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INTRODUCTION TO OTTOMAN METROLOGY

In recent years, with the utilization of the incomparable wealth of the Ottoman archives, studies on Ottoman social and economic history are making rapid progress. Many of these publications nevertheless appear to be of limited value, and some totally misleading, simply because their interpretations or statistical tables are based on imprecise or inaccurate definitions of the terminology and units of measurement. Admittedly, editors of texts have sometimes made efforts, focusing on a particular area, to determine terminology and measurements used in their sources. But in most cases such efforts do not go beyond reproducing information found in the dictionaries, or at best Walther Hinz's handbook on Islamic weights and measures[1]. It was assumed, for example, that the Ottoman *dirhem* weighed 3.207 gr at all times, and all series of weights — *oḳḳa*, *ḳanṭār* and so on — were computed on this assumption. Also, it was supposed that *kile*, *oḳḳa* or *ḳanṭār* were always identical in all parts of the empire and for all kinds of goods. Sometimes, it has not been noticed that *lidre* and *lodra*, usually written in the same way as لدره, were different units of measurement. The word *kile* was often used by the Ottomans interchangeably for all local grain measures regardless of their actual size or weight, and the *kile* for rice was half the kile used for wheat. Thus, a measure could vary in the same area according to the kind of merchandise measured.

It is evident that in order to reach reliable conclusions in the studies on Ottoman social and economic history, our primary task is to begin a comprehensive and systematic study of Ottoman metrology. Such a study should comprise not only a tabulation of weights and measures with reasonably exact equivalents, but also Ottoman policies and practices in metrology, and local practices and measurement systems which often continued under Ottoman terminology in various parts of the empire.

This is clearly a work that goes beyond one person's capacity. It is necessary to organize our efforts as a team in this vast and arduous

[1] *Islamische Masse und Gewichte umgerechnet ins metrische System*, Leiden : E. J. Brill 1955 (hereafter *IMG*).

field. Experts in each Near Eastern country should focus on local metrology trying to find concrete evidence for local measures; folklore evidence should also be checked with regard to local measuring systems[2].

In 1981, at the meeting of the *International Committee of Pre-Ottoman and Ottoman Studies* at Cuenca (Spain), the proposal for such a common effort was enthusiastically endorsed. *Turcica* promised to publish such studies in a series in order to accumulate the necessary materials and studies for a final guide on Ottoman metrology. In this paper, I have tried to bring together some notes on the formation of the Ottoman central measuring system and some observations on Ottoman policies towards local measuring practices.

Ottoman metrology itself is an important topic involving Ottoman cultural, administrative and economic history. Generally speaking, a particular measure used traditionally in a society is part of its culture and often continues as one of the most persistent elements of that particular culture. Custom has, in a traditional society, the assurance of reliability established through centuries of experience. Thus, it is no wonder that under the Ottoman rule local or regional weights and measures persisted in many areas even when terminology conformed to that of the central system. This is particularly true for the Ottomans as their central bureaucracy had often recognized wisdom and practicality in local measurement systems. This point shall be illustrated in the evolution of measurement systems in Serbia, Bosnia and Albania. This line of study can substantially be supported and enlarged by field work on folk measurement systems in the countries once within the Ottoman empire.

ORIGINS

The Ottoman imperial metrological system itself apparently owed its formation to a combination of Turkish, Islamic and local traditions. There are indications of an original Turkish measuring system in Turkestan based on *arşın* and *batman*. Middle Persian origins of these two words[3] can be interpreted as the influence of the Persian system

[2] In an inquiry of Abdülkadir İnan, *Türk Halk Bilgisine ait Maddeler*, Istanbul 1930, 27, we learn that the following measures were still in use in Anatolia at that time: *arşın, batman, çeten, endāze, kile, okḳa, ölçek, somar. Çeten* is found in an Ottoman regulation dated 1542 (see Berindei-Veinstein, XV-2) concerning goods imported from Circassia. Today the word is pronounced *çatan, çeten, çiten, çetene* and so on, meaning a large basket to carry straw, thence, a unit of measure for straw. The word comes from *çit*, dried reed to make baskets (*Derleme Sözlüğü*, III, 1088, 1149-50).

[3] R. R. Arat, «Batman», *İslâm Ansiklopedisi*, II, 343; *Ibid.*, «Arşın» (T. H.), I, 615-616; G. Clauson, *An Etymological Dictionary of Pre-Thirteenth Century Turkish*, Oxford: The Clarendon House, 1972, 305-306, his etymology (*bat-*: 'something which sinks') cannot be accepted.

as a result of Turks' commercial relations with Iran through the Sogdians. On the other hand, Chinese influence, particularly in the Uighur culture area, is attested.

Arşın, also in the form of *arşun, arjın, alçin* in Turkish dialects, was from the Pahlavī *araşn* (new Persian: *āraş, raş*). *Batman, badman* in the Uighur documents, came from the Pahlavī word *patmān*, in ancient Persian *patimāna*. Composed of *pat* (pad) and *māna patimāna* may originate from «the mana of the king» of the late Assyrian system (see App. I). According to the Uighur texts, it was used in measuring meat, cotton, grain and various groceries as well as wine and water. Also, the surface of sown land was shown to be measured in *badman*. In modern times it was identified as the equivalent of one Chinese *ketti* or 604.79 gr. In Buhara it equalled 45.093 kg. The series of the measure was as follows: 1 *batman* = 4 *untser* = 80 *ara*[4]. The use of *batman* in Iran, and its spread in Anatolia, may be associated with the Seljuk and Mongol rule. *Batman* and *männ* were used interchangeably in the Ilkhanid Iran[5]. *Batman* was known to Fr. B. Pegolotti[6] at Ayasoluk (Ephesus) around 1340. He states:

> Il peso d'Altoluogo si chiama *battimano*, al quale peso si vende in Altoluogo tutte mercatantie. Panni lani si vendono ad Altoluogo a una misura che si chiama *accono*. Biado si vende in Altoluogo a moggio (...). Battimano 1 d'Altoluogo di cosa che non manchi torna in Genova libbre 32. Moggio 100 d'Altoluogo di biado fanno in Genova mine 57.

Clearly, *batman* was the basic weight in this busy Turkish (Aydın) port and apparently used for the same commodities as in Central Asia centuries ago. It weighed 32 Genoese *libbre* or 10.144 kg. (One hundred *moggio* of wheat equalled 57 *mine* of Genoa or 57 × 83 kg = 4731 kg; for *libbra* and *mina* of Genoa see Heers, Piccamiglio, 21; thus, 1 *moggio* (*mud* or *kile*) equalled 47.31 kg. *Accono* for *panni* [wollen cloth] may be a distorted spelling of *arşun* (*arcono*) rather than Armenian *gankoun*: Evans, 55 note 5).

At any rate, the original Turkish measuring system must have come into existence already in Central Asia as a result of intensive commercial relations with Iran and China[7]. A closer study of Uighur documents in the future may reveal the Turkish system in detail. *Dīvān Luġāt al-Türk*[8] (written in 1074 or 1077) contains these measures:

[4] See R. R. Arat, «Batman», *ibid.*

[5] See *IMG*, 17-21.

[6] *La Pratica della Mercatura*, ed. Allan Evans, Cambridge, Mass., 1936, 55-56.

[7] In eastern Turkish *čīzā* comes from *č'i-tse*, a Chinese foot measure and *jin* from *čin*, a Chinese pound: B. Laufer, *Sino-Iranica*, New York: Paragon Book Gallery, 1967, 579; for Uighur measures see N. Yamada, «Four Notes on Several Names for Weights and Measures in Uighur Documents», *Studia Turcica*, ed. Ligeti, 491-98. A. Davidovich, *Materialy po Metrologii Srednevekovoi Srednei Azii*, Moscow 1970.

[8] I am indebted to Robert Dankoff for the above list; see the new edition of the

artığ (half a balanced load), *ülgü*, *ḳırḳlım* (a heaping measure), *saġu* (*al-mikyāl*, a grain measure), *käwçi* (= 10 *raṭl*)[9], *batman* (= 1 *manā*), *yığaç* (= 1 *farsah*), *tada* ('a piece of land extending as far as the eye reaches'), *ḳulaç* (fathom), *ḳarış*, *ḳarı* (*ẕirā'*), *çığ* (*ẕirā'*).

The surest way to determine the origins of Ottoman metrology is to examine the physical measures from the Seljukid period.

Preliminary studies of Seljuk and early Ottoman weights were carried out by Nancy Pyle[10]. She studied the Seljuk ring weights and found them to vary in weight between 30 g and 1290 g[11]. They are all made of bronze and copper and some bear stamps, *tamġa*s, of Ottoman times. She suggests[12] that «the ring shape of these weights apparently exclusive to Anatolia at the time of the Seljuks, was spread by the Ottomans in the form of okkas to the far corners of the Middle East». They can be used for metrological studies only when detailed lists with exact weights are published. It is extremely curious that some of them bear *tamġa*s of early Ottoman Sultans[13]. These weights may be standard weights kept in the central treasury department or made on the models coming from there.

All of the sixty-one ring weights studied by Nancy Pyle are based on *dirhem* and cast in a series of pieces, the largest unit being 400 *dirhem*s. The descending units are : 200 *dirhem*s (1/2), 100 *dirhem*s (1/4), 50 *dirhem*s (1/8), 25 *dirhem*s (1/16) and 10 *dirhem*s (1/40). Departing from the assumption that the Anatolian *dirhem* weighed 3.20735 g, she is of the opinion that physical changes which occured over time were responsible for the variations in the ring weights. She observed that the majority of them vary less than 10 percent «from the standard units of *dirhem*s». One actual *oḳḳa* piece weighed 1248.835 g or 389 *dirhem* (see chart no. 1). If we take Ottoman *dirhem* as 3.072 g (instead of 3.207 g) the Ottoman standard *oḳḳa* should actually be 1228.8 g. At any rate, she believes these weights cannot be assigned to the series of the *miṯḳāl* units of Iran.

The Ottoman ring weights of the sixteenth century, Pyle notes, are different from these «Seljuk» ones in appearance. The Ottoman weights have no decorative motifs and «are often stamped on the surface» with identifying *tuġra*. The earliest Ottoman *oḳḳa* weights dated by Pyle belong to Süleyman I (1402-1411).

For the Seljukid period, the *vaḳfiyye*s (pious foundation deeds)[14] constitute another reliable source for the weights and measures. In one of the earliest *vaḳfiyye*s, that of Karatay dated 651/1253, which was drawn up for his caravanserail[15], *ūḳiya*, *irdab*, and *mudd* are referred to as the measures used in the distribution of the provisions — meat, wheat and bread — to the guests and employees[16]. It is said that every guest was to be given three *ūḳiya* of bread daily, «the *ūḳiya* weighing one hundred dirhem»[17]. «The *oḳḳa* (*ūḳiya*) in general use in this period in Anatolia», Osman Turan suggests, «was most likely of that weight», that is, one hundred *dirhem*. One of the weight rings examined by L. Pyle[18] is indeed of a weight of one hundred *dirhem* or about 320 g[19]. This was the equivalent of the Byzantine *argiriki litra* (Schilbach, 229) or what is called *raṭl Rūmī* (321.428 g : Hinz, 31).

Also in the *vaḳfiyye* of Kemāl al-Dīn Aḥmed (d. 725/1324)[20], bread is distributed «by *ūḳiya* of Sivas» which was apparently 100 *dirhem*. In Pegolotti (p. 65) $2\frac{1}{4}$ *mene (männ)* of Sivas equalled 1 *ruotoli* of Acre or Famagusta. He added that all goods are sold in the *ruotolo* of Sivas («Salvastro»). Since 1 *ruotolo* of Acre equalled 2.2 kg, 1 *männ* of Sivas corresponded to 977 g (Hinz, 21). Neither *ruotoli* nor *mene* of Sivas in Pegolotti correspond to the full *oḳḳa* (400 *dirhem*) or its subdivisions as tabulated in N. Pyle (p. 103)[21]. Pegolotti's weights might be connected with the transit merchandise from Iran to Syria. In the everyday transactions in Sivas, a one hundred *dirhem* piece of *oḳḳa* (in Pyle's list $\frac{1}{4}$ of *oḳḳa*) must be used as demonstrated in the *vaḳfiyye*s. This

Divān : Türk Şiveleri Lügatı, eds. R. Dankoff and J. Kelly, Cambridge : Harvard Printing Office, 1982, I-II.

