	1:1	5:1	1:48	ca. 5:1	ca. 1:12
Ω:Φ		4:1	96:1	96:1	4:1	100:1	8:1
ω:φ		1:1	125:1	25:1	250:1	26:1	126:1
Ω:ω		4:1	96:125	96:25	2:125	50:13	4:63

The quantities of HT 9 are written in terms of units and 'fractional' signs. Here Ω will represent a unit as written on face a, and ω a unit written on face b. A naive assumption is that Ω and ω, the fiscal units of the two records inscribed on the tablet, are obviously arithmetically and fiscally equivalent as standard

measures. They may represent utterly different things, as e.g. a loaf of bread and a jug of wine. Since of Ω there are recorded fractions of 1/4, 1/2, and 3/4, it is clear that quantities smaller than Ω may be expressed simply as fractions of Ω, and it is a naive assumption that any fraction might be found. For ω, since only units are written, it is even possible to assume that its unit may be indivisible, as e.g. a sheep. For either it is a possible, but not necessary, assumption that there was a hierarchy of larger and smaller measures by which fractional quantities might be regularly measured, as e.g. 2℔ 4s 6p. For Ω such a hierarchy might well include another measure equal to 1/4Ω, itself divisible into even smaller fractional measures. For ω we might imagine any system of subdivision. The assumption of a hierarchy of measures would be a first step toward a sophisticated assumption that from such an obviously uninformative text significant clues to Minoan metrology and accounting practices might be made evident.

To start with the assumption that Ω and ω were different materials, with Ω divisible without a hierarchy, would be sound. It is clear, however, that there is some relationship between them, if only that the two accounts appear on the two sides of the tablet, and that the quantities are attributed to the same set of sign-groups, of which the last, ES, es, seems to indicate the totals of the others. That the relationships (cf. Table 2, column VII) between related quantities, though not uniform, vary within a limited range, from 1:1 for IV:iv to 7:4 for AD:ad may be pertinent. It is not impossible then that of Ω and ω, one might be a commodity and the other its value in a different commodity, or that Ω and ω, whether subdivided differently or uniformly, might be the same commodity.

When we wish to compare for each sign-group the mixed quantities of Ω, we may find it more convenient to reduce the numbers to a common denominator, as in VIII, top. Or one may, even in the absence of any evidence for such an assumption, suppose that there are implied within each Ω or ω regular smaller subdivisions, which we may identify in columns VIII-XIII as Φ, φ, ΦA, φα, ΦB, etc. These will usually be aliquot parts of the next larger measure, but need not be. I illustrate in VIII with gallons (Ω) of wine divided into quarts (Φ), and ω, a man, divisible only as φ = ω. Thus the three men of ad are associated with the 21

quarts of wine of AD. These are the minimum divisions; many others are possible, but the parts of Ω must be 1 divided by 4, 8, 12, 16, ... 4n, while those of ω may be 1 divided by any 1, 2, 3, 4, ... n.

We may introduce, because Was has done so, four further possible, but unnecessary, assumptions. Assume that 1), the materials of Ω and ω may be identical (the presence of 82a in HT 9 a.2 suggests in any case that face a concerns wine), and 2), that Ω ≠ ω, but 3), that Φ = φ, and 4), that ES = es, *actually,* that is, not arithmetically. The consequences of these assumptions might be illustrated more simply one at a time, and with 4a), IG = ig. The minimum numbers of ΦA and φα which will satisfy these assumptions in this text are shown in IX. The assumption of ES:es = 1:1 entails the relationships of Ω:Φ, ω:φ, and Ω:ω, as shown. But multiples of these would equally satisfy the conditions, e.g. T *(tantamount)* at 6000, or 9000, Ω:Φ at 192:1, 384:1, ω:φ at 250:1, 375:1, etc.

As it naturally seems unlikely that Minoan measures of such relationships can be identified, a further unnecessary assumption will increase the stock of possible relationships in this text. Let the relationship ES:es be as well satisfied by 1:n or n:1 as by 1:1. I illustrate two of these in X and XI. U may then be any multiple of T, and W any submultiple of U. But as it may be that even this device will not lead to the discovery of Minoan measures so related, a further (penultimate) unnecessary assumption will increase the stock of possible relationships in this text, i.e., that calculations need not be exact'! Let any relationship of ES:es be as well satisfied by *ca.* 1:n or *ca.* n:1 as by 1:1. I illustrate two cases in XII, XIII. The limitations remaining in the interpretation of the text are that the number of Φ attributed to ES must, whether as the large number W or the small number X, be a multiple of (ES =) 125Φ, and the number of φ attributed to the larger Y or the small Z must be a multiple of (es =) 24φ. And, of course, W must approximate nX, and Y must approximate nZ.

