A CONSIDERATION OF THE ANCIENT NEAR EASTERN SYSTEMS OF WEIGHT

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Recently at the Ancient Orient Museum we held an exhibition in connection with the trade in lapis lazuli (Hori and Ishida, 1986) and on that occasion had an opportunity to come into contact with two weights which had been unearthed in Afghanistan and Iran. Moreover a weight recently was brought to Japan said to have been unearthed in Kerman. I shall introduce these three items and make a comparative investigation of related data in the first chapter. In chapter two we shall reconstruct the Irano-Afghan system of weight, followed by the author’s hypothesis which is an attempt to establish its position in the system of weights of Western Asia. In conclusion the author considers that the main systems of weight of Western Asia, for example of Sumer, the Indus and Dilmun were all established under influence received both directly and indirectly from the Irano-Afghan system.

In writing this report I express my gratitude to Mr. J. Gluck and Professor I. Hirayama who gave permissions to make public resource materials, and also to Miss H. Pittman of the Metropolitan Museum of Art and Dr. J. E. Curtis of the British Museum who kindly arranged the photographs of related materials.

I

Weight A. This is a stone weight considered to have been excavated from the Kerman region of Iran, and is part of the J. Gluck collection (Pl. I). A large amount of pottery and stone implements was unearthed from the Kerman area at the end of the 1960s, and as an object collected at that time whose provenance is to a certain extent established, we may consider it a good specimen. A single flat rectangular slab of chlorite, a semicircular grip is affixed to the upper side to form a handled rectangle. The total height is 25.5cms, and its width is 26.7cms; the lower section is 1.5cms thick, and the upper section is 2cms thick. The grip

* The Ancient Orient Museum.
A CONSIDERATION OF THE ANCIENT NEAR EASTERN SYSTEMS OF WEIGHT

is 2.3cms thick and is quite thin towards the base. Its total weight is 3150grms. Both sides of the rectangular slab are engraved with a shallow relief carving, on one side of a twin-headed eagle holding two snakes in its claws, with on the opposite side an engraved design showing palm trees with tents hanging between them. The carved surfaces are extremely smooth, all the surfaces demonstrating the same degree of erosion and it is a perfect piece completely devoid of any loss or damage.

The article which most resembles this specimen is one excavated from the Azerbaijan region of Iran in the 1930s and now in the collection of the Archaeological Museum of Tehran (Vanden Berghe, 1966, pl. 151). This too is made from a black stone, possibly, it is thought, of the same chlorite manufacture as weight A. It is similar in the respect that on one side is depicted an eagle holding snakes, and on another face the tent motif appears, but it should be noted that there is a fairly large variance in the details of the design.

The greatest distinction lies in whether the eagle represented in the central image has one or two heads but as I shall touch on this subject at a later stage, I shall first deal with an investigation of other aspects of this image. Both figures are shown in large scale their wings spread, but this design was a motif widely used in ancient Iran too from the time of the designs of the Susa D style painted pottery of proto-Elam (for example, Amiet, 1966, nos. 101, 105, 110, and also the pottery of the Giyan IV period which was influenced by it, and so on.) The eagle represented on weight A demonstrates two talons at the front of its claws and two at the back, giving us a feeling of something rather out of the ordinary. It is natural for a bird of prey's claws to be represented with three talons at the front and one at the back. However there is an example of a twin-headed eagle represented on a cylinder seal of the Kassite period with two talons at the front and two at the back of its claws (Buchanan, 1966, no. 526a), and it does not go to say that there were absolutely no variations in representation, but the meaning implicit in this representation is unclear.

Concerning the point of the twin-headed eagle, let us at this point look at some related material. First I shall mention a seal of the Guti period. (Frankfort, 1939, fig. 38). This shows a scene in which the seal's owner, Urdun, is shown performing a libation before the god Ningirsu. Beneath the inscription is an eagle, interpreted by Frankfort as a twin-headed eagle, and it is stated that this kind of spirit appears on seals after the advent of the Guti period. The attendant of the god Ningirsu is the sacred bird Imdugud, represented as an