[9] Perhaps the Persian word *käfçe* from Arabic *kaffa* (the basin or scale of a balance) might be suggested as an etymology of *käwçi*. In western Turkish we find *kepçe* < *käfçe*.

[10] «Ottoman Okka Weights», *Belleten*, 61, Ankara : Turkish Historical Society, January 1977, 115-123; *idem*, «Anatolian Ring Weights», *Journal of Turkish Studies*, II, Cambridge, 1978, 97-106; for the existing collections see N. Pyle, 101, note 1; for Persian weights Bruno Kisch, *Scales and Weights*, New Haven, 1965, Paul Balog, «Pesi di Bronzo Islamici del XIII secolo», *Anaderni Ticinesi di Numismatica a Conticerita Classiche*, Lugano, 1973, 179-87.

[11] N. Pyle, «Anatolian Ring Weights», 98, 103.

[12] *Ibid.*, 98.

[13] The *tamġa* on the reverse side of the bronze ring weight photographed and published by Pyle, *Ibid.*, p. 106; figure 5, can be read as Meḥmed b. Bāyezīd Ḫān; compare P. Wittek, «Notes sur la tughra ottomane», *Byzantion*, XX, 1950, p. 274; and Suha Umur, *Osmanlı Padişah Tuğraları*, Istanbul : Cem Yayınevi, 1980, 99-102.

[14] For a list of the published *vaḳfiyye*s of this period see Kayaoğlu, *Vakıflar Dergisi*, XIII, 1-15.

[15] Published by Osman Turan, «Selçuk Devri Vakfiyeleri, III. Celâleddin Karatay, Vakıfları ve Vakfiyeleri», *Belleten*, XII/45, 17-171.

[16] *Ibid.*, lines 63, 65, 91.

[17] *Ibid.*, p. 95 line 208.

[18] Pyle, 99.

[19] In the *vaḳfiyye* of Ṣāḥib Ata (ed. by Şadi Bayram and Ahmet Hamdi Karabacak, «Sahib Ata Fahrüd-din Ali'nin Konya İmaret ve Sivas Gökmedrese Vakfiyeleri», *Vakıflar Dergisi*, XIII, 31-69) there seems to be a reference to a variety of *oḳḳa* weights (see p. 56; the printed Arabic text is not legible).

[20] İsmet Kayaoğlu, «Rahatoğlu ve Vakfiyesi», *Vakıflar Dergisi*, XIII, Arabic text p. 20, line 65.

[21] Unless there existed an *oḳḳa* subdivision of 300 *dirhem*.

is identical to *raṭl Rūmī* or Byzantine *argiriki litra*. This weight is also identical with the Ottoman *lidre* of 100 *dirhem* in the *batman* system. The fact that the Ottomans revalidated and used Seljuk ring weights is taken as a proof that the Ottoman *oḳḳa* was also based on *dirhem* with the same weight. While Byzantine *litra* seems to have been commonly used it is safe to say that Iranian-Ilkhanid tradition (*batman* > *mān*) constituted the basis of «the imperial-official» measuring system of Turkey before the rise of the Ottomans. Handbooks on state finances written in Iran were followed in the chanceries of Anatolian states[22]. The following list of terms used in connection with measures may give an idea of the extent to which the Ottomans inherited this tradition (see Table I).

Besides *oḳḳa* (400 *dirhem*) and *lidre* (100 *dirhem*), *mānn* and *batman* were apparently widely used as larger units in Anatolia in the early 14th century. In the 1330's, Al ʿUmarī[23], obtaining his information from two visitors to Anatolia, reported that there, *raṭl* varied from one region to another between 8 and 12 Egyptian *raṭl*. According to the same source[24], Bursa's *raṭl* was identical to that of Germiyan which was 3120 *dirhem*. Since 1 Egyptian *dirhem* equalled 4.68 g (Hinz, 4), one Germiyan or Bursa *raṭl* was 3120 × 4.68 = 14.600 kg. Here, *raṭl* was apparently confused with *mānn* or *batman*. As a matter of fact a unit of 4 *mānn* which is found in India, with a weight varying between 12-16 kg (in Surat : 14.969 kg) (Hinz, 22-23), might be the same as the *raṭl* (4 *mānn*) of western Anatolia.

[22] See Z.V. Togan, «Moğollar Devrinde Anadolu'nun İktisadî Vaziyeti», *Türk Hukuk ve İktisat Tarihi Mecmuası*, I, 1931, 15. *Resālā-ye Falākiyyā* discovered by Z.V. Togan is edited by Walther Hinz, *Die Resālā-ye Falākiyyā des ʿAbdollāh Ibn Mohammad Ibn Kiyā al-Māzandarānī, Ein persischer Leitfaden des staatlichen Rechnungswesens (um 1363)*, Wiesbaden : Franz Steiner Verlag, 1952; for other financial handbooks see Ibid., *Einführung*; also Nejat Göyünç, *Das sogenannte Ǧāmeʿ o'l-Hesāb des ʿEmād as-Sarāwī*, unpublished Ph.D. dissertation, Göttingen 1962; *idem*, «Imad es-Seravī ve Eseri», *Tarih Dergisi*, XV 20, Istanbul : University of Istanbul, Faculty of Letters, 1965, 73-86; Mirkamal Nabipour, *Die beiden persischen Leitfäden des Falak ʿAlā-ye Tabrizī über das staatliche Rechnungswesen im 14. Jahrhundert*, unpublished Ph.D. dissertation, Göttingen, 1973; also see the important study of Walther Hinz, «Das Rechnungswesen orientalischer Reichsfinanzämter im Mittelalter», *Der Islam*, 29, Berlin 1949, 1-29 and 115-141. Among the sources of the late Ilkhanid period in Iran, *Mukātebāt*, ed. M. Satī', Lahore, 1945 and *vaḳf* deed, *Rebʿ-i Raşidī* of the vizir Raşīd al-Dīn, ed. I. Afşar, Tehran, also contain valuable information of the measuring system of Iran for this particular period.

[23] Al ʿUmarī, *Masālik*, 19-48.

[24] 36, 42.

TABLE I

WEIGHTS, MEASURES AND TERMS INDICATING CATEGORIES OF GOODS IN *MUKĀTEBĀT-I RAŞĪDĪ* AND *RESĀLĀ-YE FALĀKIYYĀ* (ca. 1363)

	Equivalents in Ottoman Turkish
ʿAded : number (of animals, lumber, iron bar, etc.)	*ʿAded*
Akça : silver coin	*Akça*
Bār-i asb : horse packload	*At-yükü*
Bār-i aster : mule packload	*Katır-yükü*
Cārīb : measure of capacity (for grain)	*Cerīb* (rarely used, see *mudd* and *kile*)
Dästäcä : a sheet (of fur)	*Deste*
Dīnār : money of account	*Hasene* (*sikke*), *altun*
Dirham : weight (for musk, drugs, saffron, aloe wood, etc.)	*Dirhem* (see *infra*)
Fard : a single piece (of carpet)	*Ferd*
Ḥabba : a grain (of pearl)	*Ḥabbe*
Ḥiml : (pl. *aḥmāl*) camel load, or any packload	*Ḥiml*, *deve-yükü*, *yük*
Ḳabḍa : hilt (of sword or bow)	*Ḳabża*
Kaylçä : measure of capacity (for grain)	*Keylçe*, *keyl* or *kile*
Ḳilāde : so many collars (of hunting animals)	*Ḳilāde*
Ḳiṭʿa : piece (of mohair, stone, tent, etc.)	*Ḳiṭʿa*
Ḳaṭār : a train of seven camels	*Ḳaṭār* (a train of six camels)
Let : A piece (of European cloth)	(rare)
Mafāz : strand (of pearls)	*Dizi*
Mānn : weight (for spices, sandal, meat, bread, iron implements, barley in retail)	*Men*
Miṯḳāl : musk, precious stones, ingot of gold or silver	*Miṯḳāl*
Mucalladä : books	*Mücelled*
Mudd : (Asia Minor) measure for grain	*Mud*, *müd*
Nafar : person, number (of persons)	*Nefer*
Pāstāv : *saḳirlāṭ* (European woolen cloth)	*Pastav*, *tsḳirlāt*, *çuḳa* (1 *pastav* = 50 *zirāʿ*)
Raʾs (pl. *ruʾūs*) : head (of animal)	*Reʾs*, *ruʾūs*
Som : bar (of silver), ca. 516 gr. (Hinz)	*Som*
Taḫtä, *taḫtäcä* : a sheet (of fur)	*Taḫta*, *taḫtaca*
Ṭāḳ (pl. *ṭāḳāt*) : a single (garment)	*Ṭāḳ*
Taṭbeḳä : four (horse-shoes)	(rare)
Töb : *ṣūf* (mohair), *saḳirlāṭ* (European woolen cloth) silk cloth, pôstîn (fur), *ḳamīṣ* and *sarābil* (shirt and trousers), *aṭlās* (satin)	*Top* (a bale)
Vaḳr, *viḳr* : packload	(rare)
Zevc (*ziv-c*) : a pair (of shoes, stirrups)	*Zevc*, *zivāc*
Ẕirāʿ : textiles, *vālād* (silk cloth), *kirbās* (cotton or flax fabric)	*Ẕirāʿ*, *arşun* (*arşın*), *endāze*

The Seljukid Sultanate and the Turcoman beyliks were founded on Byzantine territories and established commercial relations with Italian maritime states[25]. An active trade, particularly in wheat, alum and cotton had developed between Italy and Turkey in the period 1200-1350. There was also a large-scale transit trade between Asia and the Mediterranean through Iran and Anatolia in the same period. Then, two sets of weights and measures, Byzantine and Arabo-Iranian, contributed to the formation of an international (Italian) measuring system which was prevalent in the commercial transactions in the Levant. In other words while in the past Roman-Byzantine (and Iranian) systems had become the basis of the Islamic weights and measures in the post-Crusades period it was Islam that provided the basis of an international measuring system[26] (see Table II).

In brief, the Seljukid and Italian sources of the early fourteenth century attest that *batman*, *lidre*, *oḳḳa*, *ḳanṭār* and *kile*, the basic terminology in the Ottoman system were commonly used for weights and measures in the Seljukid Asia Minor before the Ottoman period.

Ottoman *oḳḳa* (*vuḳiyye*, *ūḳiye*), which became the basic unit in the Ottoman weights system, equaled 400 *dirhem* or ten times one *ṣaʿī vuḳiyye* (see Table III) or four times *raṭl Rūmī (lidre)* of 100 *dirhem*. Thus, the identification of the exact weight of *dirhem* is of crucial importance. In the calculations of *oḳḳa* in kg, Walter Hinz's suggestion[27] (1 *oḳḳa* = 1.2828 kg, based on 1 *dirhem* = 3.207 g) is followed in all recent publications whereas according to Sahillioğlu's calculations[28], the official *dirhem* in use (in coinage) down to the end of the

[25] In addition to W. Heyd, *Histoire du commerce du Levant*, I, ed. F. Raynaud, Paris, 1936, recently discovered documents show that these commercial relations were closer than we realized : see Osman Turan, *Türkiye Selçukluları Hakkında Resmî Vesikalar*, Ankara : Turkish Historical Society, 1958; E. Zachariadou, «Sept traités inédits entre Venise et les émirats d'Aydın et de Menteşe (1331-1407)», *Studi pre-Ottomani e Ottomani*, Napoli, 1976, 229-240.