Thus I have been able to 'discover' a relationship between Ω and ω in XIII, which is exactly that of Ω = a 4-gallon Tangier kula, and ω = a 63-gallon hogshead of wine. By multiplying es = 24 by the 126 gallons in the two hogsheads for 3024, and ES = 31¼ by the 8 gallons in the two kula for 250, I have discovered that es

is approximately 12 times (a simple relationship) as large as ES. For XII, there is the case of ω, a Roman amphora of 26 l., suitably related to Ω, a hectoliter of 100 l., and es approximately 1/5 of ES. But it must at once be admitted that it is not a good idea to mix disparate systems of measure, as liters and ancient amphorae, and that no one of these measures is likely to have been a Minoan measure.

At the head of this section I described the process I have been analyzing as «discovery by anarithm». Many of Was' procedures can be so described. Clear examples are the determination of oil capacities by HT 114 and 121 (*Kadmos* 12,29-35) and the identification of two classes of labourers, and their different ration scales for 'wheat' and 'figs' in HT 89 and 100 (*Kadmos* 11,9-12). Anarithm is a nonce word unworthy of becoming a neologism. It is constructed on the model of anagram. Just as in finding anagrams in a word or phrase an ambiguity is introduced permitting the production of many dull words, but also of an occasional pleasing and unexpected outcome, so in finding anarithms one can find many useless numbers, but also an occasional pleasing and unexpected set of numbers. Decipherment by anagram or by anarithm has a certain place. But the advantage of anarithms for one class of decipherers is that the polyrrhythmy introduced by the ambiguous process is concealed by the lack of ambiguity in the original numbers and definiteness of the final result, the anarithm.

Though many significant words have been deliberately hidden in anagrams, e.g. in «haec immatura a me iam frustra leguntur-oy» [20], it is a cardinal error, when one has found a message in a striking and pleasing anagram, to take the unexpectedness of the coincidence as an index of the truth of the message. Just so, when a pleasing and unexpectedly appropriate anarithm has been found, that it is almost incredibly striking cannot properly be taken as invincible evidence of the correctness of a decipherer's solution.

We may now see what Was has done. I present his calculations (as far as I understand them) with comparative material in Table 3.

20 Attributed to Galileo Galilei.

TABLE 3. WAS' TEXT, INTERPRETATION, AND EXPANSIONS.
JS '42, *per KADMOS* 10

	XIV	XV	XVI	XVII	XVIII	XIX	XX
	ΩA	ΦZ	ΦH	ΦΘ	ΦI	ΦK	ΦΛ
AD	*5¾*	*23*	184	148	690	690	690
UV	10	40	320	320	1200	1200	1200
IV	4	16	128	128	480	480	480
AY	2	8	64	64	240	240	240
IS	*2¼*	*9*	72	72	270	270	270
AN	*2¼*	*9*	72	72	270	270	270
IG	*4½*	*18*	144	144	540	540	540
ES	*30¾*	*123*	T = 984	V = 984	W = 3690	W = 3690	W = 3690
	ωα	φζ	φη	φθ	φι	φκ	φλ
ad	3	3	123	360	27	51	66
ig	3	3	123	360	27	51	66
uv	8	8	328	960	72	136	176
is	2	2	82	240	18	34	44
ay	2	2	82	240	18	34	44
an	2	2	82	240	18	34	44
iv	4	4	164	480	36	68	88
es	24	24	T = 984	U = 2880	X = 216	X = 408	X = 528
Assumptions: Ω ≠ ω, Φ = φ, and in XVIII-XX Ω = 120Φ, and							
ES:es		123:96	1:1	4:15	ca, 17:1	ca. 9:1	ca. 7:1
Ω:Φ		4:1	32:1	32:1	120:1	120:1	120:1
ω:φ		1:1	41:1	120:1	9:1	17:1	22:1
Ω:ω		4:1	32:41	4:15	40:3	120:17	60:11

His text (Table 3, column XIV) is that of JS '20, which Brice in ILA does not accept as a reading [21]. In XIV, XV I have emphasized by italics the differences both in readings and interpretations of the signs E, J, JE from my unlikely interpretation (VII, VIII). In XVI, XVII I offer the calculation of T, and of one possible set of U and V, apparently not considered by Was. Three related Minoan measures of Ω = 32Φ, ω = 120φ, and Φ = φ are not likely to be found, though they might be looked for. In XVII, by starting from the

[21] In *ILA*, 8, Brice suggests that the «1» of «31» may have been added as an afterthought, but his text, Plate 2, is «31 JE».