Vol. XXII 1986
eagle with the head of a lion, but in the case of this picture the beak is bent sharply into the shape of a hook, like a bird of prey’s, and it is an eagle’s head, and no other bird’s. Thus it is probably an attendant deity other than Indugud, but it is not clear just what it is. The image of a twin-headed eagle was much used in the northern Afghanistan region in the first half of the second millenium B.C. For example, the object shown in Fig. 1 is a stamp made of silver on which is depicted a goddess with two eagles’ heads grasping snakes in both hands, and we may say that it shares essentially the same motif as weight A. Also there is a figure portrayed on a silver axe as being half-man and half double-headed eagle, said to have been excavated recently in northern Afghanistan (Pittman, 1984, no. 36). The representation of a two-headed eagle appears on Hittite seals and is seen here and there in each region of ancient Western Asia, but in all events it is a minor deity whose nature, one is compelled to say, is at present unclear.

The image of an eagle grasping a snake was widely distributed over a large area of Western Asia. The snake was taken as the symbol of water, the earth and of rebirth. For example on a stamp of the Uruk style excavated from Tepe Gıyan snakes are arranged around a central scene of goats and plants (Amiet, 1980, no. 98); the snake is the symbol of the life-giving earth. The eagle on the other hand was from early times thought to be a symbol of heaven or of the sun. For example, on a cylinder dating from the period of Jemdet Nasr to ED I there is a depiction of an eagle above a herd of goats and cows, and there is also an example of all-pervading rays of light emanating from the eagle’s wings and illuminating the earth (Amiet, 1980, no. 762). Also there are examples among the seals belonging to the ED I period of the Tree
of Life and animals portrayed with an eagle with out-stretched wings perched at the top of a tree (Amiet, 1980, no. 766). This is the original form of the winged disk which stands at the top of the pillar of later ages. The pillar originally meant the sacred tree, and the winged disk meant the eagle, symbol of the sun.

When one looks at it like this, one can probably imagine that the eagle and the snake depicted on weight A are images representing ancient man's view of the world as heaven and earth. At this point one recalls the tale of Etana which is included among the Sumerian legends. The main protagonists in this tale are the eagle and the snake; the story goes of how an eagle and a snake who were on good terms with each other built nests at the top and at the bottom of a tree (already at this point the concept of contrast between heaven and earth is suggested). They both laid an egg in their respective nests, but malevolence erept into the eagle's heart, and it ended up by eating the snake's egg. The snake, bewailing its fate, swore revenge on the eagle. The snake hid in the belly of a dead animal, the eagle came and was about to peck at the carcass. The eagle's young had predicted that "the earth (i.e., the snake) will catch you" and, just as was prophesied, as the eagle pecked at it, the snake bit the eagle, dealing it a fatal wound. The king of the animals, Etana, on instructions from the sun god Shamash, helps the eagle, in return for which he is taught the whereabouts of the herbs of Heaven which cure barren women .... This story is from Sumer, not an Iranian legend, but the face that a concept of this kind of confrontation between heaven and earth, and the idea of its being symbolised by by the eagle and the snake, was spread throughout Western Asia can be seen in the way that the eagle and the snake are depicted confronting each other on the seals excavated in Afghanistan, which I have touched on already.

Next let look at the reverse side of weight A. Here we have palm trees and what are called "tent designs" carved across two levels. The motif of 3 palm trees with roots spread wide apart is often used in the case of this kind of weight. The chlorite example in the collection of the Boston Museum of Fine Art shows a tent and palm trees in a panel, (Kohl, 1979, fig. 9), a representation which fairly closely resembles that of weight A.

So, where may we place weight A in terms of date? Similar items have been unearthed over a fairly wide area from Syria to the Ferghana region of Central Asia, but hardly anything certain is known about the levels from which
they were excavated. Details of the level from which one of the articles was excavated are clear, and that is an object excavated from the remains near Soch in Ferghana, and which has been classified as dating from the latter part of the Bronze Age, that is to say the latter half of the second millennium B.C. (Pugachenkova, 1965, fig. 5), but if we compare this age with the date proposed for these kinds of remains it is too late, and it may very well be that it was passed on from generation to generation over a fairly long period of time. A weight without decoration was excavated at Susa (Mecquenem, 1934, fig. 6–2) and has been taken as being of the Susa C period, i.e. the beginning of the ED period (Miroschedji, 1972, p. 161). Moreover, an object has been excavated from the Tepe Yahya IVB stratum which reutilised a fragment of a stone weight (Kohl, 1979, fig. 8), and at its latest we can apportion to it a date of the latter half of the third millennium B.C. Judging from the material, style and design of these chlorite article they are objects which were made in the Kerman region, particularly centred around Tepe Yahya. They belong to what is called the Intercultural Style (Khol, 1978, 1979), and are regarded as dating from about 2700–2500 B.C.