[26] Now see E. Schilbach, *Byzantinische Metrologie*, I, München : C.H. Beck'sche Verlagsbuchhandlung, 1970, 175 ff.

[27] *IMG*, 1-8; *idem*, «Hyperper und Asper», *Der Islam*, 39, 1963, 79-89.

[28] Ö. L. Barkan, «The Price Revolution of the Sixteenth Century : A Turning Point in the Economic History of the Near East», *International Journal of Middle East Studies*, VI 1, January 1975, 12 note 2, gave a summary of Sahillioğlu's findings in his Ph.D. dissertation. Tabrīzī *dirhem*, weighing 3.072 g, was used in the Ottoman empire until the end of the seventeenth century. Sahillioğlu asserts that in the 1500's and 1571 the *dirhem* was 3.072 g. (*Belgeler*, IV, 16; *İFM*, 23, 176); «according to our calculations based on the gold coin of Mehmed II», he says «one *dirhem* was 3.072 g. until the middle of the seventeenth century» (*BTTD*, 1, 1969, 39). The *ṣaʿī dirhem* was definitely fixed as 3.125 g (*IMG*, 3), but *Dimiṣḳī* (Damascus) *dirhem* weighed 3.086 g (Hinz, 5). For Gāzān Khān's monetary reform and the weight of *dirhem* see Z.V. Togan, «Moğollar», *THIM*, I, 5, 12. For the Ottoman *dirhem* and changes introduced or legalized at various dates, Ottoman documentation has still to be carefully collected and studied. The following is an example of how such documents can give a decisive clue : «If the gold coin (*florî*) is to be of pure gold, 129 coins are struck from one hundred *miṯḳāl* of soft gold» (Regulations of the mint of Serres, TKSL, Revan 1935, folio 138). An Ottoman document establishes that 1 *miṯḳāl* equalled 1.5 *dirhem* (see Barkan, *İFM*, XIX, 253). A complete list of the amounts of gold or silver with the exact number of coins struck each time can be established from the Ottoman records. Their comparisons with the actual coins can tell us the exact weight of *miṯḳāl* and *dirhem* units for coinage at a given time. Such a study is still to be done.

TABLE II

ITALIAN WEIGHTS AND MEASURES IN USE IN THE LEVANT (PEGOLOTTI, 1340)

	Equivalents in the Ottoman period
Botte (see Schilbach : βουτζίον)	*Fuçı*
Cantaro (Arabic : *ḳinṭār* known in two units large and small; see Schilbach : χεντηνάριον, χαντάριον)	*Ḳanṭār*, large and small
Carrara (Arabic : *ġirār*)	*Ġirār*, or *ġarār*, or *ḥarār*
Cubello (see Schilbach : χουβέλιον)	*Ḳıbıl*, *ḳabal*
Diremo (Arabic : *dirham*, see Hinz, 1-8; Schilbach : δραχμή, δράμιον)	*Dirhem*
Libbra, see *ruotolo*	
Maticale (Arabic : *miṯḳāl*, see Schilbach : ἑξάγιον)	*Miṯḳāl*
Mecucco (Arabic : *makkūk*)	*Mekkūk* (in Syria)
Metro (Arabic : *medre*) (see Schilbach : μέτρον, Latin : *metra*, *metreta*, *mitreta*)	*Medre*, *metre*, *maṭara*
Mina (Arabic : *mann*) (see Schilbach : μίνα; Hinz : *männ*)	*Men*
Moggio (*modelli* or *mondelli* : 1 24 of *moggio*; Arabic : *mudd*; Schilbach : μόδιος)	*Mud*, *mut*, *müd*
Occhia (Arabic : *wuḳiyya* or *ūḳiya*; see Schilbach : οὐγγία)	*Oḳḳa*, *vuḳiyye*, *ūḳiye*, *ḳiyye*
Oncia (Arabic : *ūḳiya*; see Schilbach : οὐγγία, onca)	*Ünke*, *nügi*, *nüki*
Quarta (Roman-Byzantine, see Schilbach : χάρτα; Pegolotti refers to it as a measure of grain in Pera, of oil in Rhodes and wine in Cyprus. This «one fourth» measure is used widely in Italy, Tunis, Spain and England)	*Ḳarta*, used in Albania for grain measure during the first decades of the Ottoman rule, it is referred to as a measure from pre-Ottoman period.
Rubo, *rova*, *riova*, *arroba* (from Arabic *ar-rubʿ*)	*Rubʿ*, *çāryek*
Ruotolo, *libbra* (Arabic : *al-raṭl*; see Schilbach : λίτρα, libra)	*Lidre*, *lodra*

seventeenth century was *Tabrīzī dirhem* of 3.072 g and after that time the *Rūmī dirhem* of 3.207. It is known that Ottomans also used *Dimişķī dirhem* which was equal to 3.086 g[29]. The question is whether the *Rūmī dirhem* was in use in everyday life before it was made the standard for coinage. In all our calculations here we followed the *Rūmī dirhem* of 3.207 g weight or one *oķķa* = 1.2828 kg.

TABLE III

ŞIFĀ CANONICAL WEIGHTS ACCORDING TO MEḤMED MEVĶŪFĀTĪ[30a]

1 *vasķ* = 60 *sā'* 1 *ṣā'* = 8 *raṭl* 1 *vuķiyye* = 40 *dirhem*	measure for the things of great quantity measure for the things of small quantity
1 *ḥiml* (*yük*) = 300 *männ* (*batman*) 1 *männ* (*batman*) = 260 *dirhem* 6⅔ *dirhem* = 1 *istar*	for cotton
1 *faraķ* = 36 *raṭl* 1 *raṭl* = 12 *vuķiyye*	
1 *ķirba* = 50 *batman*	

For *şar'ī dirhem* see *infra*.

THE DUAL WEIGHTS SYSTEM AND THE DUODECIMAL SYSTEM

In the Ottoman system of weights as given in the fifteenth century handbooks written for the finance department scribes, as well as in the sixteenth century official records (see TKS, Revan, 43a) two systems are clearly distinguished : one based on *lodra*, or *ķanṭar lidresi* equal to 176 *dirhem* (= 564.432 g), and the other on *lidre*, or *vezne lidresi* equal to 100 *dirhem* (= 320.7 g) (sometimes 120 *dirhem* = 384.84 g).

Thence, two weight series were derived :
1 *batman* = 72 *lidre* = 7200 *dirhem* (= 23.090 kg)
1 *ķanṭār* = 100 *lodra* = 17600 *dirhem* (= 56.443 kg)
The first series was used in weighing fine valuable goods, and the second series, for heavy goods. Silver was weighed and computed in *lidre*.

[29] Silver was weighed in *Dimişķī dirhem* in the silver mines of Siderokapsa (Mademokhoria) and Kratovo : see R. Anhegger and H. İnalcık, *Ḳānūnnāme*, 66.

[30a] M.M. is the translator and commentator of *Multaḳā' al-Abhur*, a compendium of Islamic law by Ibrāhīm al-Ḥalabī (1459-1549) who came from Aleppo and settled in Istanbul. Mevķūfātī's translation had a wide circulation in the Ottoman empire. I used the edition of 1318, vol. I, Istanbul, 152-53.

We find the two different weight series in the pre-Ottoman systems as follows (Hinz 16-23, 27-33; Schilbach, 285).

Egypt : 1 *raṭl folfolī* = 12 *ūķiya* = 144 *dirhem* = 450 g (for fine goods)
raṭl kabīr = 160 *dirhem* = 500 g (for ordinary goods)
Syria : *raṭl* = 600 *dirhem* = 1.850 kg
1 *Zāhirī raṭl* = 480 *dirhem* = 1.500 kg
Iran : 1 small *männ* = 260 *dirhem* = 833 g
1 heavy (Tabrīzī) *männ* = 3 kg
Venice : *libbra sottile* = 301.230 g
libbra grossa = 357.749 g
Genoa : *libbra sottile* = 316.750 g
libbra grossa = 348.450 g

In addition to the dual system in weights another continuing tradition is the duodecimal system. The duodecimal- and hexadecimal-systems apparently originated from the Mesopotamia and was transmitted through the Greco-Roman system to the Mediterranean world.

In his recent work on Byzantine metrology, Erich Schilbach pointed out[30b] that the basic unit upon which depended all other Byzantine weight units, and the measures derived from the weights, was the λογαριχὴ λίτρα, the accounting pound. This pound was directly related to the *libra* of the Roman empire. In the late Roman empire the system was based on the following series : 1 *libra* = 12 *uncia* = 48 *sicilicus* = 72 *sextula* = 96 *drachme* = 288 *scripulum* = 576 *obolus*; and 100 *libra* was estimated as 1 *centenarium*. After the monetary reforms of Constantine the Great the *libra* was assigned a weight corresponding to 326.16 g

In the Byzantine empire *logariki litra*, the gold pound, was divided as follows : 1 λογαριχι λίτρα = 12 οὐγγίαι = 72 ἑξάγια = 1728 χεράτια = 6912 σιτόχοχχα[31]. The basis of this series — 1 *litra* = a 72 *solidi/nomisma* gold piece — was generally maintained down to the twelfth century. In order to determine with the greatest precision the actual weight of *litra* in various periods, Erich Schilbach used statistical data based on the monuments and gold coins, and he came to the following conclusions[32] : 322 g (6th-7th centuries); 320 g (7th-9th centuries); and 319 g (in the following period).

Under Islam the Greco-Roman system continued, and maintained similar terminology : *ķanṭār (centenarium)*, *raṭl (litra)*, *ūķiya (uŋgia uncia)*, *miṯḳāl (exagia)* and *dirham (drachme)*, *ķirāṭ (keratia)*. In fact, the two types of *litra (litre)* of the Greco-Roman and Byzantine periods were to be found in the Islamic metrological system. The Byzantine *argiriki litra*, also known as *mega talanton*, which was used

[30b] *Byzantinische Metrologie*, München : C.H. Beck'sche Verlagsbuchhandlung, 1970, 160. For the ancient Mesopotamia see Ap. I.

[31] *Ibid.*, 161-162.

[32] *Ibid.*, 166.

commonly in trade, weighed 333.333 g and corresponded to 12½ οὐγγίαι (uŋgia)[33].

Erich Schilbach believes that[34] under the Umayyads, the Byzantine *argiriki litra*, weighing 333.333 g (or in early Byzantine period 337.5 g), occupied a dominant place in the Arabic metrological system and had a weight of 337.55 g.

An Umayyad *raṭl* weight of the year 744 A.D., examined by R. Ettinghausen[35], was found to weigh 337.55 g. Since 1 *dirhem* weight corresponded to 2.3 *miṯḳāl*, the dirhem in this *raṭl* was computed as 3.125 g. Abbasid glass weights confirm the same[36].

TABLE IV

ISLAMIC WEIGHTS: A DUODECIMAL SYSTEM
ACCORDING TO W. HINZ AND E. SCHILBACH

Raṭl	1					
Ūḳiya	12	1				
Miṯḳāl	72	6	1			
Dirham al-kayl	108	9	1.5	1		
Ḳirāṭ	1728	144	24	16	1	
Ḥabba	6912	576	96	64	4	1

Evidently, the duodecimal system was an arithmetic arrangement followed by the finance secretaries and accounting experts that determined the particular serial arrangements in various measuring systems. It must have been applied first to the coinage system, and since gold and silver coinage required precision in weight to the highest degree, it was taken as the model by other serial arrangements. In the Greco-Roman world the weight of *solidus/nomismata* and its subdivisions, and in the Islamic culture area that of *dīnār*, and its relationship to the silver coin (1 to 12) provided the basic system to be followed. Since divisibility into fractions was highest in a duodecimal system, this offered the most efficient and practical means in accounting and transactions. Thus a serial arrangement with 12 and its fractions or multiples was established.