equation Ω = 120φ, I accept e.g. one of Was' premisses, which I shall later discuss as the 'wine-medimnos', i.e. that in the Linear A texts 'wine' (82a in HT 9 a.1) is measured in units of 'Minoan medimnoi', each holding 120 'Minoan khoinikes', and distributed in units of 1/60, 1/20, or 1/10 'khoinix' [22]. He applied that ratio to Ω and Φ. I have instead applied it to ω and φ, to show that it could be done, not that, even with U and V simple multiples and submultiples of T, it would be interesting. The simplest way of calculation is what Was has followed. He explains W = 3690 as the product of 30 3/4ω and 120 'khoinikes'. To find the number of φ in ω, and the number of X in W, he divides W by ω = 24. Since the result, 153 3/4, is a mixed number, he turns to the submultiples of 153 and 154 (as being most approximately 153 3/4). Available for the closest approximation in 154 are 2 × 77, 7 × 22, and 11 × 14; for 153: 3 × 51, 9 × 17. He may have considered 2 × 77, 11 × 14, and 3 × 51, but he does not mention these possibilities. He does mention, only to reject it, 9 × 17. He adopts 7 × 22. I cannot tell whether he meant to reject 9X = W or 17X = W, so I illustrate both in XVIII, XIX. He takes 7 × 22 in the form 7X = W and 22φ = ω, column XX. He may have considered other approximations in the submultiples of 152, 155, 151, 156, 150, &c., but as he does not mention these I may ignore them too.

Up to this point, Was' exposition is clear enough; his premisses, his assumptions, his calculations are stated or easily inferred. What he does not explain, and what is not easily inferred, is the process of choosing from among the solutions (i.e. the 7 × 22, 22 × 7, 14 × 11, etc.) the one he adopts. Might it be the closeness of the approximation of ES:es to n:1 that is the clue? No, for ES:es 14:1 or 77:1 (ω = 11φ, 2φ) were approximate, and his consideration of either XVIII or XIX, less aproximate, was mentioned. Might it be that the possible ratios of ES:es = n:1 could be arranged in a scale of appropriateness, in which obviously 7:1 is near the top, and 14:1, 77:1, and either 9:1 or 17:1 near the bottom? But then, since one is mentioned as worth consideration, either 17:1 or 9:1 must not be too far from the top. Might it be

[22] *Kadmos* 11,20 (the 'wheat-medimnos'); 12,55, and 13,113 (the 'wine-medimnos').

that some values of ω:φ are preferable to others? Thus obviously 22:1 is near the top, 11:1 and 2:1 near the bottom, and of 9:1 and 17:1, one is almost at the top, the other near the bottom. In his comment (*Kadmos* 11,10) «the figure of 17 in the latter seems a trifle odd», with its note, «unless there would have been that number of labourers, which, again, seems excessively large for the amount of wine involved», it is clear that Was followed other criteria in his exposition, but there is little indication what they might have been. I see no other objective criteria in Was' exposition. Am I correct in assuming that there is none which follows from the premisses, and from the assumptions which I have attributed to Was? Some external criteria are needed.

Such criteria might come in at least two forms. 1), a comparative study of historical measures and their parts, especially for liquid measure, might show that some relationships as of ω:φ are more often found than others. 2), some independent evidence of a Minoan liquid measure of a particular relationship to the measures ω and φ he has discovered in the interpretation of HT 9 might be available to confirm one or another choice. I see no evidence that Was considered 1), and anyway 2) would be far preferable. But does the 'kados' complex now offer any help? I, at least, conclude that there may indeed have been a Minoan measure $^{11}/_{60}$ths of the size of Ω, or even simply 22 times as large as φ, but that nothing in the premisses, the assumptions, and the calculations which Was presents (if the 'kados' complex will hold no water) can demonstrate it.

There are easier ways to come to the same conclusion, and I suspect that some of his readers found these. Arbitrarily to find some of the assumptions I have labelled 'possible but unnecessary' to be 'unlikely' or 'impossible' will do. I was long content to do just that, but the articles are still published. Or, an even better way would be to apply reasonable criteria to his premisses.

3. Other premisses and the 'wine-medimnos' complex

Premiss I is the text of HT 9, with the readings of JS'42. Although there are other readings, as I have indicated in Table 1, Was must accept this since it is apparently essential to his Premiss II. I.e., HT 9 a is the first text he presented in his determination

of the values of the fractional signs E, J, JE and the rest (*Kadmos* 10,36). On that page he printed, of course, the equivalent of CTLA's text, but by p. 40 had determined that the text of JS'42 must be correct, and with that text his values of E, J, and JE permit a proper summation in ES. On one point Was may have made a contribution. In HT 9 b.1 he reads an 82a not noted by any editor. The surface is poor, there are shadows in the photographs which apparently might belong to an 82a. Autopsy by eyes I trust, preferably mine and another's, might convince me that 82a either could be there, or can hardly have been there.