Weight B. This is a handled rectangular-shaped weight, made from bronze and lead (Pl. II-1, Fig. 2), said to have been recently excavated from the Kerman region, and is now in the collection of Professor I. Hirayama. Its width is 33.2cms, height 24.6cms, and at its thinnest part it is 2.8cms thick;
it measures 5.5cms at the handle. Its weight is 16,641grms. As shown in the cross-sectional view it was made by pouring lead in from one side of a bronze frame, and the handle portion is thought to be of lead wrapped around a bronze core, but as X-rays cannot penetrate it we cannot say for certain.

On the body are represented triangular, rectangular and wedge-shaped designs in lead, but what could these mean? It is a design which is little seen on stone containers or on earthenware. Perhaps it arises from the openwork designs composed of mud bricks which decorate the walls of temples and palaces. An example of this kind of decorated wall is the west wall of the palace of Mundigak of level IV (Casal, 1960, pls. XII & XIII). Weight B is of basically the same shape as weight A, and its age can be estimated as being about the same.

Weight C. This weight is said to have been excavated from the northern part of Afghanistan and is in the collection of Professor I. Hirayama (Pl. IV, Fig. 3). It is in the shape of a disk of 27.5cms diameter, 1.1cms thick and made of lead. It is extraordinarily heavy (6809grams). There is a rectangular
hole in it, and it is slightly smooth at the point where one's fingers go. It is just the right kind of implement for holding or putting down. Near the edge there are seven holes made in the shape of a three-staged pyramid which were arranged in the wrong position, and the middle area of both sides is occupied by a bull with large horns, shown in profile.

According to analysis, more than 90% is Pb, along with small amounts of Si, K, and moreover traces of Cu, Fe, and Ag are said to be present (according to information from Mr. T. Kaku), but one can see no examples of lead objects as big as this in Western Asian antiquities. At present only two items are known which resemble this lead weight, both of which are thought to belong to the Bronze Age culture of northern Afghanistan (Pottier, 1984, nos. 290 & 291). They are both 26cms in diameter and 2.5cms thick, a shade smaller than weight B. On their upper edges there are holes constituting grips, and they accord with weight B in as far as there are several cross-shaped and pyramid-shaped holes drilled in them.

The use of lead in Central Asia had already begun by the fifth millennium B.C. This can be realized from the fragments of the personal articles found buried with the dead in the graves of the lower level of Anau Tepe, i.e. of the period of Namazga I, tubes and spirals of 1.5–1.7cms in diameter, and of less than 4cms in length (Pumpelly, 1908, figs. 293, 294). The lead was usually extracted as lead sulphide, which was obtained in large quantities as a by-product of silver-refining. A fair number of silver mines are known of in the mountain ranges of the Hindu Kush, and weight C is thought to be made of lead obtained from the refining of the ore in this vicinity.

Naturally the weight comprising article C was made by using a mold, probably not of the composite kind but an open mold. There are no traces of joints at the sides, and traces of reworking can be seen where the rim is decorated with a pyramid pattern. It is thought that when a weight was made of metal, an ingot of previously determined weight was used and poured into the mold, and slight modifications were added after casting. In the case of an open mold the weight has only one face and it is difficult to add a design on both sides. On the weight in question, a bull is shown in the centre on both sides, but how was it applied? The picture of the bull is not shown in relief but as a design in fine outline and incisions, whose expression is extremely weak, and it is hard to think of the picture having been carved into the mold. Moreover when one examines that outline closely, it seems that corrosion has
A CONSIDERATION OF THE ANCIENT NEAR EASTERN SYSTEMS OF WEIGHT

built up, and the greatest likelihood is that formerly it was overlaid with a metal foil made of gold or of some other such metal, and that the engraved lines and dots were applied over that; one wonders if it is not the case that corrosion formed on the contact surface of another type of metal and built up over the outlines.