[33] For Islamic systems of measurement in general H. Sauvaire, *Matériaux pour servir à l'histoire de la numismatique et de la métrologie musulmane*, 3 vols, Paris, 1882-1887; with the exception of useful suggestions in *IMG* there is no systematic investigation done on the origins and evolution of Islamic systems of measurement.

[34] Schilbach, *op. cit.*, 176-177.

[35] R. Ettinghausen, «An Umaiyad Pound Weight», *The Journal of the Walters Art Gallery*, II, Baltimore, 1939, 73-76, cited by *IMG*, 3, note 3.

[36] Hinz, *Ibid*

It was a system generalized in large areas by the imperial bureaucrats — Roman, Byzantine, Perso-Arabic and Ottoman; and local metrologies followed this serial arrangement (see Table IV and VI).

OTTOMAN WEIGHTS AND MEASURES, 1500

Handbooks for accounting and arithmetic containing lists of the weights and measures used in a given period must be classified among our sources on metrology. The following are the best known Ottoman books of this kind.

Muḥyī al-Dīn Meḥmed b. Ḥāccī Atmaca wrote his *Macmaʿ al-Ḳavāʿid* in 899/1493[37], at the end of his career. Written by a *muḥāsib kātib*, scribe specialized in accounting, this work is designed to be a handbook for beginners (*mubtadī*) in the art of accounting. Having a theoretical basis in the earlier Arabic and Persian handbooks on accounting and arithmetic, it provides us with the actual Ottoman measures in use in his time in the introduction and in the examples he gives. Many copies of this popular book survived[38]. Here we made use of the MS. Bibliothèque Nationale, Paris, Supplément turc no. 543, 15b-39a. Though three or four folios are missing at the beginning, this particular MS appears to be a very good one with tables. The same volume contains (40b-61a) a translation by Yūsuf b. ʿAbdullāh of *Miftāḥ-i Kunūz-i Erbāb-i Ḳalem Miṣbāḥ-i Rumūz-i Eṣḥāb-i Raḳam* written by Ḫayr al-Dīn Ḫalīl b. Ibrāhīm in Persia around 880/1475.

Handbooks on arithmetic and measures in Ottoman Turkish closely follow Muḥyī al-Dīn Meḥmed's work. Naṣūḥ Maṭraḳcı's *ʿUmdat al-Ḥisāb*, written in 923/1517, must be mentioned in particular. Among later works on arithmetic and accounting[39], the following are worthy of mention: *Miftāḥ al-Ḥisāb* by Dervīş b. Ḥasan written in 988/1580, and *Tuḥfat al-Aʿdād fī'l-Ḥisāb* by ʿAlī b. Velī Selānīkī[40].

[37] M. Tahir, *Osmanlı Müellifleri*, III, Istanbul, 1342 1923, 252.

[38] For the copies in TKS, see F. Karatay, *Türkçe Yazmalar Kataloğu*, II, no. 1581.

[39] Halil's book, *Faẕlaka-i Ḥisāb*: Süleymaniye Library, Esad Efendi, no. 3172; Meḥmed b. Atmaca: Esad Efendi, no. 3176, Köprülü Library, M. Āsım, section no. 341; Naṣūḥ Maṭraḳcı's *ʿUmdat al-Ḥisāb*, Şehid Ali Library, no. 1907, Nuriosmaniye, no. 2984, folio 52 aff.; for books on arithmetic and metrology also see O. Nuri Ergin, *Muallim Cevdet ve Hayatı*, Istanbul; H. Sahillioğlu, «Eski Hesap Kitaplarının Değeri», *BTTD*, VII, March 1968.

[40] M. Tahir, *op. cit.*, 284, 305, 310; Karatay, *op. cit.*, 516-19.

TABLE V

YŪSUF SINAN ḤALĪFE'S TABLE OF MEASURES
(ca. 1500)

Money: akça, smallrt units of *akça*: 1 2, 1 4, 1 8
1 *akça* = 100 *pişez*[41] or *pūl*
1 *pişez* = 100 *şa'īr*
1 *şa'īr* = 100 *zarra* (*zerre*)

Measure of Length: zirā'
1 *zirā'* (or *endāze*) = 100 *parmaḳ*
1 *parmaḳ* = 100 *iplik*
1 *iplik* = 100 spider's thread
smaller units of *zirā'*: 1 4, 1 8, 1 16, 1 32
1 4 of *zirā'* = 1 *çāryek*
1 32 of *zirā'* = 1 *girch* (*girāh*)
1 *sā'at* or *farsaḫ* = 7500 *arşun* of mason

Measures of Capacity: mudd > kile
1 *mudd* = 20 *kile*
1 *kile* = 50 *ḳadeh* or *kāse*
smaller units of *kile*: 1 4 *kile* = 1 *seng* = 12 *ḳadeh* 50 *ḥabbe*
1 2 *kile* = 1 *şınık* = 25 *ḳadeh*

Measures of Weight (for heavy goods): ḳanṭār > lodra
2 *ḳanṭār* = 200 *lodra*
1 *lodra* = 176 *dirhem*

Measure for silk: lidre
1 *lidre* = 120 *dirhem*
30 *lidre* = 1 *vezne* or *vezniyye*

Measure of Weight (for fine things): miṯḳāl
1 *miṯḳāl* = 24 *ḳirāṭ*
1 *kirāṭ* = 4 *şa'īr*
(A detailed list of smaller units of *miṯḳāl* is given)

[41] The Persian word *pişez* or *pişeza* means a small monetary unit. In the Ottoman Empire, the common word for it was *mangır* or *mangur*.

TABLE VI

MUḤYĪ AL-DĪN MEḤMED'S TABLE OF WEIGHTS AND MEASURES
(1493)

Measure of Weight (for fine things): miṯḳāl and its fractions
1 *miṯḳāl* = 6 *dang* = 24 *ḳirāṭ* or *çekirdek* or *tasū* or *tassūc* = 96 *şa'īr*
1 *miṯḳāl* = 1.5 *dirhem*
1 *dirhem* = 4 *dang*[42]
1 *dang* = 4 *ḳirāṭ*
1 *ḳirāṭ* = 4 *şa'īr*

Money: akça (or dirhem) and its fractions
1 *akça* = 100 *pişez* or *fidūs*
1 *pişez* = 100 *şa'īr*
1 *şa'īr* = 100 *ḫardal*
1 *ḫardal* = 100 *zarra* (*zerre*)
1 8 *akça* = 1 *pūl*
1 2 *akça* = *nuṣf* or *yarım*

Measure of Length: zirā'
1 *zirā'* = 100 *parmaḳ*
1 *parmaḳ* = 100 *rīşte* or *iplik*
3 *parmaḳ* and 12.5 *rīşte* = 1 *girch*

Measure of Capacity: mudd (plural: amdād)
1 *mudd* = 20 *keylçe* (*kilece*)
1 *keylçe* = 50 *kāse*
1 *kāse* = 100 *ḥabbe*
1 4 *keylçe* = 1 *şınık*

A handbook on arithmetic in Greek[43], most probably written by a Greek scribe in Ottoman service in Salonica around 1500[44], provides interesting information on Ottoman weights and measures of the period. In the arithmetic problems given as examples in the text the old Byzantine weights system (1 *litra* = 12 *uŋke* = 72 *exagia* = 1728 *keratia*) is abandoned, and, instead the Ottoman *ḳanṭār* > *lodra* (*lidre*) system is applied as follows[45]:

[42] From Persian *dāna*, *dānac*, grain or *dānak*, small grain. *dang* is a fourth part of a *dirhem* or sixth part of anything (Steingass; cf. Hinz, 11).

[43] H. Hunger and K. Vogel, *Ein byzantinisches Rechenbuch des 15. Jahrhunderts. Text, Übersetzung und Kommentar*, Österr. Akad. der Wiss. Phil.-Hist. Kl. Denkschr. 78, Band 2, Abh., Wien, 1963.

[44] Since one *florı* was worth 50 *akça* and one *litre* of silk 100 *akça* in the book it must be written around 1500, while Hunger and Vogel, 9, date it much earlier.

[45] *Ibid.*, 29, 35, 94, 111.

1 *kentiarion* = 44 *okades* = 176 *litre* = 17600 *dramis*
1 *okades* = 4 *litre* = 400 *dramis*
1 *litre* = 100 *dramis*

compare this chart with the Ottoman official list below p. 255. Ottoman official sources agree in general with the lists given in the handbooks (see Tables V and VI).

TABLE VII

WEIGHTS AND MEASURES IN THE MARKET REGULATIONS OF BURSA, ISTANBUL AND EDIRNE AROUND 1500[46]

Measure	Goods Measured
Arşun > *rub'* or *çāryek* > *girāh (gireh)*	textiles, furs
Arşun > *karış*	lumber, hair-cloth sacks
Batman > *okka* > *dirhem*	groceries, meat, fruits dried or fresh (in retail)
Kanṭār > *okka* > *dirhem*	groceries, pepper, iron, flax, wool, cotton (wholesale or in retail)
Kile > *okka* > *dirhem*	salt
Mudd > *kile* > *şinik*	grain, flour (*kile*, also spelled *keylçe*)
Miṯkāl > *dirhem*	precious metals
Dirhem	fine spices, drugs
Deste	implements and the like, felt
Huzme	paper
Biçin, *bağ*	clover : 1 *biçin* = 20 *bağ*, 1 *bağ* = 1 *okka*
Beden	furs : 1 *beden* = 1 *suit*
Çömlek	yoğurt : 1 *çömlek* = 2 *okka*

The regulation (TV, no. V, p. 338) required that *kile* (capacity measure for grain, flour and salt), *arşun* (linear measure), and *dirhem* (basic unit for weights) were constantly to be checked by the *muḥtesib*, market inspector.

[46] Ö. L. Barkan, «Bazı Büyük Şehirlerde Eşya Fiyatlarının Tesbit ve Teftişi Hususlarını Tanzim Eden Kanunlar», *Tarih Vesikaları*, nos. 5, 7, and 9; a critical edition of these important documents on the basis of many extant copies is needed.

TABLE VIII

CONTAINERS, WEIGHTS AND MEASURES AND ITEMS FOR WHICH THEY ARE USED IN THE REGISTERS OF CAFFA, AKKERMAN AND KILIA AROUND 1500[47]

Term or Measure	Goods measured or referred to
'Aded (number of ...)	hides, bales, ceramics, pieces of fabric, knives, trousers, lumber, mats, etc.
Arşun, see *ẕirā'*	
Barduḳ (a cup, a measure)	clarified butter, oil of cotton seed
Baril, see *varil* (a barrel)	
Batman	dyes, soap, cotton yarn, rice, *halva*
Çāryek (one fourth, a measure)	raw silk
Çeki	meat
Çift (a pair),	shoes
Çit (a basket, a measure)	dried fruits
Çuval (a sack)	walnuts, hazelnuts, alum, rice, soap
Dâne (a single piece of)	furs, cups
Denk (a bundle)	ropes, felt
Deste (a packet)	knives, handkerchief, girdles, hats,
Dizi (a string of)	figs
Döş, see *ṭaraf*	
Fuçı (*fiçı*) (a cask)	wine, honey, lemon juice, vinegar
Ġarār (a large sack)	cotton
Ḳabża (handle of)	swords, knives, bow
Ḳanṭār	tin, copper, nails, dyes, henna, sugar, *pastırma* (dried meat), dried fruits, honey, clarified butter, flax, soap, cotton
Ḳat (a complete set of)	hankerchief, pieces of fabrics, coats and overcoats (*ṭolama*), pieces of leather, cord, carpet, turban
Ḳaratil	wine, caviar, *araki*, alum
Kıyye, see *vaḳiyye*	
Ḳıṭ'a (a piece of)	pack covering, pieces of velvet and mohair (*şōf*) and cotton goods (*bogasi*), carpet, leather, quilt, shirt, dresses, box, handkerchief, girdle, a bridle, a saddle
Keylçe (*kile*)	wheat, millet, flour, rice, walnuts, the chick pea
Ḳirba (a leather sack)	implements
Lidre	raw silk

[47] For these registers see my «The question of the Closing of the Black Sea under the Ottomans» *Arkeion Pontou*, 36, Athens, 1979, 91-92.

