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THE LINEAR „B“ LOGOGRAMS *111, *110, AND CORRESPONDING BALKAN POPULAR MEASURES OF VOLUME FOR DRY MATERIALS

Айспракѝ: Садови наменети за практична употреба служеле и како мерки за течност или суви пресипливи материи од најстаро време. Истражувајќи ги старите балкански мерки во музеите и на терен каде сè уште се употребуваат, авторот забележал извесни паралели меѓу нив и микенските мерки, сп. ЖА 47, 63-86. Волуменот на сатовите, рачно изработени од дрво или глина, варира, но константна е нивната распределба на помали делови. Забележително е дека како во микенските така и во старобалканските мерки *децималниот* метрички систем е преплетен со *хексагезималниот* (1 : 10 : 60). Во продолжение на поранешните истражувања, овде се анализираат микенските мерки означени со логограмите *V*111* и *Z*110*, помали од *T*, соодветна на *кушел* (десетти дел од најголемата мерка - товар/кило), споредените со архаичните балкански: *ваџан* и *исџол*, сочувани во Југозападна Македонија (охридско и кичевско). На крајот на *Апнех* е додадена метричка и лингвистичка паралела на садот-мерка за течност, мик. *212^{IAS} (*u-do-ro*), слов *ведро*.

1. According to E. L. Bennett Jr. “logograms” are ideograms, numerals, fractional quantities and metrical signs¹. The ideographic symbols *111 ($\langle |$), assigned *V*, and *110 ($\neg \supset$), – *Z*, denote fractional quantities of *112 (\top), the tenth part of the main unit of volume for dry materials: the first (*V*) as its sixth part, and the second (*Z*), as the fourth part of the latter. It is noticeable that some parallels of these logograms can be recognized in the Balkan popular measures. Their divisions and subdivisions show that two metric systems, *decimal* and *hexagesimal*, were intertwined like in near-eastern and Mediterranean ones.

Prof. Bennett gave a detailed description and analysis of the Ohrid *kutel*², presented to the participants of the VIII Mycenaean Colloquium (Sept. 15–20, 1985 in Ohrid). He found that it corresponds to the Mycenaean tenth part of the main volumetric unit for

¹ *Florent I*, 161.

² *Tractata Mycenaea*, 62–64; *Studies in Mycenaean and Classical Greek Presented to John Chadwick*, *Minos XX-XXII*, 1987, “To Take the Measure of Mycenaean Measures”, 89–95.

dry materials, and noticed that the marked divisions of the *kutel*'s volume, which permit direct measurement of its half and of two-thirds, suggest but do not in themselves confirm the existence of a physical measure (whose name is still unknown to him) of one-sixth of a *kutel*. He was excited by the fact that the *kutel*, divided into 6 smaller units, corresponds exactly to the Mycenaean unit T. According to him it represents a first real proof of the way the Mycenaeans could measure dry pourable materials. Therefore he eagerly appealed to those knowing the language of the region to describe the use of a *kutel*, and to give more details about the other measures, smaller than *kutel*³.

Examining the measures and their names, first in the republics of the former Yugoslavia, then to other Balkan countries, I was simply disappointed by the great diversity of the volumetric units with different capacities and their terminology. One of the reasons for the diversity of their capacity is the fact that the vessels, usually intended for other practical aims and also used for measurement, are hand-made. Naturally, they are not precise and they do not guarantee an absolutely equal size. On the other hand, there is a dialectal and linguistic discrepancy: one and the same term in different places is used with different meanings and denotes various volumetric values. Quite often one and the same measure is called by different terms in various places.

I had serious doubts especially about the measures smaller than the *kutel* and its subdivisions (*vagan* and *grst*). For a long time I could not find either their terms (names) or vessels with a corresponding capacity. I realized that this complicated material cannot be understood, without a systematic metrological and historical approach. Therefore I checked up numerous vessels, kept in our museums and in some villages where they are still used. In spite of the great diversity of vessels concerning their measures and their names, on the basis of a linguistic and metrological analysis I could clearly see some common features in their division and subdivision. I published the results of that research in *Živa Antika* 47 (1997, 63–86), where I tried to reconstruct the Balkan popular volumetric system for dry materials in comparison with the Mycenaean one. Here I am dealing, mainly, with measures of volume smaller than a *kutel*, related to the Linear B logograms *111 and *110, with some additional notes.

³ *Tractata Mycenaea*, l.c.: "Just as for the Linear B systems of measurement we would be greatly helped by the appearance of some of the physical measures there represented, so for the *kutel* we would be greatly helped by the publication (or perhaps reference to publication) of records in which the *kutel* and its companions were used for measurement. To expect to find a continuous tradition which would link this modern and solid measure with the Linear B notations of measures is unreasonable - but a pleasant dream."

Vagan

2. As we already mentioned both in Mycenaean and in the Balkan popular measures of volume for dry materials two metric systems, *decimal* and *hexagesimal* were combined: the main (highest) unit - a *donkey load*, divided into ten parts and designated in Linear B with *112 (T), corresponding to *Ohrid kutel*, both divided into sixth parts.