Next I would like to examine the image on weight C. It is clear that the pattern of seven pyramid-shaped holes around the edge derive their origin from the Chalcolithic painted pottery designs of southern Turkmenia. Also, these designs spread as far as the eastern part of Iran and the Afghanistan region, as can be seen in the painted pottery of the periods of Shahri Sokhta I and of Mundigak. During the period of Namazga V the pyramid motif was used as an openwork or engraved design on small pottery vessels and as a form of decoration on the earthenware vessels (Masson, 1981, pl. XVIII), and on entering the Namazga VI period it was used on numerous occasions as a motif for bronze stamps. Accordingly, it is thought that this pyramid pattern was adopted as a motif for weights under the influence of the cultural traditions of the area from the eastern part of Iran to Afghanistan.

As mentioned above, a bull occupies the central area on both sides, in both instances in profile and facing to the left. It is portrayed with an angular face and body and with great ponderous horns. On one side the front part of the animal's torso is engraved with claw-shaped marks to show body hair and there are 3 lines of dots on its hind legs to show sinews. The methods used to render the figure and its details are consistent with an ox embossed on a silver object decorated with a farming scene excavated in northern Afghanistan (Amiet, 1984, pls. VI & VII). There are small circular patterns drilled in at the joints of legs and also on the middle part of the body, but one wonders what these mean. In both pictures of the bull the marks are incised in the same place, and they are by no means devoid of meaning or just an irregular pattern. The Bull constellation of the 12 signs of the Zodiac had at its centre the principal star Ardebaran, and was already determined in the Old-Babylonian age (Waerden, 1949). However as the Bull constellation shows only the upper half of the animal's body from the neck to the horns, it was described as the "Jaw of the Bull" in the Babylonian records; and one cannot consider the pictures on the weights which represent the full body-length of the bull as being consistent with the Bull constellation. In records of the Old Babylonian period the words the "Stars of Elam" are recorded, but they are thought to signify the constellations of the Iranian system,
not those of Babylon (Waerden, op. cit.). Images which combine pictures of
animals and stars have been in existence from of old. For example, on a cylinder
seal of the end of fourth millenium B.C. excavated from the area around Susa
is engraved huntsman and animals like bulls, lions, goats and camels, and
though the surfaces between them are covered with dots (Amiet, 1980, no. 1587),
some area of dots are surrounded by lines, and these signify stars and constellations.
It is not too far-fetched to imagine that the bull on the weight is a
constellation, and that semi-precious stones were inlaid in the small holes
which depict the stars.

So at what age should we estimate these lead weights to be? Flat discs
made of stone and with holes in them to form grips have been excavated from
the Tepe Hissar IIIB and C periods (Schmidt, 1937, pl. LXII), and the same
kinds of remains were found at the level with the remains thought to be the
graves of the temple of Artin Tepe I in southern Turkmenia (Masson, 1981,
fig. 22–1), all of which are put at the end of the third millennium B.C. These
and the object which comprises weight C vary in that they are made from
different materials but their shape is exactly the same, and they are of almost
the same age, i.e. we can estimate them as dating from around 2000 B.C.

II

In the preceding chapter I talked about 3 weights. This kind of relic is
generally termed a weight but the first one who considered it to be such was R.
Pumpelly, who carried out a general survey of Turkmenia in 1904. L. Warner,
who arranged the large stone implements excavated at the Anau site, put
forward Pumpelly’s suggestion that the stone implements which had handles
were probably used as weights, and reported a weight of 13.59kgms (Pumpelly,
1908, Vol. II, p. 478). These ideas were pursued with the excavations of Sialk
and of Hissar and so on but strangely enough, although they were termed
weights, they were hardly ever weighed to see what their weight was.

First I shall carry out a classification by shape of the related material, and
then estimate its age. At this point I should like broadly to distinguish them
by dividing their shape into 4 broad categories.

Type 1

Of oval or semicircular shape, a handle is affixed to the top in order to
enable one to grip it. Their distribution is known of from the middle region of Iran, Tepe Sialk, as far as the northern part of Afghanistan. The oldest specimen among them is an article excavated from Dashli Tepe (Khlopin, 1963, p. 9), of the Namazga I period, i.e. it has been identified as being of the 5th. millenium B.C. The material of the periods of Sialk III and Hissar I (Ghirshman, 1938, pl. LXXXV, s. 223, Schmidt, 1937, pl. XVIII, H2095) is put at the middle of the fourth millenium B.C., and moreover the articles of Anau Tepe excavated from the upper part of the northern tell are considered to be of the period of Namazga II, i.e. of the first half of the fourth millenium B.C. This type is the oldest of a series of weights.