Term or Measure	Goods measured or referred to
Men	liquids (wine, oil), pepper, utensils of copper, flour
Medre	wine
Mīzāne (*mezzana*?, between *ḳaratil* and *baril*)[48]	liquids
Mud	grain, rice, flour
Nügi	tin, silk, walnut
Pāre, *pārecik* (a piece or a small piece of)	tent, piece of woolen cloth (*çuḳa*) or cotton cloth (*kirbās*), leather, steel, felt, rock-salt
Pastav	woolen cloth (*çuḳa*), crystal cups
Post (a single skin of)	furs
Ṣandūḳ (a box of)	soap, sugar
Sapo, *sapi*	salt, clarified butter
Seped (*sepet*) (a basket of)	raisins, figs
Ṣevb (*eṣvāb*) (a garment of)	caftans, mohair or fur coat
Ṣiḥāf (a large bowl of)	cheese, *pestil* (fruit paste)
Taḫtāc (a single piece of)	fur
Ṭāḳ (a fold or a piece of)	silk cloth, turban, mohair for one dress, fabric for one bed (*döşeklik*), fish
Ṭaraf (a side of)	fish
Tāy	bale of cotton cloth, mohair or hemp
Top (a whole piece or a bundle of)	bale of henna, hashish, leather, silk cloth (*vālā*, *tāfta*), furs, dresses
Tulum (a skin container)	cheese, butter, honey, *pekmez*
Ünke, see *nügi*	
Varil	cheese, honey, vinegar, nails, knives, *araki*
Vuḳiyye (1 *vuḳiyye* = 300 *dirhem*)	pepper, grain, flour, sugar, henna (in retail), all kinds of spices, cotton yarn
Ẕirā'	all kinds of cloths
Zivāc (pairs of)	shoes

Finally, the following note from an early sixteenth century collection of Ottoman regulations[49] can be considered as an official list of Ottoman weights in this period and corroborates continued use of *ḳanṭār* and *batman* systems. It reads:

> The following is recorded as practiced among people
> 1 *ḳanṭār* = 17600 *dirhem* = 44 *ḳıyye*
> 1 *lodra* = 176 *dirhem*

[48] I think that this is a Turkish folk etymology of the Italian measure *mezzana*.

[49] *Ḳānūnnāme*, TKSL, Revan no. 1936, 43a.

> 1 *batman* = 7200 *dirhem*, in terms of *lidre* it is 72 *lidre*, in terms of *vuḳiyye* it is 18 *vuḳiyye*
> 1 *lidre* = 100 *dirhem*
> 1 *vuḳiyye* = 400 *dirhem*
> *ḳlābton* (gold wire) of Istanbul is 10 *miṯḳāl* and 15 *dirhem*. It is worth 95 *akça*;
> *ḳlābton* of Bursa is 10 *miṯḳāl* and 14 *dirhem* and it is worth 94 *akça*.

However, the *ḳanṭār* had a different weight in Bursa as is illustrated in the Bursa court records. In *Rabī'* I, 891/March 1486 a shipment of 8 *ḳanṭār* of steel and 23 *ḳanṭār* of tin was sent to Bursa[50]. These weights were given «in terms of the *ḳanṭār* of Istanbul». «When they were weighed in Bursa with the *ḳanṭār* of Bursa», the document reads, «the steel was found to be 4 *vuḳiyye* (*oḳḳa*) and the tin 12 *vuḳiyye* short». Thus, the *ḳanṭār* of Bursa must be about 43.5 *oḳḳa* while that of Istanbul was 44 *oḳḳa* at that time.

STANDARDIZATION

Ottoman conservatism regarding measures is in complete conformity with the gradual Ottoman process of integration of an area into the imperial administration. It was a policy of the Ottomans to keep the pre-conquest laws and customs to which the indigenous population was long accustomed[51]. Their abolition, it was thought, would entail difficulties and discontent. As will be seen, change often was simply the replacement of the pre-conquest terminology with the Ottoman one. This process usually took quite a long period of time, and in some cases it was never completed. As to the special groups which were maintained in their original status with pre-conquest regulations — local Christian miners or military groups such as the Eflaks, for example — the process of change was much slower. Thus, we find the Serbian or Bosnian systems of measurement, with or without original terminology, included in the Ottoman regulations of the fifteenth century concerning such communities.

However, taxation in the timar system required a kind of standardization in prices and consequently in measures. Since in the Ottoman registers all *timar* revenues were to be computed in terms of the Ottoman *akça* for each timar unit the price of each agricultural product, grain in particular, was to be fixed by the government. In doing this the central government had to use a standard measure which was the *Istanbul*

[50] Bursa Şer'iyye Sicilleri, Bursa Archaeological Museum, no. A 5/5, 38a. Steel and tin were to be shipped to Larende to found cannons.

[51] See my «Suleiman the Lawgiver and Ottoman Law», *Archivum Ottomanicum*, I, 1969, 126-36; *idem*, «Ottoman Methods of Conquest», *Studia Islamica*, II, 1954, 103-129.

kilesi or *oḳḳa*. Once the price was fixed, price fluctuations at the market were no longer taken into account[52]. In general taxation and administrative exigencies led the Ottoman government to introduce reforms for standardization in certain areas. Under Ottoman administration, the *sancaḳ* is taken as a basic administrative unit and tax rates were determined for each *sancaḳ* in a special regulation (*ḳānūnnāme*) concerning that particular *sancaḳ*. Thus, in a quite large area within the boundaries of a *sancaḳ*, uniformity in the weights and measures was to be realized under the *sancaḳ ḳānūnnāmesi*. In most cases, however, the standardization within the *sancaḳ* was carried out by extending a typical local measure to the whole *sancaḳ* and its equivalent was clearly defined in terms of the official Ottoman standards. Such reforms attempted in Hungary and Bosnia during the sixteenth century are documented.

In Hungary, a *kile* (*kayl*), the measure of capacity for grain, varied widely from one area to another as evidenced in an imperial decree dated July 2, 1579[53]. The same decree stated that the population of the country asked for a uniform measure. Thereupon, the Sultan ordered that from that time on, a *kile* was to be 30 *oḳḳa* throughout the province, and the local cadis were ordered to enforce it. The following is a translation of this order[54] (see Appendix II).

> Order to the Beylerbeyi of Budin and to Behrām, the *defter-emīni*[55] of the same province with [the special assignment] of making the population and tax survey of the said province: since you submitted to my Porte together with a list of problems to be answered that the *kayl* [to measure tithes in grain] is 84 *vuḳiyye*[56] in some of the *ḳaḍāḥḳs*[57] and 66, 72, 100, 90, or 35 in some others in the province, and that the population in all of them wants uniformity in their *kayl*, I order that the *kayl* be 30 *vuḳiyye* for all of them. Now this is my order that you should [compute the tithes] and enter them in the new survey book accordingly, and that this order will be declared in a most efficient way in each *ḳaḍāḥḳ* so that

[52] According to the instructions to the surveyors, the current price for each product is fixed as follows: the year was divided into three periods, the time of harvest or delivery, the middle and the latter part. The surveyor had to bring with him the document certifying whatever price was fixed by the local cadi for each period, and the central government fixed the standard price. Thus the prices we find in the registers are based on the current prices of each *ḳaḍā* area. However, in the *taḥrīr* registers, drawn up as a rule one for each *sancaḳ*, the price fixed for each kind of grain was often applied to the whole *sancaḳ*. In other words, it was the central government or, actually, *Niṣāncı* who fixed average prices for each *sancaḳ*.

[53] BA, *Mühimme*, no. 40, 47.

[54] For the facsimile see appendix II.

[55] The *Defter-emīni* of Budin is the secretary in charge of the affairs concerning the *tīmārs* in the province of Budin.

[56] *Vuḳiyye* here is the Ottoman *okka* (*oḳḳa*) of 400 *dirhem* or 1.2828 kg.

[57] *Ḳaḍāḥḳ* is the area under the jurisdiction of a *ḳāḍī* (cadi).

> previous measures shall be totally discarded and new ones of 30 *vuḳiyye* made, and from now on the measurement and transactions shall be carried on by the new *kayl* and the local cadis shall enter in their official court books a copy of my imperial order so that the newly appointed cadis too shall act accordingly. This order is given to Sinān, one of the *defter çavuş*es of Budin [to be taken to Budin] on 7 *Cumāda* I of 987-2 July 1579.

However, uniformity was not established throughout Hungary as G. Káldy-Nagy[58] could identify the following *kayl*s in the various parts of it:

— 1 *kile* of Mohaç = 1 Hungarian *fertál* = 24 *oḳḳa* = 30.76 kg
— 1 *kile* of Peçuy = 32 *oḳḳa* = 41.024 kg
— 1 *kile* of Egri (1693) = 41.024 kg
— 1 *kile* of barley in Buda (1665) = 18 *oḳḳa* = 23.76 kg.

Ottoman standardization attempts in Bosnia and Hercegovina are particularly interesting for demonstrating not only the Ottoman motivation for reform but also the fact that grain measures were directly related to the pre-Ottoman units of grain tax. Apparently the Ottoman administration began to show an increasing concern for the grain measure in the region in connection with the government fixed grain prices and their repercussions on the timar incomes. For example, the fixed price of 15 *akça* per *kile* was confusing if the *kile* was 33 *oḳḳa* in one area and 64 *oḳḳa* in another. The discrepancy might have led to serious disputes between the timar-holders and the peasants. In the early regulations there was no specification of the exact amount of the measure used; however, in the regulation of 1530 and subsequent regulations, each local measure was carefully defined in terms of the Ottoman standard weight, the *oḳḳa*. (see Table IX). The *Ḳānūnnāme* of 1565 opens with the following provision[59]:

> When it was reported to the Porte that in the old register the *kile* was 64 *vuḳiyye* (*oḳḳa*) in the city of Saray (Sarajevo) while in the *ḳaḍā*s of Višegrad, Brod and Kobaş the weight of the local *kile* and the fixed price per kile was different, the Sultan ordered that *kile*s and prices should be identical in all these *ḳaḍā*s, and prices would be increased 2 *akça* [per *kile*] for wheat and lentil and 1 *akça* for wild wheat and oats[60]. In compliance with the order, *kile* was fixed at sixty *vuḳiyye* and recorded as such in the new survey book, and wheat and lentil were priced at 22 *akça* per *kile* and wild wheat at 13 *akça* per *kile*, oats at 7 *akça* per *kile*,

[58] I am indebted to Andras Riedlmayer for kindly translating for me Gyula Káldy-Nagy, «Magyarországi török adóösszeirások» (Turkish Tax-Registers in Hungary), new series no. 52 of *Értekezések a történelmi tudományok köréből*, ed. by J. Varga, Institute for Historical Research of the Hungarian Academy of Sciences (Budapest Akadémiai Kiadó), 1979, 27-28; see L. Fekete, «Türk Vergi Tahrirleri», *Belleten*, XI, 1947, 312.

[59] *Kanun-i Kavanin-name*, I, ed. B. Durdev et *al.*, Sarajevo: Orientalni Institut u Sarajevu, 1957, p. 71.

[60] *Maḥlūṭ* (*mahluta*) is a kind of wheat with thick skin like barley (see *Derleme Sözlüğü*, IX, Ankara: Türk Dil Kurumu, 1977, p. 3105) or wild oats.

TABLE IX

FIXED PRICE PER *kile* OR *yük* IN *akça*

	province of Saray		province of Kilis		province of İskenderiye		İpek
	before 1565 1 *kile* = 50, 64, 66 *okka*	in 1565 1 *kile* = 60 *okka*	before 1574 1 *kile* = 64 *okka*	in 1574 1 *kile* = 64 *okka*	in 1529-1536 1 *yük* = 120 *okka*	in 1570 1 *yük* = 160 *okka*	in 1570 1 *yük* = 120 *okka*
wheat	20	22	20	25	36	80	40
lentil	20	22			36	50	40
mahlıç (wild wheat)	12	13	13	20	20	24	20
oats	6	7	8	10	18		

while must is priced at 7 *akça* per *medre* in accordance with the old register.