The name of this smaller unit, the sixth part of a *kutel*, is almost forgotten among the younger generations in Macedonia. However, older people know it, and I personally remember since my childhood that for such a measure my grandparents used a *vagan*, a utensil in every-day use, which can be found in every house. The *vagan* is a big round, wooden or earthen deep dish, like an open tureen. It has been used since the oldest times, and in the villages it is still in use as a common dish, put in the middle of the *sofra*, a low round table. The members of the family, seated around the *sofra*, eat from that *vagan*. P. Skok (*Et.rj.s.v.*) describes it: 1^o. as a wooden or clay vessel for keeping food; 2^o. a dish for common eating, and 3^o. a measure for grain. The same description of *vagan* is given in other dictionaries and ethnographic studies⁴.

By a pure chance the symbol V for the logogram *111, coincides with the initial letter of the name *vagan*. Prof. Bennett marked the fractional quantities of the gravimetric and volumetric system in Linear B with letters in their alphabetical order. For the measures of weight in descending direction he used: L (*118), a *talent*; M (*117), 1/30 of a *talent*; N (*116), 1/4 of M; P (*115), 1/12 of N (O is left because it is used as an abbreviation of *o-pe-ro*), and Q (*114), 1/6 of P. Then in the system of measures for liquids for 1/3 of the main unit (28.8 l.) he used S (*113), which is of the same capacity as T (*112), (9.6 l.) for dry materials. The sixth part of both of them is designated with the next letter V (U), and its fourth part - with Z.

In museums there are a large number of wooden and clay *vagans*. As it is still in active domestic use, the production of *vagans*, both wooden and ceramic, has continued until the present day. The previous primitive manufacture of wooden *vagans* from a single piece of wood (beech, oak, walnut) was changed with turning techniques, and in recent times with electric machines. In the mountain village of Oreše, below the peak of Solunska Glava, between Veles and Prilep, there are several families who continue manufacturing

⁴ Речник на македонскиот јазик, с.в.; Ст. Младенов, *Български шѣлковен речник*, София, 1951, с.в. *vagán*: "deep vessel, clay, metal, or wooden, sometimes with a handle"; В. Георгиев, *Български етимологичен речник* (БЕР), с.в.; *Rječnik Jugoslavenske akademije* (RJA), с.в.; P. Skok, o.c., с.в.

vagans by tradition from the father to the sons. Clay *vagans* were first also hand-made, later on a potter's wheel, now there is a ceramic industry, where among other things, *vagans* are also made.

Along with the term *vagan*, several other variants are wide-spread in all the Balkan languages: *misur*, *panica*, *pjato*, etc. In Modern Greek μισούρι 'dish'; Alb. *misúr*, *pjatë*; Romanian *gaván*, with a metathesis from *vagan*, *platóu* (= *pjato*)⁵; Arom. *misur*^u 'clay-pot', a kind of measure⁶.

The term *vagan*, as a cultural term, is wide-spread in some other European languages, cf. Czech *vahán*, 'pan of balances, and vessel for baking', Ukrain. *vagan* 'bread-trough', Russian *vagán* 'wooden dish'; Lit. *vagōnas* 'vessel for butter', Old Prussian *wagonis* 'a kind of dish', Est. *waagen* 'deep dish, tureen'. But its etymology is not clear⁷. In O.Ch.Sl. the term *vagan* does not appear.

The oldest known record of this word appears in a Boeotian inscription from Thespieae, dated to early IV century BC.⁸, which represents a list of different public goods of the Heraeum. The majority of the things mentioned are kitchen utensils: ὑδρίαί ἑνδεκα / στάμνοι χάλκιωι τριῖς / φιάλα / φαγάνω δύω, etc.

The form φαγάνω (l. 18), evidently the dual of a noun, m. in -ος, or n. in -ον, is not included in Liddell-Scott-Jones's *GEL* with the initial φ, lost in most Gr. dialects, but as ἥγανον, τὸ, Ion. for τήγανον, Anacr. 26. Τήγανον is a known word for *frying pan*.

I found that the first contacts between ἥγανον and τάγηνον came at the semantic level rather than at a morphological one. As a technical term, the meaning of φάγανον cannot be separated from Germ. *Wage* 'balance', *bilanx*, *kantar* (< Lat. *centenarius*), *merilo*, etc., 'measure' for weight, but at the same time for volume. It denotes one 'pan' of the balance, the same as Gr. πλάστιγξ, -ιγγος, Lat. 'lanx' (cf.. Meillet, *DELL* s.v.: "plat circulaire [ou rectangulaire] plateau de balance"). The root of the word is probably **weight-*, from which there are derivatives in almost all the IE languages (cf. J. Pokorny, *IEW*, 1119-20): Skt. *váhati* 'führt', Lat. *veho*, Got. *gawigan*, iterat. *vaga* 'hin-und her-bewegen', *wagon* 'vibrieren', etc.). The first -a- in (φ)άγανον > ἥγανον is long, the same as in other IE corradicals, e.g. Ang.-Sax. *wāga* 'lanx', O.Ch.Sl. кѣсъ, O.H.Germ.

⁵ M. Tomici, *Dictionar macedonean-român*, Skopje, 1986, s.v.

⁶ Z. Golab, *Kruševio Aromanian Dialect*, Skopje, 1984, 235.