Premiss II includes the values of E at 1/2, J at 1/4, and JE at 3/4. In *Kadmos* 10,35-51, Was clearly presents his arguments for this evaluation of these signs, with suitable qualifications at several points. But in his other articles he finds no reason to insist on those qualifications. I have tried to show in *Kadmos* 19, 1980, 11-23, that though Was' and some other identifications are possible, none can yet be demonstrated, since quality and quantity of the texts one must work with are still insufficient.

Premiss III is the 'wine-medimnos' itself. That «wine, however, was recorded with the unit for dry capacity and daily rations calculated in tenth parts of the khoinix, equalling two kyathoi» [23] is illustrated in these articles in connection with only a few of the Linear A texts in which 82a (the 'wine' ideogram) occurs. These are HT 9, 30, 28, 27, 100, 121, 114, 89. Other texts including 82a are discussed without reference to 'wine', and for other purposes.

I have found some real difficulty in identifying the first statement of this premiss, and I cannot find any explicit account of upon what evidence Was came to be convinced of its validity. In the discussion of HT 9 it appears as a premiss (Was'81,10). For HT 30 it was taken as a premiss (*Kadmos* 13,99ff), but it is modified (p. 113) by the additional possibility of distributing 'wine' in one-third fractions of a 'kyathos'. For HT 114, 121 and 100 it is taken as a premiss (*Kadmos* 12,32), though it is described somewhat ambiguously. One might imagine the discussion of HT 114 and 121 (pp. 29-32) to imply that the 'wine-medimnos'

[23] Was '81,10. *Kadmos* 11,7.

was here still simply an assumption being tested. But in those texts two possible schemes of distribution of 'wine' were detected. The one in which it was distributed in 1-'khoinix' rations was preferred; the one suggesting distribution in 1/3 ['khoinix'] was rejected. The reason for preference was that, already, «it has been found that wine was allocated in one-tenth or one-twentieth (the kyathos) parts of a khoinix» (p. 32). The premiss has clearly been established before this choice had to be made in HT 114 and 121.

In this series of articles there is no discussion of the measurement or distribution of 'wine' earlier than the discussion of HT 89 and HT 100 (for the first time) in *Kadmos* 11,17-20. Here the 'wine-medimnos' is not stated to be a premiss, but the discussion might make it appear that it is one already established. The first mention of 'wine' is found on p. 17: «the wine ratios seem to point to the latter possibility. If wine is included...». The second mention is a «Table III. Payment (per diem) of labourers», and a column labelled «Wine (added)», with entries of «2/10, 3/10, 4/10, 5/10», corresponding to references to HT 89, HT 100. The final mention, in the summary of results, is the sentence «Calculations could be made of both the amounts and the subdivisions of cereals and figs, and also of the addition of wine for these various categories». These are not conspicuous indications either that the 'wine-medimnos' has been discovered as a premiss, or that it is an assumption being tested. But if Was does not point to its presence, he has not hidden it. From the text of HT 89, p. 11, take the quantities corresponding to L66 (23), Lc 58 (22), *maimi* (4), L 125 (13), and *tara* (5). Multiply those by the corresponding fraction in the 'Wine' column, i.e. L66 ($23 \times 2/10$), Lc 58, *maimi* ($[4 + 13] \times 4/10$). L 125, *tara* ($[13 + 5] \times 5/10$). Add those products together and multiply by the 'fifty days' for which (p. 12) rations were required. ($[46/10 + 104/10 + 800/10] \times 50 = 12000/10$). Observe that on p. 11 the text of HT 89 shows 'wine 10». Divide 12000/10 by 10 to obtain the number of rations per 'wine'. The result is that 1 'wine' = 120 units, distributed by 2-, 3-, 4-, 5-tenth units. Which is, without the name, the 'wine-medimnos'. If the 'wine-medimnos' is present in the discussion of HT 89 and 100 in *Kadmos* 10, and if, uncharacteristically, Was has omitted any account of this discovery in those texts, we cannot easily tell whether he established the 'wine-medimnos' by means of the analysis of

one or both of these texts, or whether, having discovered it in other texts, he merely applied it as a premiss to their interpretation.

I believe I have found the origins of the 'wine-medimnos' as a premiss, inadvertently concealed by two unfortunate typographical errors, and by an incomprehensible failure to discuss the evidence for the premiss. The third paragraph in *Kadmos* 12, p. 28 which begins: «In the study of the Mallia text... daily rations appeared as two-, three-, four- or five-tenths of a khoinix...», and the fourth, pp. 28-29, wich begins «It seems, therefore, that the recording of wine on the Mallia tablets was executed in medimnoi...» lead, by p. 28, note 2, to *BICS* 18,16-25. I have repeatedly read that article, and find that it shows only that in the Mallia tablet H 20 (in the «Minoan Hieroglyphic script»), while 'wheat', 'figs', 'barley', and 'olives' were measured by a 'Minoan medimnos' of 120 'khoinikes' (p. 23, table VII), 'wine' and 'oil' were measured by a 'Minoan metretes', one-fifth the capacity of the 'Minoan medimnos', and containing 480 'kyathoi' (p. 24, table VIII).