On the other hand, the *kile* in use in the *kadā* of *Yeni-Pazar* was only 44 *okka* and wheat was priced at 15 *akça* per *kile*, wild wheat at 10 *akça* per *kile*, oat at 5 *akça* per *kile* and must at 7 *akça* per *medre*. Since the prices [at a *kile* of 44 *okka*) cannot be further increased they were left at these prices without change as found in the old register.

It should be noted that the Ottoman administration did not introduce its standard *kile* of 20 *okka* in Bosnia, the so-called *İstanbul kilesi*, but took the local measure as a basis for standardization for the region because a drastic change in the actual weight of the measure might have caused confusion in the collection of timar revenues and disputes between the peasants and timar-holders. Ottoman standardization in Bosnia and Hungary reveals the real nature of the Ottoman reform in weights and measures which aimed at uniformity only in a particular region, or *sancak*, under particular conditions. In some areas even the measure in use in each *kadılık* was officially recognized as the only unit in which to pay tithes in kind[61].

In Bosnia, obviously standardization was attempted to avoid over-taxing certain areas when the same fixed price (*narh*) was applied in a region where grain tax was not delivered in tithes. If the tax was to be paid in *kile* or *yük*, the areas with larger measures would suffer. If it was to be paid in cash, the areas with smaller measures would suffer. Both methods were practiced in the Ottoman empire, although the Ottoman regime tried to extend its original system of tithes in kind everywhere. What is to be noted here is that the fixed price system was closely interrelated with the measuring. Fixing grain prices was the basis of the Ottoman finances as it made it possible to compute the revenues and their distribution among the timar-holders each with a fixed timar income determined in monetary units. Suppose the grain prices were lower in one area compared to another — because of a good harvest or soil fertility, or distance from the market — the tithes delivered in kind would mean a lower income (*Sipāhī*s had to sell their tithes at the market); but in such a case they usually tried to make the peasants pay in cash in terms of a fixed price. Then for this particular region, a larger measure was the solution from the financial standpoint.

A similar situation with divergencies in measure and in price can be found in Bulgaria as late as 1579 as demonstrated in the following table.

[61] The Regulation of Silistre dated 1569 reads: «The peasants shall deliver (to the timar-holder) by their own [local] *kile*» (See the text in Ö. L. Barkan, *Kanunlar*, 281-20).

TABLE X

LIST[62] OF VARIOUS *KILE*'S IN USE AND GRAIN PRICES IN THE *SANCAK* OF NIGEBOLU (NICOPOLIS) IN THE YEAR 987/1579

	kile in *okka*	prices in *akça*			adjusted price for wheat of 20 *okka* (in *akça*)
		wheat	barley	*mahlūṭ*	
Nigebolu, Rahova and Pilevne	100	12	9	6	2.4
Ivraca and Sofya	100	14	9	6	2.8
Tirnova, Ziştovi and Hotalca	80	11	9	6	2.74
Tirnova (certain *kadılık*s)	60	11	6	5	3
Hezargrad	60	9	6	5	2
Şumnu and Eski-Cum'a	60	11	7	6	3.7
İzladi	20	8	5	4	8
Yanbolu	24	8	5	4	7.67

From the above tabulation it is clear that in Danubian Bulgaria grain prices were much lower, and the units of grain measuring much larger compared to İzladi (a mountainous area), and Yanbolu (near large urban centers). The discrepancies which had been maintained for such a long time can perhaps be explained by the above mentioned reasons, such as permitting the *sipāhī*s of cheap grain areas to have larger amounts of grain per unit. Thus it is reasonable to suggest that standardization was not always seen as an ideal policy by the Ottoman administration. The actual price differential occuring as a result of shortage or transportation costs was met not by increasing the price but by reducing the unit of measure. It was important for the administration to define clearly in the regulations the actual size of the measure for each area in order to keep timar-holders' cash revenue more or less stable since grain tithes were surrendered in kind. Thus, a *sipāhī* in the area of Tirnova and Ziştovi should receive wheat tithe from a *kile* of eighty *okka* in order to obtain eleven *akça* when converted into cash, while the same amount of cash was obtained in the Şumnu and Eski-Cum'a area from a *kile* of 60 *okka*.

This situation can explain why the Ottoman government was cautious in pushing a strict standardization policy for every region. Defining the actual size of the *kile* for grain in a region was used to prevent possible disputes and, ultimately, to guarantee the *timar*-holders' interests in case the peasants would claim to deliver tithes in the smaller unit of measure of a neighbouring area.

[62] *Niğebolu şehrīr defteri*.

In general decreasing the contents indicated by a particular measure was the usual means of adjustment to the changing market conditions when under a government-enforced maximal price ceiling there was no other way of adjustment left for the producer. Merchants and government had recourse to the same method in export trade. Apparently affected by such a policy, Venice made Hızır, ruler of Aydın guarantee in the treaty of 1348 not to change the weights and measures in her trade with the principality[63]. Examples can be found during the Ottoman period of the government agents' decreasing the measures in order to increase taxes which were computed per unit of measurement. The traders tried to do the opposite to pay less on the customs (see Appendix III). This practice was responsible for the diminishing over time of weights and measures in general. However, in the capital city Istanbul a policy of strict standardization and control was pursued.

Assaying and the periodical inspection of weights and measures was considered one of the most important duties of the government since the opinion of the populace was that shortages, high prices and famine were often associated with the failure of the authorities to check fraud and abuses committed by merchants and traders. In the capital city it was considered one of the most important functions of the grand vizir to personally inspect weights and measures in Un-Kapanı where Istanbul's provisions arrived and the main bazaars were located[64]. All the officers responsible for the city's provisioning and security accompanied him in his tour. He punished on the spot those traders who had failed to comply with the standards and prices[65]. Enforcement of a fixed price per unit as recorded in the *narḫ* or *ihtisāb* regulations was the objective of such inspection tours. In other words, in the capital city of the empire the grand vizir took care to perform the duty of cadi and *muḥtesib* (market inspector) himself, and he tried to show people that he was concerned personally with this matter of vital importance for the city. «One of the important points on which people's welfare depended was the enforcement of the regulation of fixed prices and thus the maintenance of good order in the affairs of people in trade»[66].

In Istanbul two officials, *kileci* (assayer) and *tamġacı* (stamper), under the *muḥtesib* were constantly in charge of testing and certifying all kinds of measures in use at the market. Using standard measures kept in the public treasury the *kileci* did the job of assaying (*'ayār*) and then the *tamġacı* certified the correctness and validity by imprinting the official stamp (*mīrī tamġa*) on measures. Their office was at the

[63] E. Zachariadou's article, *supra*, note 25.

[64] *Ḳapān* balances at the customs house, considered the most reliable, were used by the officials to check measures for heavy goods: see O. Nuri (Ergin), *Mecelle*, I, 640.

[65] «Osmanlı Kānūnnāmeleri», *Milli Tetebbu'lar Mecmu'ası*, I 3, 1331/1917, 503-505.

[66] Imperial order dated *Şa'bān* 1215/January 1801 reproduced in Osman Nuri (Ergin), *Mecelle*, 373-74.

Çardak (Çarṭāḳ) pier where all kinds of provisions arrived by sea for Istanbul's provisioning[67].

The *ḳutucus*, the makers of grain measures, had to bring to the *kileci* and *tamġacı* in Çardak for adjustment and certification under regulation the *kile*s they made before they sold them.

A list of various kinds of measures (*rezne*) made by *ḳutucus* of Istanbul are listed with their exact capacity in the *narḫ* regulation of 1640[68]. In towns and small cities the functions of *kileci* and *tamġacı* were performed by the *muḥtesib* who charged a small fee for this service (2 *akça* for *kile* at Caffa, in 949 1542, but 4 *akça* for stamping *arşun*). The *muḥtesib* was to periodically tour the market places in the town and check the weights and measures in use. If he found out any default he would take the offender to the cadi's court and penalize him according to the court decision by imposing fines or subjecting him to a beating in public or imprisonment. Offences committed on necessities were considered criminal and severely punished[69].

It is known that the Ottoman government kept standards to assay weights and measures in circulation. For example, a rope sealed at two ends for measuring fields in *dönüm* was kept in the treasury department at the Sultan's palace[70]. Under Selim III a standard *arşun* (*arşın*) made of ebony and divided into *parmaḳ* and *ḫaṭṭ* was put in the newly established school of engineering in Istanbul[71].

A revolutionary plan for the standardization of all weights and measures for the whole empire was proposed following an economic crisis around 1640. When, in 1640, a reform was embarked upon to halt the inflation in silver *akça* and to set correct prices at the market, the government was advised «to standardize *kile*, *arşun*, *vuḳiyye* and *dirhem* in all the provinces of the empire according to the standards of Istanbul»[72]. It was observed that the travelling merchants despaired because each province had its own system of weights and measures so they were cheated. «Just as the Sultan's [symbols of authority,] *ḫuṭba* and *sikke* (Friday sermon and coinage) are the same everywhere in his empire», the adviser added, «so *kile*, *arşun*, *vuḳiyye* and all the other measures should be the same as in Istanbul». The proposal, however, had no effects.

[67] The government was concerned about enforcing standards, especially when traders made frauds in the weights and measures in order to reduce the rates of the taxes to be paid; for an example see O. Nuri (Ergin), *Ibid.*

[68] *Evḳār Defteri*, facsimile text, 144.

[69] See O. Nuri, *op. cit.*, I, 637-43; also the regulations of *iḥtisāb* of Istanbul, Bursa and Edirne published by Ö. L. Barkan, *TT*, nos. V, VII, IX.

[70] See my «Rice Cultivation and the *Çeltükci-Re'âyâ* System in the Ottoman Empire», *Turcica*, XIV, 123.

[71] *Âzeb çeşmesi*, ed., İstanbul Sular İdaresi, Istanbul 1954.

[72] *Kitâbu Meṣâliḥi'l-müslimîn ve menâfi'i'l-Mu'minîn*, ed. Yaşar Yücel, Ankara: Dil ve Tarih Coğrafya Fakültesi, 1980, 12.

A dominant commercial center imposes over time its weights and measures in a spontaneous way in a quite large area. For example, Tabriz, the most important international center of Asian-European trade during the period 1260-1360 actually imposed its measurement systems on Anatolia, particularly eastern Anatolia. Pegolotti remarks that Trebizond (Trabzon) which was one of the great emporiums of the Tabriz trade had the same weights and measures as Tabriz. Ottoman Istanbul played a similar role for the regions which maintained an intensive traffic with it. Istanbul's standards came into use in a province mostly for the goods subject to such a traffic — in Cairo, for example, *zirâ'* to measure woollen cloth was the same as that of Istanbul in length (Hinz, 56). *Kile* of Istanbul to measure grain became a standard in several areas mainly because of their regular grain exports to Istanbul.

Also it was true that market dues imposed on weight or per piece were responsible for some sort of standardization. It was not only the nature of the goods transported, or the means of transportation but also the government taxation per unit that determined the standardized types of containers (see Table VIII). While *bāc*, a transit due, or market due was taken per unit — bundle, bale, packload etc — customs dues were taken ad valorem and therefore goods were weighed at the public scales. In order to prevent disputes the regulations of tolls and market dues (*ḳānūn-ı bāc ve tamġa*) often defined the weight and measure of the bale used. For certain goods it was mandatory to be weighed at the public scales called *ḳanṭār* or *mīzān*. There were two kinds of *ḳanṭār*, big and small (*büyük ḳanṭār* and *küçük ḳanṭār*), whereas, for precious goods such as silk, a balance with greater precision called *mīzān* was used. It is also to be remembered that Ottomans tried to simplify commercial taxation in the conquered lands, for example, in Eastern Asia Minor during the period 1516-1540. They distinguished between horse and camel packs as far as transit dues were concerned and reduced the rate of customs dues from five per cent to two per cent.