⁷ Cf. Vasmer, o.c., s.v. According to G. Meyer, *Neugriechische Studien*, 2, Wien 1894, 15, Modern Gr. βαγένι is borrowed from Slavonic languages, but Vasmer found that the borrowing is in the opposite direction; Battisti -Alesio, *Dizionario etimologico italiano*, 1-4 Firenze 1950-54, - of Mediterranean origin.

⁸ Cf. C. D. Buck, *Greek Dialects*³, No 39, *SEG* 24, 36; J. Chadwick, *Lexicographica Graeca*, Oxford, 1996, 117.

wāga 'Wage' and *Wiege* 'cradle', etc. The form of *vagan* looks very much like a balance 'pan', and its original meaning is a measure, ration (fixed quantity of food allowed to four people, as we shall see below).

The etymology of the second word *τάγηνον* is obscure⁹. Very likely it is derived from *τάγή* (< *τάσσειν*), which has several different meanings. However, one of its quite frequent uses in the Hellenistic period is also 'ration', and 'stipulated amount to be delivered' (cf. LSJ, *GEV*, s.v.: 5 and 6). Thus it denotes a measure, the same as *vagan*, and this could support the suggested contamination. From the technology and the external appearance of the old *vagans* kept in our museums, there can also be followed the transition of (f)άγανον to τήγανον. *Vagans* with handles are an intermediate degree of this transition to the τήγανον 'frying pan' (see illustr. No 10 in *Živa Antika* 47, 85s.).

It is not easy to determine the size of the absolute value of a *vagan* which is a very old measure and during the centuries its value varied in different places. In Croatia the *vagan* was a measure of grain with a volume of about 50-63 l. (Vlajinac, o.c.184), which corresponds to the Macedonian *osmak* and *strana*, and in some places with a *kilo* and *tovar* 'load'¹⁰. Regarding the signs noted on the inner surface of the *Ohrid kutel*, and the practice in some parts of Central and West Macedonia (Prilep, Veles, Kičevo, etc.) the approximate volume of the *vagan* is 1.5-2 l.¹¹

The synonyms of *vagan*, widespread in Macedonian dialects: *misur* and *panica*, have the same meaning.

The *misur* is a deep round ceramic or wooden vessel for eating, but also used as a measure. According to Vasmer (o.c.), Filipova-Bajrova (o.c.), etc., this term penetrated into the Balkan languages through Modern Greek μισούρι, Middle Gr. μισούριον), from Lat. *missorium* < *misus*, -us 'dish, measure (as a part of the table)', and this from *mensura* < *metior*, 4, *mensus sum*, cf. also *mensa* 'table' with the original meaning 'a holy round cake', which was divided diagonally into four parts. Its division into four (equal) parts, which dates from very remote times, is significant for determining the size and subdivisions of the *misur* and *vagan*.

⁹ Cf. H. Frisk, *GEW*, s.v.: The connection of this word with the root **iēg-* 'bruler', Boisacq, s.v.; P. Chantraine, *Formation*, 198, is rejected in *DELG*.

¹⁰ The capacity of the Austrian *vagan* was 61.5 l.; Hungarian about 62.5; in Croatia during the last century its size varied from 40 - 52 *okas*, cf. Vlajinac, l.c.

¹¹ The makers of wooden *vagans* in the village of Oreše explained to me how they make them of approximately equal size. First they cut pieces of solid wood (beech, oak, walnut) of equal dimensions, and then they hollow them. I have measured both old wooden *vagans* from the museum and the newly manufactured ones, and I found that the differences in their capacity are minimal (about 0.1-0.2 l.).

The word *panica* is from the same semantic circle. It is a term which appears in several IE languages with the meaning 'vessel and measure for volume', but is of unknown origin. P.Skok (o.c., s.v.) describes it as a 'dish, frying pan', '*tigan*', which could be earthen, wooden or metallic; Slov. *ponvica* and *povna*, with a metathesis < *ponva*, O.H.Germ. *pfana* < Middle Lat. *panna* 'pan', transferred into West French *pan*, *pon*, 'cupola, dome'; Bret. *pann*, *panne*, 'frying pan' and 'illus' of balances; Swedish *panne*, Irl. *panna*, Lit. *pana*, etc. This was transferred into South Slav. languages from Balkan Latin. Czech *pánev*, Pol. *panew* is from O.Ch.Sl. *панъ*.

The volume of a *panica* was not always equal everywhere. In O.Ch.Sl. *паница*, dimin. of *панъ*, gen. *панѣ* (very likely borrowed in the Moravian period from German), could be a big vessel 'cisterna' (*Supr.*, 552, 13) along with *паницѣ зѣло малѣ* (*Supr.* 550.1)¹². In Macedonia it corresponds both to the standard size of *vagan*, i.e. *misur*, and *vaganka*, *misurka*, of a small size, about 1/4 of a *vagan*. *Pjato* and *kalenica* are not registered as regular measures¹³.

In cases when millers do not have a *vagan* or a similar measure smaller than a *kutel*, they use a *cap*, which is of nearly the same size. The oldest record of a *cap* as a real measure appears in miner's affairs with a volume of 4 *okas*. M.Vlajinac (o.c.p.361) notes that in some places grain, flour, fruit and other products, which are much lighter than minerals, were measured with *caps*.