There is a paragraph in *Kadmos* 12,28, however, which precisely describes what is stated in *BICS* 18. It is the second, immediately preceding the two paragraphs I have cited. If then we recognize and correct two typographical errors, we may recognize in the second paragraph beginning: «The Mallia text mentioned...» (page 28) a correct statement of the conclusion of *BICS* 18. We may then correct the third paragraph (pp. 28-29) to begin: «In the study of the *two Hagia Triada texts, HT 100 and HT 89* attention was paid...». We may correct the fourth paragraph (p. 29) to begin: «It seems therefore, that the recording of wine on the *Hagia Triada* tablets was executed in medimnoi...». These corrections not only will make the statements correspond to the facts, but will make clear the contrast Was intended between the second and third paragraphs of his article in *Kadmos* 12:1. The 'wine-medimnos' was discovered either in the interpretation of HT 89 or HT 100, or both, or in the interpretation of some other Hagia Triada texts about which Was has said even less than the has said about HT 89 and 100.

Could the 'wine-medimnos' have been discovered in the analysis of HT 89 and 100? The analysis of 'wheat/millet' and

'figs' fully described on *Kadmos* 11,1-12 showed that the 'wheat-medimnos' process derived from H 20 in *BICS* 18 was applicable to these two HT tablets, and indicated a ration-period of 10 days for HT 100 and of 50 days for HT 89. Assume in HT 89 equal day-rations for 67 people for 50 days, requiring a total of 3350 equal day-rations. In the same way in HT 100, assume equal day-rations for 10 days for 97 people, requiring 970 equal day-rations. Let the 3350 day-rations equal the 10 'wine' recorded in HT 89, and one 'wine' will contain 335 day-rations. At that rate 970 day-rations would amount to 2.8955223 'wine'. Although the number of 'wine' in HT 100 is not reported (neither here nor elsewhere in Was' articles), such an amount could not have been equally distributed, and therefore 'wine' was, like 'wheat'/millet' and 'figs', unequally distributed.

Therefore test the obvious model, the 480-kyathos 'Minoan metretes' which, like the model of the 'wheat-medimnos' successfully tested in HT 89 and 100, came from *BICS* 18. In a 'wine' in HT 89 there must be at least 335 day-rations; in a metretes there are 480 kyathoi, quite enough to experiment with. In HT 89 let the day-ration for *maimi* be 5 'kyathoi', and for L 125 2 'ky.', and 1 'ky.' for the rest. HT 100 then will have no less than 2 $^{17}/_{48}$ 'wine'. Or let *tara* have 5 'half-ky.', *maimi* 4 '$^1/_2$ ky.', L 125 and Lc 58 3 '$^1/_2$ ky.'. Then HT 100 could have exactly 2 'metretes' of 'wine'. But if with extended experiments no pleasing result appears, test another handy model, the 120-'khoinix' 'Minoan medimnos' from *BICS* 18. In a 'wine' in HT 89 there must be at least 335 day-rations; in a 'medimnos' there are only 120 'khoinikes'. Some fraction of a 'khoinix' is called for. Thirds, fourths, or fifths might do, but the transfer of the factor in the 10-day period to a factor in a tenth-'khoinix' will do even better. Let, in HT 89, *tara* and L 125 have $^5/_{10}$ 'khoinix', Lc 58 and *maimi* $^4/_{10}$, and L 66 $^2/_{10}$ 'kh.'. The HT 100 could again have exactly 2 'medimnoi' of 'wine'. Or with another distribution exactly 2$^1/_2$ 'medimnoi'. Was chose still another possibility. And with other possible ratios of large and small measures to try, what limit is there to possibility? Unfortunately I have not been able to see any rational way of choosing even among these five 'solutions' I have described. I greatly regret Was' failure to record his calculations of the distribution of 'wine' in H 100 and 89, because he

has obviously found some still unpublished rational way of choosing. For, without a *demonstration* that the 'discovery' he has chosen is to be preferred, it ought to appear that the 'wine-medimnos', which he seems to have used as a premiss even in the explication of HT 100 and 89, must be considered no more than an unsupported assumption. Could a 22-'khoinix' 'kados' have confirmed it? This brings us back to a more general discussion of the texts Was has used in his studies, especially those possibly involved in the origin and development of the 'wine-medimnos'.