LAWS OF STANDARDIZATION IN THE NINETEENTH CENTURY

Serious attempts at standardization and unification of weights and measures throughout the empire were made only when westernizing reforms were introduced in the *Tanzimat* period (1839-1876)[73].

[73] For the legislation introducing the metric system see *Dustûr*, vol. V, 744, and its *Zayl* (supplement), vol. II, 203. G. Young, *Corps de Droit Ottoman*, vol. IV, Oxford 1905, 366-67. Young also published (367-76) tables of the old weights and measures with their metric equivalents which are based on the information drawn on the *Bulletin de la Chambre de Commerce Française*; Verney and Dambmann, *Les puissances étrangères dans le Levant*, and the data supplied by the *Ottoman Public Debt Administration*. Also see Osman Nuri (Ergin), *Mecelle*, II, Istanbul.

With a special law the Ottoman government made the use of the metric system mandatory in all official transactions from March 1, 1871, and for all subjects throughout the empire from March 1, 1874. It made exceptions for the canonical *dirhem* used in the transactions administered under Islamic Law as well as in coinage and jewellery. Subsequently, several handbooks were published for the application of the new system. Galib Bey's *Yeni Miḳyāslara dā'ir Risāle* (Treatise on the New Weights and Measures), Istanbul 1287/1871, was republished in 1299 and 1331. Under a *ḳarārnāme* (decree) issued on 29 *Şevvāl* 1298/24 September 1881, lists of conversions of the old weights and measures into their metric equivalents were published[74].

These laws and regulations remained unimplemented, and in September 1881, a new decree had to be issued to make the use of the metric system mandatory in the empire. Again a decree issued in 1886 which made the use of the metric system obligatory in Istanbul after five years, had no more success due to the resistance of the people which apparently was supported in religious circles. In fact the religious code of law (*Mecelle*), codified since 1869, followed Islamic metrology in general (*kayl* for *makīlāt*, *vezn* for *mavzūnāt*, *'aded* for *'adediyyāt*, and *ẕirā'* for *maẕrū'āt*)[75].

In connection with the question of whether any change occured in the weight of the *şar'ī dirhem*, Cevdet Paşa, chairman of the commission for preparation of the *Mecelle*, sent a letter to the Egyptian government in May 1872, inquiring about the ancient model *mudd* made of copper in Egypt[76]. He reminded them that in 571 1175, Al-Rifā'a wrote that he saw a model in the *Dār al-Ḥisba* in Cairo reportedly based on *Ṣā'* (Hinz, 51) used in the Prophet's time, weighing 337 *dirhem* of pure water. From Cairo Mahmoud Bey reported (through Ṭal'at Paşa) that his calculation showed that the weight of *dirhem*, based on the measure reported by al-Rifā'a, had not changed and it always was 3,0898 g[77]. At any rate, the Ottoman law summarized in this article (Table XI) which introduced the metric system can be taken as a point of departure for Ottoman official metrology in general. In addition, tables published by G. Young based on this official regulation, as well as the information in the *Bulletin de la Chambre de Commerce Française* (nos. 77-80, 1893), and some other sources, are useful in that they provide further details on old Ottoman weights and measures of various parts of the empire (Table XII).

As was true for the earlier attempts to reform the weights and measures in the Ottoman empire, the new law introducing the metric system remained a dead letter except in official dealings and in the big port cities of Istanbul, Salonica, Izmir and Beirut. Under a law of the Republic of Turkey dated March 26, 1931, the metric system was to be applied throughout Turkey beginning in 1934[78]. But again it took some years before the people used the new measures. Even today one can find many old weights and measures still used in remote and isolated parts of Turkey.

[74] *Fī 29 Şevvāl sene 1298 ve fī 11 eylūl sene 1297 tarihile şeref-mutā'allıḳ buyrudan irāde-i seniyye-i Pādişāhī mūcibince yeni ölçülerin tanẓīm ve tensīḳile şuver-i icrāiyyesi haḳḳında ḳarārnāmedir*, second edition, Istanbul: Topḥāne-i 'Āmire Printing House, *Cumāda* 19, 1299.

[75] *Mecelle*, articles 132-137 (definitions), articles 217-299, deals with the validity of the sale contracts when the legal weights and measures were not used; for weights and measures mentioned in *Mecelle*, also see the chapter on the division of inheritance; articles 1114-1191. However in the explanations, weights and measures in current use such as *batman* and *oḳka* are also mentioned. In the sixteenth century another great Ottoman legist Abū's-Su'ūd attempted to revive and enforce old Islamic standards as part of his general attempt to fully apply the *şar'ī* principles in the Ottoman administration (see my, «Süleiman the Lawgiver and Ottoman Law», *Archivum Ottomanicum*, I, p. 132). He also tried to explain, on the authority of *şar'ī* sources, the difference between the *ẕirā'* currently used in measuring textiles and that used in surface measuring.

[76] Mahmoud Bey, «Le Système métrique actuel d'Égypte», *Journal Asiatique*, série 7, I, 1873, 76-80.

[77] Compare *IMG*, 2-3, who affirmed that the standard canonical *dirhem* was 3.125.

TABLE XI

WEIGHTS AND MEASURES IN THE OTTOMAN REGULATION OF 1298 1881[79]

Measure of Length : arşun
1 *arşun* of mason or architect = 24 *parmaḳ*
1 *parmaḳ* = 12 *ḫaṭṭ*
1 *ḫaṭṭ* = 12 *noḳṭa*
1 *arşun* of *çarşu* (bazar) or *endāze* = 8 *rub'*
1 *sā'at* or *farsaḫ-i ḳadīm* = 7500 *arşun* of mason
Measure of Weight : oḳḳa
1 *oḳḳa* or *ḳiyye* = 400 *dirhem*
1 *dirhem* = 16 *ḳırāṭ*
1 *ḳanṭār* = 44 *oḳka*
1 *çekī* = 4 *ḳanṭār*
1 *batman* = 6 *oḳka*
Measure of Capacity : kile
1 *kile* of Istanbul = 4 *şinik*
1 *şinik* = 2 *ḳutu*
Measure of Surface : dönüm
1 *dönüm* = 1600 square *arşun* of mason

[78] No. 1782 and 2083 in the official code of laws of Turkey.

[79] See above note 74.

Equivalents of the old measures in the metric system

1 *arşun* of mason = 0.758 m
1 *arşun* of *çarşu* = 0.680 m
1 *endāze* = 0.650 m
1 *farsaḫ* = 5685 m
1 *oḳḳa* = 1.282945 kg
1 *dirhem* = 3.207363 g
1 *kile* of Istanbul = 37 cubic decimeters
1 *ḳanṭār* = 56.4496 kg
1 *çeki* = 225.798 kg
1 *batman* = 7.69767 kg
1 square *arşun* of mason = 0.574564 sq. meter
1 square *arşun* of *çarşu* = 0.4624 sq. meter
1 square *endāze* = 0.4225 sq. meter
1 *dönüm* = 919.3 sq. meter

TABLE XII

WEIGHTS ESTABLISHED BY G. YOUNG *CORPS DE DROIT OTTOMAN*, IV, OXFORD 1905, 367-369

Weight	Place	Equivalent		used for
		local	metric	
Batman	Asia Minor	6 *oḳḳa*	7.694 kg	
Batman	Adana	4 *oḳḳa*	4.848 kg	
Batman	Mossul	7 *oḳḳa* 80 *dr.*	9.236 kg	indigo and spices
Batman	Urfa (Ruha)	1 *oḳḳa* 320 *dr.*	2.309 kg	indigo
Boğday (see *dang*)				
Çap	Van	36-45 *oḳḳa*	46-57 kg	grain
Dang			0.05 g	
Dirhem		64 *dang* or 16 *ḳirāṭ*	3.2073625 g	
Fitil		2 *naḳīr*	0.00125 g	
Hilan	Istanbul		25 g	liquids
Ḳanṭār		44 *oḳḳa*	56.449 kg	
Ḳanṭār	Maghreb (Barbary)	-	51.360 kg	
Ḳanṭār	Anatolia	180 *oḳḳa*	230.922 kg	
Ḳanṭār	Syria and Maghreb	200 *oḳḳa*	242.400 kg	wood and charcoal
Ḳanṭār	Mardin	240 *oḳḳa*	307.896 kg	
Ḳanṭār	Aleppo	250 *oḳḳa*	320.725 kg	for caravan packloads
Kara	Basra	2000 *oḳḳa*	2565.900 kg	dates
Karataş	Erzurum	1 *oḳḳa* 100 *dr.*	1.603 kg	
Ḫarub or *Ḳirāt*		4 *dang*	0.2004 g	

Ḳiṭmīr	—	2 *zerre*	0.00031 g	
Men (small)	Mesopotamia	6 *oḳḳa*	7.694 kg	
Men (special)		12.5 *oḳḳa*	16.036 kg	«gomme adragante»
Men (heavy)	-	12 *oḳḳa*	15.388 kg	
Men	Baghdad	19 *oḳḳa*	24.396 kg	
Miṯḳāl	-	1.5 *dr.* or 24 *ḳirāṭ*	4.811 g	precious stones, rose oil
Miṯḳāl	Turkish	—	24 g	
Miṯḳāl	Persian	—	22 g	
Naḳīr		2 *ḳiṭmīr*	0.000625 g	
Oḳḳa	—	400 *dr.*	1.283 kg	
Oḳḳa (old)		6 *okiye*	1.282945 g	78 *oḳḳa* = 100 *kilo* after the introduction of the metric system
Oḳḳa (new)		—	1.000 kg	
Oḳḳa (new	Adana	—	1.212 kg	
Oḳḳa (heavy)	Mesopotamia	2.5 *oḳḳa*	3.210 kg	meat, vegetables, fruits
Oḳḳa (fraudulent)	İzmir	380 *dr.*	1.219 kg	
Oḳḳa (Egypt)	Jedda	—	1.050 kg	
Oḳḳa (*Venedik ḳanṭārı*)	Albania	—	1.412 kg	all kinds of merchandise except silk and cocheneal
Okiye (*ounce*)	Mesopotamia	100 *dr.*	324 g	
Okiye	Jaffa	75 *dr.*	243 g	
Okiye	Syria	66.5 *dr.*	213 g	
Okiye	Maghreb	10 *dr.*	32 g	
Vezne	Syria	25 *oḳḳa* or 12.5 *raṭl*	32.025 kg	
Vezne	Baghdad	78 *oḳḳa*	100.066 kg	
Vezne	Mossul	10 *oḳḳa*	12.284 kg	
Vezne	Mesopotamia	32.5 *oḳḳa*	41.605 kg	
Quarta	Salonica	3.4 *oḳḳa*	963 g	
Quintal (*ḳanṭār*)	İzmir	40-44 *oḳḳa*	51.308-56.400 kg	heavy goods
Quintal		80 *oḳḳa*	102.616 kg	ordinary goods
Quintal	-	180 *oḳḳa*	230.922 kg	special goods
Quintal		78 *oḳḳa*	100.066 kg	goods from Europe
Quintal		39 *oḳḳa*	50.033 kg	goods from G. Britain
Raṭl (*rotol*)	Syria	2-2.5 *oḳḳa*	2.564-3.205 kg	
Raṭl	Mesopotamia	1 *oḳḳa*	1.283 kg	
Raṭl (Egyptian)	Jedda	113 *dr.*	360 g	
Taġār	Mesopotamia	1000 *oḳḳa*	1283 kg	
Taġār (heavy)	-	1560 *oḳḳa*	2000 kg	
Taġār	Mossul	200 *oḳḳa*	256 kg	see *ḳanṭār*
Çeki		176 *oḳḳa*	225.790 kg	

Çeki		195 *okka*	250 kg	wood (official)
Çeki	Ayvalik	100 *okka*	128.28 kg	wood
Çeki	Salonica	135-140 *okka*	173-179 kg	wood
Çeki	Mitylene and İzmir	180 *okka*	230.896 kg	wood
Çeki	İzmir	250 *dr.* plus 5 per cent	763 g	opium
Çeki	"		4.564 kg	mohair
Çeki	Turkey	100 *dr.*	320 g	gold and silver

The new system caused confusion in the bazaar when, for instance, under the law introducing the metric system, the new *çeki* was fixed at four *kanṭār* of 50 kg each or 200 kg which was 12.5 kg less than the old *çeki*. The merchants of firewood began to use the new *çeki* without adjusting the price accordingly. Thereupon the government ruled that *çeki* was to be 250 kg in the future. It was reported by the French in Istanbul (*Bulletin de la Chambre de Commerce française*, no. 180, March 1902) that is was impossible to determine the exact weight of *çeki* used by the merchants of Istanbul.