Ispol

3. Following the principle that every standard measure can be divided first into its halves, there is also a vessel called an *ispol* with the capacity of a *semi-vagan*. It is made in different forms, but often like (an) open hand/s, ready to accept something. The Serbian word *ispolac* is used as a measure of about 0.5 l. (cf. M. Vlajinac, o.c. 311). It is used in water-mills for drawing flour, in settlements along lakes and bigger rivers for ladling out water from boats, at fountains along the roads for drinking-water, etc. The word is a compound from the prefix *iz-* (*ex*, *de-*) and the noun *pol/ovina* 'a half' (cf.

¹² *Slovník jazyka staroslověnského*, Akad. VĚD, Praha, 1982, s.v.

¹³ The *pjato* is a shallow dish of different dimensions. The name is connected with Ital. *piatto*, Lat. **plattus* < Gr. *πλατύς*, 'flat, shallow, wide'. Modern Gr. *πίατο* is borrowed from Italian *piatto*, which is also distributed in all the Balkan Slav. and non-Slav. languages, cf. Alb. *pjat*, Rom. *platou*, Arom. *piatéle*, through Greek from Italian (cf. Z.Golab, *The Aromanian Dialect of Kruševo in SR Macedonia*, SFRYu, MANU, Sk. 1984, 243). *Kalenica*, 'earthen dish', from the pan-Slavonic *kal* 'mud', a ceramic term (cf. P.Skok, o.c., s.v. *kāo*), borrowed in Alb. *kalenicë* with the same meaning is also not documented as a special measure, except in cases when women borrow from their neighbours flour, soft cheese, etc.

St.Mladenov, o.c.; *BER*, s.v.; P.Skok¹⁴, o.c., s.v. *pol*²). Its original meaning is a vessel with the capacity of one half of a certain measure. In Croatia there is a term *polvaganica*, but the Croatian *vagan*, as we have already mentioned, has a much larger volume. The word *pol* is derived from IE **(s)p(h)el* 'split', with *o*-grade *pol*-.

In Macedonian museums there are *ispols* of different dimensions, but two prevail: the first bigger, a *semi-vagan* = 2 *grsts*, and the other = a half of it, a quarter of the *vagan* = one *grst*.

From practice it is known and confirmed in the literature that the smallest popular measure of volume is a *handful*. In Macedonia, along with the *handful*, known as a *raka* (hand) or *šepa*, there is another measure with both hands, called a *grst* < **grēt-ti* from the verb *grtati*, *грѣтити*, 'gather together'. In Italian is a "manciata e manata con due mani" (Belini, *Dizionario*, s.v. *brancata* "quanto uno, può, prendere con due mani"; Stulić: "it quod manibus continentus"; Vuk Karadžić, *Srpski recnik*, s.v. *grst* and *pregršt*: "Beide flache Hände zum Fassen hingehalten; ambae volae ad accipiendum quid paratae"). From the Slavonic languages it penetrated into Alb. *grusht*, Roman. *gîrst* (Miklosich), corradical with Myc. and Homeric Greek ἀγορτός, ἀγείρω, ἀγορά.

Although strictly taken the extent of the *grst* depends on the hands, from 0.3 to 0.6 l., in popular metrology it is a real measure with a determined value of average size, ca 0.4 - 0.450 l. There is evidence that hominy has been made in Montenegro, by the Kuči tribe, with a ration of "one full *grst* of corn-flour for every adult man" (*EtnoGRAFSKI Zbornik*, SANU, XLVIII, 101). M. Vlajinac (o.c., 241) hesitates whether it is a *handful* or a *grst*. In Macedonia (Prilep, Demir Hisar, village of Velmevci, etc.) the same measure, i.e. one full *grst*, is also taken as a ration of hominy for an adult man.

Valuable data about the size of the *grst* were registered in 1933 (*Гласник Етноѳрафскоѳ музеја у Беоѳрагу*, VIII, 23) determining precisely that one *kutel* (of 13.5 l., or *kanta* of about 12 kg) contains 30 *grsts* of grain. The *kutel* of the Ohrid type, which is 2 - 2,5 l. smaller, contains 24 *grsts*, reckoning 4 *grsts* to a *vagan*; one *kutel* of 6 *vagans* X 4 = 24 *grsts*, and a *kilo* contains 10 *kutels* X 6 *vagans* X 4 *grsts* = 240 *grsts*.

¹⁴ P. Skok, o.c., s.v. *pāl*j, gave another possible explanation of *ispo(l)/ac* < *pāl*j, gen. *p(a)llja* 'haustrium', denom. *pāljkati* 'to draw'; *pāl*jka 'pumpkin, watering-pot from gourd', derived from a pre-Slavonic stem in different grades: **pel-*, **pil-*, **pol-*, **pal-*, cf. *(s)plakati* 'to rinse, swill', Maced., Bulg. *plakne* with the same meaning, Polish *plōkac* 'wash'; *pljuskati* 'to ladle water from a boat' < IE **pleu-*, etc. This etymological explanation perfectly corresponds to the function of the *ispol*, a vessel for drawing water, flour etc., but in popular etymology the word is also connected with *pol* 'half' since the middle ages, cf. *Solunska legenda*: "zborъkъ sъdici ...supolъ svezanou" 'bound through the middle'. In fact *ispol*, as a measure, denotes one half of some quantity.