4. THE TEXTS HT 30, 15, 28, 27, 121, 114, 100 AND 89

With his article in *Kadmos* 17, Was began citing Linear A texts primarily from GORILA. Though he occasionally omits a subscript dot, or a bracket before or after a number, or has let slip a typographical error, he obviously both prefers GORILA's text and is aware of the occasional differences of these texts from ILA's. These differences would affect a few of his calculations. Before GORILA was available, Was generally relied on ILA (even where consultation of IHTPC might have helped find a better text), and in a few places seems to have deviated even from these. I have already suggested to Was that a reconsideration of the texts he used in *Kadmos* 10 for the evaluation of the fractional signs might be worth while. Not that he ought to find new values, but the justifications might be better founded. I pass over these texts, and point out some conspicuous examples in *Kadmos* 11-13 of doubtful texts taken as sure, and especially those others on the interpretation of which depends some or even much of the later argument.

HT 30 (*Kadmos* 13, 110-112). Was' transcription shows in line 4 left, «millet 14 1/4»; in line 7 right, «L'2 1», in line 8 right, «dikhowes + *pu* 2/5». These, except for the omission of a subscript dot, follow ILA. GORILA and CTLA show (I shall try to transcribe them as Was would): «millet [ ] 14 1/4»; «L'2 1[» «[dikhowes + *pu*] 1/5». I.e. some other sign might intervene after 'millet' or some number might increase «14 1/4»; L'2 might have more than «1»; some other sign than 'dikhowes + *pu*' might have preceded a fraction, of which the surviving trace does not suggest «2/5», but perhaps «1/5». The adoption of other readings would af-

fect the interpretation of this text, but would not seriously affect the interpretations of texts later introduced.

HT 15 (*Kadmos* 12,142-143). This does not involve 82a, but it is instructive, Was' transcription shows in line 5, «kiro 40». GORILA CTLA, ILA, IHTPC, *and also* Was in *Kadmos* 11,6-7, show a clear reading of «kiro 400». There was no calculation involving «kiro 400» in *Kadmos* 11, but in *Kadmos* 12:2, «kiro 40» is deeply involved in the calculations which suggested the existence of a «Minoan heavy talent», which, by the adoption of Was' original reading, would surely fall. I believe, however, that Was has not suggested that this weight appears in any other texts, so that this too has no serious consequences for texts later introduced.

HT 28 (*Kadmos* 12,42-55). (Was' face a is so marked by a typographical error in IHTPC, Tav. VI, followed by ILA, CTLA; it is face b in IHTPC text col. 550, fig. 18, and GORILA). Was' transcriptions show in a, line 2, «wine 4»; in line 5, «wine 4*, L44[?]». For the last ILA shows «wine 3[ ] L44[». GORILA reads «wine 4», «wine 3 (a sign not identified in IXTLA)[». CTLA agrees with «wine 4», and «wine 3», but identifies the rest as «538b E», which Was might transcribe «L'2 1/2». Calculations with these readings would affect Was' distributions of 'wine', but would affect no text later introduced.

HT 27 (*Kadmos* 12,37-42). Was' transcription shows in face a, line 1, «40[+]»; in 4, «[x]»; in 5, «43» (but ILA «43[»); in 11, «kuro 325[+]» (but ILA «320[» + «]5»); in 13, «figs 1[»; in face b, line 5, «re 24» (but ILA «re 14»); in 10, «sa 2»; in 11, «re 60»; in 14, «re[ ]20». Except as noted GORILA and CTLA agree: in a, 1, GORILA «90[», CTLA «80[»; in 4, «20[»; in 5, «43[»; in 11, GORILA «kuro 355», CTLA «355», in 13, GORILA «10 B», CTLA «10 B»; in face b, 5, «re 14»; in 10, «sa 4», in 11, «re 70»; in 14, GORILA «[ ]40» CTLA «[ ]40». Calculations with even a few of these readings would seriously affect Was' interpretations of 'wheat-equivalent' and 'wine' distributions, but would affect no texts later introduced.