Type 2

The shape of the whole is close to that of a regular square, and there is a hole in the weight so that one can hold it. Unearthed from Central Asia to the Afghanistan region, among which objects those unearthed from the ruins of Mundigak I–5 (Casal, 1961, fig. 135–4) are parallel to the period of Namazga II and put at the first half of the fourth millenium B.C.; moreover the materials from Kara Tepe (Masson, 1960, fig. 32) were discovered at the level of Namazga III. The weight from the remains at Sarazm (Isakov, 1986, fig. 8–1) is thought to be of the second period, i.e. of about 2000 B.C.

Type 3

Two types of flat disk are known, the one made of alabaster and other kinds of stone, and the other type made of lead. Those of Hissar periods IIIB and C are without decorations. In Turkmenia an object was unearthed from the graves of the level I of Artin Tepe which had a concentric circle pattern carved upon it, and which is parallel to the period of Hissar IIIC in terms of date. Lead weights are known only from illegal excavations in the northern part of Afghanistan, and are all put at about 2000 B.C.

Type 4

Weights of the type shown by specimens A and B, and the majority of chlorite manufacture, produced in the Kerman region centering around Tepe Yahya. Objects excavated from Ur are made of alabaster and differ in the system of decoration employed, and were probably produced in Mesopotamia. As mentioned above, the age of this fourth type of weight is thought to be the
middle of the third millennium B.C. As a result of excavations the fact was made clear that there was a thriving chlorite industry at Tepe Yahya. P. L. Kohl suggests that Tepe Yahya was the centre of production and distribution, but this idea probably does not hold water. We think that Tepe Yahya was no more than a small town composed of a group of specialist artisans. What maintained the sphere of trade influence which extended from Mesopotamia to the Indus must be the bigger city of Aratta or Shimashki, though their precise locations still remain unclear, and it is thought that Tepe Yahya was merely one of their satellite cities.

I have divided the weights excavated from Iran and Afghanistan into 4 types as above and weights of types 1–3 are clearly shown by their geographical and chronological distribution to belong to one system. Setting apart the object from Sochi, the majority of type 4 ranged from the south-east region of Iran to Mesopotamia and is of a different system. However, as there is an undeniable similarity in the shapes of type 4 and type 1, it is thought that the weights of type 1 developed in a different form in the south-east region of Iran.

Up to this point I have introduced the material of types 1–4 as weights, but as I have termed them weights they must be part of a standardized system. The person who set his mind to this problem was V. A. Alekshin (Alekshin, 1973). He measured the weight of types 2 excavated from Artin Tepe and Kara Tepe, and came up with values of about 4 kilos, 5.5 kilos, 7 kilos, 19 kilos and 26.5 kilos. Perceiving a variance of 1.5 kilos between each, he asserted that we could assume weights of 8.5, 10, 11.5, 13 kilos and so on up to 25 kilos occupying the range between 7 and 26.5 kilos. Moreover, he thinks that from the fact that the unit of the Mesopotamian system of weight, the mina, is about 0.5 kilos, there was probably some sort of connection between the systems of weight of Mesopotamia and of Turkmenia.

However, one cannot take his hypothesis on board as it stands. As he himself recognizes, it is impossible to place the 13.59 kilo weight excavated from Anau among them, and he thought that there is a possibility that the system of weights was not settled by the period of Namazga II, or that there was an error in measurement, or perhaps that part of the weight might have been missing. However, it is true that one can hypothesize a system which can accommodate those values as they are recorded in the report, without adaptation, and if it should prove that we cannot accommodate those values then we should look at the hypothesis itself. Moreover, we probably cannot imagine that all weights of 1.5 kilo units exist-
ed. If there were weights of standard mass which increased at intervals of, for example, $2 \times$, $4 \times$, $8 \times$ and $16 \times$, it would be possible to measure the weight of any object. Then if we added weights of values which are often used, in the case of the decimal system multiples of 5, 10, 20 and so on, it should prove to be a perfect system. What poses another problem is that objects are included which cover a wide time scale from the fifth millennium to the second millennium B.C., and we must investigate whether we can obtain a standard system regardless of differences in period.