4. It is noticeable that a large number of these measures, and their interrelations under different names, have parallels in the volumetric systems of ancient eastern and Mediterranean countries, which indicates that the Balkan metric system is based on the same principles, and originates from the remote past.

Thus, the biggest measure, the *kilo*, which consists of 10 smaller parts, *kutels* (of 5 on each side of the load) corresponds to the Babylonian *imêru* (donkey-load) - both in its volume of *ca.* 100 l. and its division into 10 smaller parts (the horse-load containing 10 bigger *kutels* = 135 l., i.e. *ca.* 120 kg, also belongs to this system). It is not to be ruled out that the next division of the tenths (*kutels*) into 6 smaller parts, *vagans*, i.e. $10 \times 6 = 60$ of the main measure, may depend on the Mesopotamian hexagesimal system.

The half a *kilo*, *osmak*, coincides with the classical-Greek *medimnos*, both in its volume of about 50 l. and in the composition of its smaller parts: 6 *hekteis* \times 8 *khoinikes* (one *hecteus* contains 8 *khoinikes* = 48 *khoinikes*), and corresponds to 1 *osmak*, which in the beginning very likely contained 8 units, equal to 4 *kutels* of 13.5 l., or 12 (2 \times 6) kg, known as *tagar*.

The smallest unit, the *grst*, which also represents a meal of flour (grain) for an adult person, can be paralleled with classical Greek *kotylê*, Egyptian *hin*, Israelite *lôg*, Akadian *qa*, etc. All of them have approximately the same volume of about 0.4 - 0.5 l. and serve as a measure for grain necessary for a meal (except the Akadian *qa*, which varies from 0.4 - 1.34 l. and sometimes denotes a daily ration for a person).

The Balkan volumetric system from the South-eastern part of Macedonia, where the *osmak* contains 5 *kutels*, each divided into 6 *vagans*, shares the most common features with the Mycenaean system. The smallest Mycenaean measure, represented by the ideogram *110 (a *cup*, *kotylê* with a handle, marked with the symbol Z, similar to the Balkan vessel *ispol*, is also a measure for a meal, and in Mycenaean Greece three such measures stand for the daily ration of a man as J. Chadwick concluded after analysing KN Am 819: *173 LUNA VIR 18 KOWO 8 SITO HORD 9 T 7 V 3, and PY Na 114: *me-ni-jo* 'menion'; *o-pi-me-ne* /*opimenei*/ 3 3/4 HORD = Z 90, daily 3 Z (cf. *Docs*² 420, and *Gnomon* 36, 1964, 323-4).

The Mycenaean metrical system of weights and volumes was clearly classified and convincingly explained by E.L. Bennett in 1950 (*AJA* 54, 204-222). It was later revised by Ventris and Chadwick [*Docs* (53-60)] only in some details. The Mycenaean measures of dry materials in descending order are as follows: 1 : 1/10 : 1/60 : 1/240 or 1 \times 4 \times 6 \times 10; for liquides: 1 : 1/3 : 1/18, or 1 \times 4 \times 3. The last two of the smallest measures are common to dry and liquid

substances in the Mycenaean system. The authors of *Docs* (55) also found a parallel with the English “*pint* and *quart*, but diverge to *bushel* and *gallon*”. The Balkan system explained above shows subdivisions identical with these ones.

As a starting-point in defining the absolute value of these Mycenaean measures, a daily/ monthly minimum of grain for an adult person is taken. In classical times a standard daily ration of wheat for a man is one *khoinix* (cf. Hdt. VII, 187) for the Persian army: ἡ γὰρ χοῖνιξ ἡμερησία τροφή, i.e. 27.5 monthly. The Spartan army, however, used to get two *khoinikes* of barley daily, i.e. 55 l. monthly (Thuc. IV. 16), because of its smaller nutritional value¹⁵. According to the cuneiform texts from Ur, between 2100-1400 BC, as well as to the tablets from Nuzi, the monthly grain ration of women-slaves and menial workers is fixed at 30 *qa*, i.e. 40 l. (*Docs*, 59).

Analysing the measures from the Linear B tablets, especially in the series PY Aa, Ab, F, in comparison with those from Babylonia, Egypt, Ugarit and Classical Greece, the authors of *Docs*. in 1956 found the following value of the Mycenaean volumetric system (*Docs* 60):

<i>Dry measures</i>	<i>Liquid measures</i>
1 unit = 120 l.	1 unit = 36 l.
T 1 = 12 l.	S1 = 12 l.
V 1 = 2 l.	
Z 1 = 1/2 l.	

with a note that a more accurate determination must await further evidence.