The following shows the continuation of the old measures (Byzantine-Italian?) in a rather isolated province.

TABLE XIII

WEIGHTS IN EPIRUS IN THE 1890's
(G. YOUNG *finxit*)

	Equivalent		
	old	*metric*	
brasse	1862 *okka*		wood
cartoutso (Preveza)	150 *dr.*		
deccari	3.5 *okka*		raw hair
kanata	3.5 *okka*	4.490 kg	olive oil
litra	1.3 *okka*	427 g	
onghion (ounce)	11 *dr.*	35.277 g	
tagār	20 *okka*	25 kg	
sikla	50 or 60 *okka*		wine

APPENDIX I

It seems that in the origins of measuring systems the folk measures based on grain, foot, cubit or finger were given precision and certain arithmetic division arrangements by state bureaucracies. Roman and medieval measuring systems including the Ottomans' can be traced back to those of Mesopotamian civilizations in their basic features[1]. Decimal, duodecimal systems and the use of a particular measure for a particular commodity and even the names of some measures can be traced back to this origin.

«Neo-Assyrian weights», J. N. Postgate says[2], «might be either 'heavy' (*dannu*) or 'light' (*qallu*), the one being twice the other. The absolute value of these weights is best attested by a series of inscribed bronze lion weights discovered at Nimrud by A. H. Layard, and ranging from 5 (heavy) *mina*s to 2 (heavy) *shekel*s»[3]. As an example we can take the series of *mina (mana)*.

	Mina Heavy	*Mina* Light	*Shekel* Heavy	*Shekel* Light	Kg
Heavy	1	2	60	120	= 1.01
Light		1	30	60	= 0.505

In the later Assyrian system measures of length followed the series of 1 - 24 - 144 - 288, and weights (old system) that of 1 - 60 - 3600. With the Hittites, 1 - 6 - 24 - 72 series are to be found in the measure of capacity (*parīsu*, *sūtu*, *ḫazil*, and *upnu*)[4]. It is observed that despite the great variety of units the system of metrology is basically the same. The *ma-na* or *ma-ne-e* had two major varieties: the *mana* 'of the king' and the *mana* 'of Carchemish'[5]. The *mana* 'of the merchant' «could refer merely to a set of weights used in the transaction in question». The ratio of 60 *shekels* to 1 *mana* is constant. 1 *shekel* equals 180 grains but only fractions of *shekel* were used. The larger weight unit was the talent

[1] C.F. Lehmann, «Das altbabylonische Maass- und Gewichtssystem als Grundlage der antiken Gewichts-, Münz- und Maassysteme», *Actes du 8e Congrès Internl. des Orientalistes tenu en 1889 à Stockholm et à Christiana*, 2e partie, section I. B. Leiden, 1893, 165-249; cf. Schilbach, 2.

[2] J. N. Postgate, *Fifty Neo-Assyrian Legal Documents*, Warminster (England): Aris and Phillips Ltd., 64. I am indebted to Mrs. J. A. Scurlock' kindness for my references to the ancient world.

[3] *Ibid.*

[4] G. F. del Monte, «Metrologia Hittita I: Le misure di capacità per aridi», *Oriens Antiquus*, 19 (1980), 226.

[5] Postgate, *op. cit.*, 65-66.

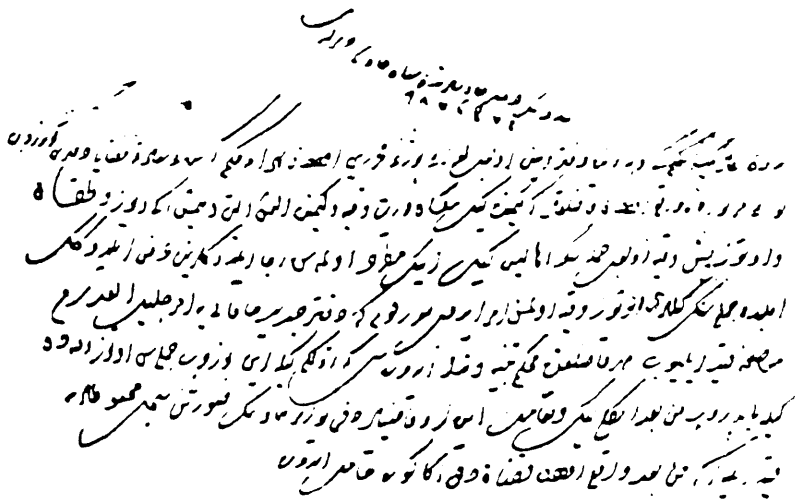
(*bi-lat* or *bissu*) which was 60 *heavy mana* or 120 *light mana*. Thus, the system was as follows :[6]

1 heavy talent = 60 h. *mana* = 120 l. *mana* = 3600 h. *shekel* = 7200 l. *shekel* = 60.6 kg
1 light talent = 30 h. *mana* = 60 l. *mana* = 1800 h. *shekel* = 3600 l. *shekel* = 30.3 kg

The system is based on multiplication of 30 *mana* with 2-4-60-120-240. In dry capacity the decimal system was followed. Linear measures were based on 'finger', 'palm' and 'cubit'. It can be suggested that the Mesopotamian basic weight unit *mana* (pound) continued in Greco-Roman *mina* (see Schilbach, p. 279) and Iranian-Islamic *männ* (see *IMG*, pp. 16-23). We have in Iran two kinds of *männ* as in Mesopotamia, *männ-i şāh* (royal *männ*) and small *männ*.

«Sometimes», Postgate points out[7], «the normal systems of measurement by volume (or weight) gave place to a unit more suited to the particular commodity. Most such units were containers of various kinds and not strictly measures at all». For instance, *maqarrutu* meant a 'roll' or 'bale' (for straw), *ebissu*, 'bundle' (for reeds) or *pittu* (for onions, sesame), *middutu* (for wine). *Homer* or *emāru*, *imēru*, the 'donkey' (-load)[8] was used as a measure (Arabic *ḥimār* means donkey).

APPENDIX II

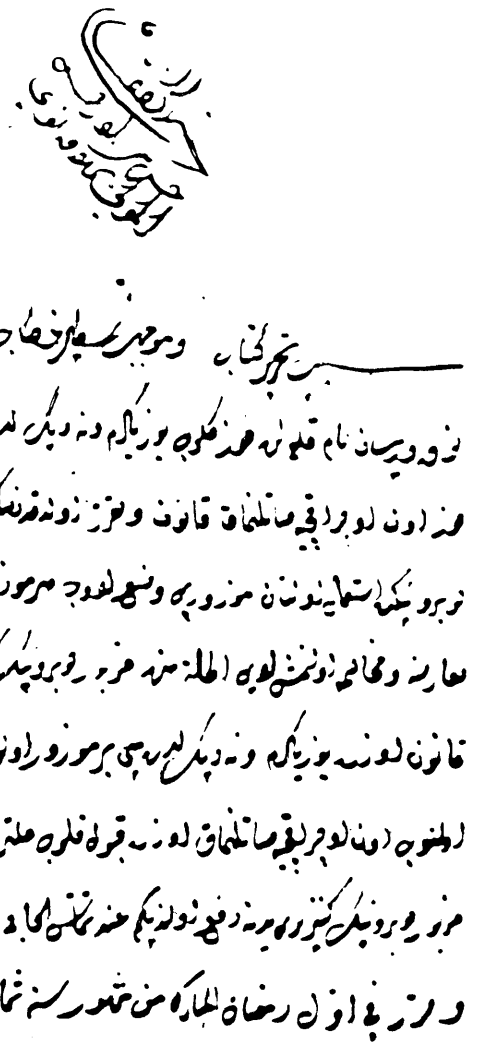


[6] Our arrangement is based on Postgate's, 64.

[7] *Ibid.*, 68-69.

[8] *Ibid.*, 67. For Mesopotamian weights and measures also see F. Thureau-Dangin, «L'U, le QA et le Mina, leur mesure et leur rapport», *Journal Asiatique*, 10e série, LXII, 1903, 79-111; O. Neugebauer, *The Exact Sciences in Antiquity*, New York : Brown University Press, 1957; *A History of Technology*, eds Ch. Singer *et al.*, Oxford, 1954, 774-84.

APPENDIX III



حرر الفقير حسن بن ادريس
المولى بخلافة نوى

1 سبب تحرير كتاب و موجب تسطير خطاب بودركيم دوبرونيك قلعه سندن

2 نووه و ريسان نام قلعه‌لره طوز كلوب يوز يكرم ونه‌ديك لدره‌سى برموزور اولوب هر مزور

3 طوز اون اوچر اقچيه صاتلماق قانون ومقرر اولدقدنصكره مذكور دوبرونيك كنيزلرى

4 دوبرونيكده استعمال اولنان موزورى وضع ادوب هر موزور طوزى اون برر اقچيه صاتوب

5 معارضه و مخاصمه اولنمش ادى الحالةهذه مزبور دوبرونيك كنيزلرى سابقا اولان قديمى

6 قانون اوزره يوز يكرم ونه‌ديك لدره‌سى بر موزور اولوب هر موزور قنطاريله وزن

7 اولنوب اون اوچر اقچيه صاتلماق اوزره قبول قلوب ملتزم اولمالرنده بو وثيقه كتب اولنوب

8 مزبور دوبرونيك كنيزلرى يدنه دفع اولنديكم عند تماس الحاجة احتجاج ادينلر جرى ذلك

9 و حررّ فى اوّل رمضان المبارك من شهور سنه ثمان و تسعين و ثمانمائة

Written by Hasan son of Idrīs, cadi at the court of Novi

The reason for the writing of this document is that previously, when salt was imported from the fortress of Dubrovnik to the fortresses of Nova and Riyesan, the established and confirmed rule was that each Venetian *muzur* which equalled one hundred and twenty Venetian *lidre*[1], was to be sold for thirteen *akça*. But, when the knezes of Dubrovnik applied the *muzur* which is in use in Dubrovnik [for the selling of their salt here] and sold each *muzur* for eleven *akça*, a dispute had arisen [between the knezes and the Ottomans]. At the present time the aforementioned knezes of Dubrovnik agreed and undertook that the *muzur* [in selling salt] is to be, in accordance with the previous regulation (*kadīmī kanūn üzere*), the *muzur* of one hundred twenty Venetian *lidre*, and each *muzur* is to be weighed by *kantar* and sold for thirteen *akça*. Thereupon this document is drawn up and delivered into the hands of the [illegible] of Dubrovnik so proof when needed.

This took place and was written on the first day of the sacred month of *Ramaḍān* in the year of 898.

[1] 1 Venetian *libbra grossa* = 357.749 g.

ABBREVIATIONS

Al-ʿUmarī, Masālik : *Al-ʿUmarī's Bericht über Anatolien in seinem Werk Masālik al-Abṣār fī Mamālik al-Amṣār*, ed. Franz Taeschner, Leipzig, 1929.

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