In HT 100 (*Kadmos* 12,34-35, and 11,10-11, 17-20) Was shows in the first two lines «Lc 55 58» and Lc' 5 4», both noted as damaged and restored. The readings of GORILA («58, [ ]»), and of CTLA («58, 6») will not be persuasive in the face of the ap-

parently correct summation of those items in Was' text as «kuro 97». But Was' treatment of the rest of the text present us with a curious problem. In *Kadmos* 11,10, in his rendering of the text, the entry «figs 2 $^{2}/_{5}$» is followed by «(rest of text not of interest; it concerns amounts of wine and oil...)». Thus neither here nor anywhere else does he state what his reading of the entry for 'wine' is. The curiosity of Was' omission of 'wine' ... comes from the fact that it is easily possible to discover just what his readings were and are. I.e., to find out what was Was' reading with the 'oil'-signs in HT 100, take *Kadmos* 12,35, table III. Multiply the 58 Lc 55 by the 3 per-diem ration of 'oil' to get 174; add to that the 12 *sadi* multiplied by the 1 per-diem ration to get 186 per-diem. Multiply that by 10 days (p. 35) to get 1860 rations, divide that by the number of 'kyathoi' in a 'metretes'-720, since this is not the 480-'kyathos' 'metretes' of *BICS* 18, but one of 720, introduced for Linear A, pp. 32-34. The result is 2 $^{7}/_{12}$, as stated on p. 35. The same method yields the other 'oil' rations. Now, in *Kadmos* 11, 18, table III, with the text of 89 on p. 11, one may multiply the 23 L 66 by $^{2}/_{10}$ 'wine' to get $^{46}/_{10}$ —but I have already done this in discussing Premiss III and the result is that one of the 10 'wine' units of HT 89 contained 120 small units. Just in the same way we may take from that same table the L 66, the Lc '5, and the *ki* (5, 4, 2) at $^{2}/_{10}$, for $^{22}/_{10}$, and the Lc 55 and *sadi,* (58, 12) at $^{3}/_{10}$ for $^{210}/_{10}$, and the 16 *tara* at $^{5}/_{10}$ for $^{80}/_{10}$, for a total of $^{312}/_{10}$, multiplied by the 10 days (p. 11) for $^{3120}/_{10}$, divided by the $^{1200}/_{10}$ths in a written unit, to get 2 and $^{3}/_{5}$, which makes it clear that Was' reading was nothing other than «wine 2 $^{3}/_{5}$».

When *Kadmos* 10 was published the reader could, of course, have consulted IHTPC (Fig. 21, and Tav. XIII), where he would find 'wine 2», apparently followed by a broken fractional sign, and three ligatures of the 'oil' sign with legible number and fractional signs. Or he might have found in ILA, pl. IXa: «wine 2[». Only now can he find in GORILA and CTLA «82a 2 J», etc.

That presents the curious part of the problem; there follow two perplexing parts. A process of scientific discovery which cannot be reproduced generally deserves limited credence. Was generally shows clearly his premisses and the workings of his discoveries, and they can usually be reproduced. It was so in *BICS* 18, and especially so in *Kadmos* 10. It was so in *Kadmos* 11,10-12

in the case of the discovery by anarithm of the distribution of 'millet', 'wheat', and 'figs' in HT 89 and 100, and in several later articles. Why is the evidence for the premiss of the 'wine-medimnos' not similarly and clearly presented? For it is evident that in the interpretation of HT 100 in *Kadmos* 12:1 it was already an established premiss. The first paragraph in 12,32 says as much. The discussion of HT 100 and 89 in *Kadmos* 11,17 does not say as much, but implies as much. On the other hand, having seen HT 89 and 100 used together to establish the common distribution pattern of 'wheat' and 'figs', one might expect that the same procedures would be applied to discover the distribution of 'wine'. And yet those common distribution patterns have certain requirements: the numbers of persons in each class must be known on both tablets; they are. The numbers of the commodities on each tablet must be known; for 'wheat' and 'figs' they are, but not for 'wine'. Only the figure for HT 89 is known in publications available by 1972. Limits for the figure for wine in HT 100 —at least two, not more than three— were clear in the publications. For the precise figure Was used, the photographs and drawings are uninformative, and only autopsy might have helped. How then did the figure «2 3/5» become known to Was?.

There is an even more perplexing, perhaps minor, problem. Since, as far as I can tell, Was has never published an illustration of the Minoan fractional sign representing 3/5, how could he, how can we recognize it? Regretfully I conclude that Was has never seen one such, and especially not in the text of HT 100. In that case it is clear enough indeed that for HT 100, the 'wine-medimnos' was used as a premiss already established, and that it was not determined in any degree by the evidence of HT 100.

But then, since HT 89 and 100 are the first two texts dealing with 'wine' presented, and since in *Kadmos* 11,17-18 the discussion proceeds as if it was determined already, where did the premiss come from? Could the premiss have been formed by analysis of HT 89 alone, and then applied to 100? I suspect it was. But then what was it that persuaded Was that a 'medimnos' divided into 1200 tenths uniquely satisfied that text? Until he shows us that, we must suppose that he arbitrarily chose that assumption over a 'metretes' of 720 'kyathoi' and other possible schemes. He might satisfy our curiosity by demonstrating in any

one of the other 'wine'-texts that no other scheme will do, or do as well — but he has not done this.