In 1964 M. Lang undertook an investigation of vessels from Mycenaean Pylos with the aim of discovering the system of measurement registered on the tablets (cf. *AJA*, 68, 99-105). She found a large concentration of vessels measuring 0.25, 0.30, 0.40, 0.50, 0.60, 0.70, 0.75 litres, and larger vessels of 2.40, 3.20 l. This suggests that 0.8 l. is an element in the system which M. Lang identified with V 1, and the smallest Z 1 with 0.2 l., so she reduced the above figures proposed by the authors of *Docs* by 60%. However, in the unit of 0.8 l. J. Chadwick saw a double Z 2, in 2.4 = V 1 1/2, and in 3.2 = V 2. In view of these data he reduced the value of the system proposed in 1956 by 20%, viz:

¹⁵ For more details about the rates of consumption in classical Greece see A. Jardé, *Les céréales dans l'antiquité grecque* I, Paris, 1925; L.Foxhall - H.A.Forbes, "Σιτομετρεία: The Role of Grain as a Staple Food in Classical Antiquity", *Chiron* 12, 1982, 43-82; A.Aloni - M.Negri, "Il valore dell'orzo nella Grecia micenea", *Atti e memorie del II Congresso internazionale di micenologia* I, Roma, 1996, 159-168.

<i>Dry measures</i>	<i>Liquid measures</i>
1 unit = 96 l.	1 unit = 28,8 l.
T 1 = 9.6 l.	S1 = 9.6 l.
V 1 = 1.6 l.	
Z 1 = 0.4 l.	

L.R.Palmer, *Interpr.* 12 - 15, 96-98, 117f. proposed a very low scale of measures with the volume of the highest one 54 l., < V 60 X 0.9 (Attic *khoinikes*) and as a standard monthly ration of grain T 5 which is too large. The fault is that he took *medimnos* as the biggest measure. In fact, *medimnos* is only a half of the main load. It corresponds to *osmak*, or *tagar* in the contemporary Balkan volumetric system. It is noticeable that the halves of these measures are used more frequently than the main one. The Greek term φορτίον, like the Balkan *tovar*, is seldom used, but all the smaller measures depend on it.

E. L. Bennett expressed some serious doubts about the system to which the *Ohrid kutel* belongs. Starting from the note with a description of the *kutel*, that it is a tenth part of the main measure, the *kilo*, containing 95-98 kg wheat, and the *kutel* itself - 9.5-9.8 kg of wheat, He correctly remarked the confusion of the volumetric and gravimetric values of the units: "Although the *kilo* is defined by weight, its part, the *kutel*, is ill-fitted to measure wheat directly in units of weight" (*Minos*, 22-24, 92). In fact, *kilo* is also determined both by volume and weight. The measures for volume are here also defined both with *l*(itres) and weight, in *kg* and *oka* (1 oka = 1.280 kg), of dry qualitative wheat. In determining the value of the popular measures I used the same definitions I had heard in the inquiries and in the literature. The weight is taken into consideration, because the burden which is going to be carried must not exceed the capacity of the domestic animal.

5. The parallels mentioned above show that almost the same volumetric units and their interrelations appear under different names on a very large territory of the Middle-Eastern, Mediterranean and Balkan countries. Therefore the question of the origin of these measures and the reasons for their diversity and uniformity arises spontaneously.

External influence, doubtless, was inevitable, but in order for foreign measures with their subdivisions to be accepted, there were certainly other external, especially socio-economic, reasons, as well as a common psychological and cultural basis.

The basic norms on which the system of this large territory was built, beyond any doubt, depended on determining the highest

and lowest metric value. The first is conditioned by the carrying capacity of the main means of transport in these regions, and they are the donkey and horse. Therefore the upper limit of the biggest measure is *ca.* 100 l. (a donkey-load), or *ca.* 130 l. (a horse-load). The lowest metric unit represents the quantity of food necessary for a meal, and/or daily nutrition of an adult male worker.

The classification of the different quantities in the volumetric units with their parts reveals three subsystems which, in spite of all differences, coincide in some key-points with the same value:

a. Very likely the oldest of them is that with a highest unit corresponding to the donkey-load. It is divided into 10 parts, 2 X 5 *kutels* by 10.8 l., i.e. 9.6 kg, according to primitive counting on the digits of both hands.

b. The *Kilo*, with divisions into a half (*osmak/tagar*), quarter (*shinik*) and eighth (*kutle*, *half-kutel* of 6.750 l.), or four *bigger kutels* of 13.5 l., i.e. 12 kg. It is remarkable that their quantity 8 X 6.75, or 4 X 13.5 = 54 l., etc. (see the table) is equal to that of 5 X 10.8 l. There is also a *kilo* in decimal division with the *bigger kutel*: 10 X 13.5 l. = 135 l. (or 120 kg), but then it denotes a horse-load.

c. The newest subsystem is that measured with the *kanta* (tin). If it is not filled to the top and without shaking, then its size is approximately that of the bigger *kutel*. If it is full up to the rim, their volume is 16.2 l. Then its size coincides with that of the bigger *kutel* in the unit called *strana* 'side', a half of the horse-load: 6 bigger *kutels* X 13.5 l. = 81 l., and 5 full *kantas* X 16.2 l. = 81 l. X 2 = 160 l.¹⁶, or 144 kg.

The metrical units of seed as measures for surface are taken mainly from the first subsystem, coinciding with donkey-load. However, for the quantity of seed another important factor, the fertility of the soil, must also be taken into consideration. More fertile soil needs more seed than a poorer one. According to Dr Risto Lozanovski, Professor at the Faculty of Agriculture in Skopje, 500-600 grains of productive wheat are necessary for sowing of 1 m² on fertile soil, whereas 300-450 are sufficient for 1 m² of poorer ground.. Therefore in the plains (e.g. Pelagonia) and valleys a *kutel* of the bigger type and even a full *kanta* are in use.

While the size of the bigger volumetric units (*kilo* and *kutel*) with their halves (*osmak* and *shinik*) differ depending on the *load* (donkey- or horse-load), but their number is constant, the value of the smaller units (*vagan* and *grst*) is the same, but their number is higher in correlation with the *kutel*. Thus, the *kutel* 1/10 of *kilo* contains 6 *vagans* by 1.8 l. (1.6 kg); 24 *grsts* by 0.45 l. (0.4 kg), the

¹⁶ G. Young, o.c. 373 found the same quantity for the *Macedonian kilo*.

bigger kutel of 13.5 l. comprises a quantity of 7.5 *vagans*, i.e. 30 *grsts*, [full *kanta* ‘tin’, probably - 9 *vagans*, i.e. 36 *grsts* with the same volume].

It seems that similar, if not the same, principles for defining the highest and lowest measures are applied in the mentioned regions, because *pondus asini* and *pondus equi* is approximately the same, and a man needs the same daily and monthly quantity of food. Their division and correlation depends on natural and practical needs, determined by centuries-old experience. Thus the system, created according to the same principles in remote times, by tradition continues to be practised especially in the mountain villages where the modern agricultural civilization has not yet penetrated.

Bearing in mind the common basis for the appearance and development of such a volumetric system, it is difficult to determine only one place of its origin. However, there is reason to admit that the experience achieved in the Mesopotamian basin, where the decimal and hexagesimal reckoning are intermixed, played a vital role in the development of this volumetric system.

A N N E X

Myc. *u-do-ro* and Slav. *vedro*

Myc. *u-do-ro* /*hudroi*/, nom. plur., ‘water-jars’ appears on tablets of both Knossos and Pylos archives: KN Uc 160 rev. 4, *]rē* *212^{VAS} 17, where the word is damaged, and PY Tn 996, 2 ... *112^{VAS} 3, well preserved, along with other terms for vessels (*pi-a₂-ra* /*phihalai*/ *219^{VAS} 2; *a-po]-rē-we* /*amphorēwe*/, dual, *209^{VAS} 2; *ka-ti* /*kāthis*/ *206^{VAS} 1), etc., followed by corresponding ideograms. The identification of *u-do-ro* with /*hudros*/ ‘water-jar’ does not have exact semantic parallel in Classical Greek. Homeric ὕδρος (Il. II, 723 +) denotes ‘water-snake’ = Classical Gr. ὕδρα, but this mycenaean term in such a context confirmed by its ideogram *212^{VAS} of a bucket-shape container, cannot be anything else but a *vessel*. In KN K 774 and 775 the ideogram is ligatured with the syllabogram *U* which more precisely defines its relation to the vessel *u-do-ro*, corresponding by functions to Classical Greek ὕδρία ‘water-pot, pitcher’.

The etymology of this word is transparent. It is derived from the IE heteroclitic *r/n* stem **wed-*, **wod-ōr*, **ud-ōr*, gen. sing. *udnēs*; cf. ὕδωρ, gen ὕδατος < **hudn-tos*, abundantly documented in all

the IE languages (cf. J. Pokorny, *IEW* 78-81, H. Frisk, *GEW*, 957-959 P. Chantraine, *Dictionnaire*, 1152-3).

A corresponding parallel to Mycenaean *u-do-ro* is the pan-Slavonic term *vědro*, Old Church Slav. вѣдро, derived from the same stem (in *ē*-grade, **wēd-*), cf. Hitt. *wedar*, Phryg. *wed-* 'water', Anc. Maced. place-name *Wedessa*, contemporary *Voden* 'Watery place'. *Vedro* is a wooden vessel primarily for holding water, but also used with different functions. It became a common term for holding liquids, used not only as a container for water, milk, wine, honey, etc., but also as a measure of volume for such materials. There are other vessels somewhere of approximately the same size, known under various names, e. g. *kabal*, *kabla*, *kobel*, *koblica*, *čabrica*, etc.¹⁷, a Balkan Turcism of Arabic origin, but the most wide-spread term, used for this purpose in the Slavonic languages is *vedro* which is also borrowed in other neighbouring languages, e.g. Hung. *wödör*, Alb. *védrë*, Ruman. *vedră*, Modern Greek βέδρον, etc.