Not by omitting the reading of «wine 2 3/5» in HT 100, but by failing to describe the process of 'discovery' of the premiss, he has made it necessary that we reject the premiss and consider it only as a still unsupported hypothesis. This makes the interpretation of every text in which he has used that premiss even more hypothetical than it might already seem.

We should now consider the text of HT 89. There are three cases. If the premiss was discovered independently of HT 89, and applied to it, any divergence in the text from what Was used for calculations in *Kadmos* 11,11 will affect only the interpretation of 89, and none of the texts dicussed later. If HT 89 is one of the texts directly involved in the discovery of that premiss, then any different reading will bring it into serious doubt. But if HT 89 is the only one involved in the 'discovery', a different text will in effect shatter the 'wine-medimnos'.

Was' text, *Kadmos* 11,11, shows in line 4, «*maimi* 4»; in line 7, «*kuro* 67»; in line 8, «wheat 20» in line 9, «figs 6», in line 10, «wine 10». These are the readings of ILA, and it must be admitted that while these may seem to agree with the drawing in IHTPC, and the photographs in both publications, the printed photographs are not clear enough to see each one of those readings. We are therefore fortunate to have in GORILA a slightly (but not much!) better photograph of a poorly preserved tablet, along with the report of skilled autopsy. In GORILA we find «*maimi* 24», «*kuro* 87», «millet 2 JE», «figs 2 E», «wine 6[». CTLA offers almost the same, dotting the sign-group «kuro», removing the dots from «2 JE», and after «wine» replacing «6[» by an illegible number. Acceptance of either «*maimi* 24» or «*kuro* 87» will disturb the distribution of 'wheat' and 'figs' in HT 100 and 89 both; acceptance of any one of those readings will break the 'wine-medimnos'.

5. Appendix: the 'wheat-medimnos'

If, simply for the sake of argument, the reader is willing to suspend judgment on the validity of the 'wine-medimnos' and the interpretation of HT 9, we may look for a moment to see how firm the 'wheat-medimnos' remains. The fall of superstructures

sometimes leaves well-built foundations unscathed. I append a discussion of a text which to some extent may be connected with the foundation after the pattern of which the 'wine-medimnos' was built. The source of the 'medimnos' for dry materials (since the 'medimnos' was not invented afresh for 'wine', but only applied as a model) is, as *Kadmos* 12,28 claims, the interpretation in *BICS* 18 of H 20, a single sherd, or rather, a unique text. The discovery in that text of the relationship of 'medimnos' and 'khoinix' and of the 'metretes' of 480 'kyathoi' is explained clearly, and it resembles many other discoveries in Was' articles. I will not discuss the method further, nor attempt to assess the validity of the other assumptions made to produce these relationships. I will discuss only the text itself. Was presents it, with no comments on any doubtful, illegible, or restored readings, in three forms, a drawing, p. 17, fig. 1, a transcription, Table I, and a transliteration, Table III, which in the following pages is not changed but reinterpreted. He includes as a reading of the beginning of his third line, or face (c) of the bar, the text: «E 103, numerals, x, E 32...», or in the transliteration: «figs, 3 + x, E 32 (full units)...». In his calculations he shows clearly, e.g. in Table IV, that he relies without question upon that text. In fact, without that text his calculations will not come out to the same result.

Was' drawing is a copy of a drawing in the publication of the text by Chapouthier, *Les inscriptions minoennes au palais de Mallia,* 23-24. The resemblance is not good, but generally close enough. Chapouthier's drawings, on the other hand, resemble very closely the photographs, Planche III. And the photographs are very clear and the clay bar well preserved. In all other parts of the tablet Was' drawings and transcriptions satisfactorily represent the text, but on face (c) Chapouthier's drawing and the photograph very clearly show not 3 but 4 strokes, so that a proper transcription of the text, in Was' system, must read 'E 103, 4, x, E 32...».

I am confident that it might be possible with the methods Was favors to make even this text, with a reading of 4 rather than 3, congruent with a scheme of a 120-'khoinix' wheat-'medimnos'. But he has not done it. I do suggest that until he does so, it may seem to judicious readers that the 'Minoan wheat-medimnos' (which is the premiss upon which rests the premiss of the Linear

A 'wheat- and wine-medimnoi', the 'Hieroglyphic metretes' and the Linear A 'metretes', and the interpretation of all the grain measures in the texts Was discusses, and all the wine and oil measures in the same texts, and perhaps the weights, the distributions of rations, the measures of area, and the related cadastral measures) itself once rested on the unsupported foundation of an accidentally defective working copy of a reliable drawing of H 20 [24].

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[24] At least one of the puzzles I have presented can be solved by: *Cynthiae figuras aemulatur Mater Amorum.*