From the existing literature¹⁸ one can see that in the past *vedro*, which is usually of the same size as *kutel*, had been largely used as a unit of measure not only for liquids, but also for dry, pourable materials, grain, and also for the surface of terrains according to the seed that can be sown. Its capacity is not always and everywhere the same¹⁹, however it corresponds considerably to the *kutel* of about 10-12 l.. The oldest written reference of *vedro* appears in the chrysoboullon of the Serbian king Dušan to the monastery of St Nicolas at the river Pčinja (North Macedonia) from 1353: assessment of wine по двѣ вѣдре звонзугате 'by two vedras of the bell-shape'²⁰. The ideogram *212 with its variant *212+U is similar to the Balkan-Slavonic popular vessel *vedro*, for holding water and other liquids, which is wider at the upper open side and narrower at the bottom²¹. This kind of *vedro* is replaced by *kofa* of the same

¹⁷ In the dictionaries *kabal*, *kabla*, etc., are explained "as *vedro* for water, Wassereimer", cf. Српски рјечник. Скупио га и на свијет издао Вук Ст. Караџић, 3rd edition, Beograd 1898; and compared with terms of other measures, e.g. *urna*, *hydria*, *cadus*, *cabalus*, *cabulus*, etc., J. Stulli Dubrovcsanin, *Lexicon latino-italico-illyrico I*, Budae 1801, and *II Riecoslovje*, Dubrovnik 1806, cf. М. Влајинац, *Речник наших старих мера III*, Београд 1968, 334.

¹⁸ М. Влајинац, о.с. II, 1964, 196-203.

¹⁹ At the same time one and same measure of volume in different places was with different value, therefore there are specific names according to the places where they were used, e.g. *kabla*, *kabel* in Dubrovnik contained 25 l.; in Zagreb *kabel* was of 20, 3 - 28, 7 l. very likely a double *kabel* similar to *Šinik*, a double *kutel* in Macedonia; Venecian *kabal* contained 10, 73 l.; in Split - 11, 4 l., six *kabels* of this type formed a big *kabel* = *barel* of 66 l.; in Dalmatia the capacity of a *kabel* was 12 l., etc., cf. Vlažina, II.c.

²⁰ Ст. Новаковић, *Законски сјоменици*, Београд 1912, 704.

²¹ In Kosovo there are *vedras* of the opposite type: narrower at the top open side, and wider at the bottom, in the shape of a bell. But they are rather for milking ewes and cows, in south-west of Macedonia called also *kobels*.

form, but wooden *vedro* with one hand for milking, which is narrower at the upper open side and wider, heavier and more stable at the bottom, is still produced and in use.

The smaller parts of *vedro* are not documented either by their contents, or by the terms. An exception is the *vedro* from the south-east of Macedonia, which contained 12 okas in the beginning of the XX century²², and was divided into six parts by 2 okas each. The *Macedonian vedro* in the region of Rodopi also contained 12 okas. It was divided into 8 *kutals* by 1.50 oka, each of them divided into 4 *četrtniks* (fourths) by 150 drams (a quarter of an oka), and each *četrtnik* contains 8 *spoons* by 18,75 drams. The quantity of six *vedras* represents a load (the big unit) for liquids, by three *vedras* on each side. The vessels for liquids usually are not filled to the brim in order not to be poured, and because the liquids are more difficult for carrying than the dry materials. The quantities contained in the Balkan popular *vedro* are not equal to the Mycenaean ones, however its dividing into smaller parts in some places is quite similar to the *kutel*, and to the Mycenaean measures.

It seems that measures for liquids are older than those for dry materials. In the very beginning primitive people lived only near waters (sources, rivers, lakes). Later, after they invented the vessel for carrying and holding water and other products, they could also live at some distance of water sources. At the same time every vessel may be used as a unit of measure for exchange. The production of vessels developed up to the perfection, using more precious and more durable materials.

In Mycenaean documents there is evidence, confirmed by the ideograms (*200-229) and written terms for about 30 different vessels without their variants from bronze, gold and silver, e.g. *di-pa* /*depas*/ *202 'vessel'; *a-pi-po-re-we*, short form *a-po-re-we* /*am(phi)phorewes*/ *203 'amphoras'; *ka-ra-re-we* /*khlareswes*/ *210 'oil-jars', etc. Some of them, e.g. *a-<pi>-po-re-we*, were also used as measures for liquids (wine, honey, oil), others, were defined for holding and measurement of only one specific product, e.g. *ka-ra-re-we* for oil.

There is an exact parallel in the Balkan popular practice of vessels both for specific functions, and as units of measure. But it is noticeable that *kutel* serves as a measure only for dry materials, and *vedro*, of approximately the same volume, devised much earlier than the *kutel*, is used as a measure both for liquids and dry materials.

Judging from the etymology of the term *u-do-ro* and the shape of its ideogram, one can see that it was the oldest vessel, invented

²² Сборник за народни умотворения, наука и книжнина, Кн. XIII, София 1902, 348, cf. М. Влајнац, о.с. 203.

for ladling and holding water. Later it might have been used with the same functions as *vedro* both for liquids and dry substances. The last three units in descending line (T - S : V : Z) are equal. At some Balkan places there is an exact parallel in dividing measures for dry materials like Mycenaean ones. For the smaller parts of *vedro* as a measure for liquids there is not enough evidence, but having in mind the fact that the *kutel* of the south-eastern part of Macedonia was divided into 6 smaller parts, there is reason to suppose that *vedro* was also divided into six smaller parts. During a long period under different states and conditions the Balkan popular measures had been often changed. Therefore one may speak only on their similarity, not identity. However there are some constant criteria used for defining their values: the highest measures according to the carrying capacity of the animal and man, and the smallest – according to the ration for the quantity of monthly, daily and single meal of a man.