If we take the materials dealt with here to be weights which are based on a uniform system, then the systems of weight of Mesopotamia and the Indus become objects of comparison from a geographical point of view. Of course the system of Achaemenid Persia which formed Iran's own original system is also worthy of examination. In this system, the unit of 1 Karša — 83.33 grms, was used based on the $1/6$ mana of Babylon (Kent, 1953, p. 180), which belonged essentially to the Mesopotamian system, and which we probably do not especially need to deal with here. Plenty of research was carried out on the systems of weight of Mesopotamia and the Indus in the 1930s and 1940s, at which stage the general principles of the system were made clear. At this stage I shall take it upon myself to quote from the work of Mr. S. Iwata who is building on that research and devoting all his energy to its development (Iwata, 1974, 1982). First on the matter of consistency in the systems of weight, the standard of weights was uniform in Mesopotamia from the Akkadian period to the Neo-Babylonian period, and was kept in the greatest secrecy, especially during the period of Ur III, and he says it was a standard pursued with from that time onwards. On the other hand, he says that in the Indus civilization the system of weights used at Moenjo Daro, Harappa, Chanhu Daro and so on was maintained in spite of the influx of people from other races, and the weights excavated from the ruins of Shirkap in Taxira are consistent with the articles of the Indus civilization. When looked at in this way, it becomes apparent that the system of weight was extremely deeply rooted in the traditions of that region, and that the system was fairly constant. It is thus possible to examine the standard weights of Iran and Afghanistan without regard to the ages.

Here are eleven examples of those weights known at present: 1650 grms* (Ur weight in the British Museum), 3150 grms (weight A), 4020 grms

* footnote: This weight was so damaged that the original value must be 1750 grms or so (Personal information by Dr. R. Curtis).
(Artin Tepe), 4080grms (Mr. Shimmel’s collection), 5475grms (Artin Tepe), 6809grms (weight C), 6975grms (Artin Tepe), 13590grms (Anau Tepe), 16642grms (weight B), 19000grms (Kara Tepe), 26500grms (Kara Tepe). In these examples the values of 1650, 3150, 6809, 13950 and 26500 are double each other, and this supports the theory that these objects were used as weights.

So can we say that the other values are meaningful figures? At this point, let us take a brief look at the system of weight of Mesopotamia and the Indus. As is well known, the standard of weight of Mesopotamia was based on multiples of 60, and using Akkadian we can say 1 sigulu is a little over 8grms, 60 sigulu are 1 mana, (a little under 500grms), 60 mana are 1 bultu (a little under 30kilos). These weights were made from various kinds of stone, bronze and metal, and animals such as ducks, lions and bulls were depicted on them; objects are also known of a geometric shape such as cylinders or discs. On the other hand the Indus weights are almost all made of stone and are square, and of very plain form, but because the language has not yet been deciphered the name of this unit is unclear. With the smallest unit of about 0.86grms, stone weights of multiple proportions have been discovered. At this point I shall offer a table of the weights unearthed from Mesopotamia and the Indus.

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<td>1 mana</td>
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<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

From this chart we can well see how the weight of the Mesopotamian and Indus weights was created based on regulated fixed multiples. If the Irano-
A CONSIDERATION OF THE ANCIENT NEAR EASTERN SYSTEMS OF WEIGHT

Afghan weights should have any connection with any of those units of weight, it should be possible to establish them within that system.

First let us try fitting the weights of Iran and Afghanistan into the Mesopotamian system:

\[
\begin{array}{ccc}
1650\ g &=& 3.4\ \text{mana} \\
3150 &=& 6.5 \\
4020 &=& 8.3 \\
4080 &=& 8.4 \\
5475 &=& 11.3\ \text{mana} \\
6809 &=& 14 \\
6975 &=& 14.4 \\
19000 &=& 40 \\
16642 &=& 34.3\ \text{mana} \\
26500 &=& 54.6 \\
13590 &=& 28
\end{array}
\]

Of course in the case of individual weights there is an attendant aberration, so we should probably allow a margin of \(\pm 5\%\). But even if we allow for this variation, they are hardly consistent with the standardization of weight of Mesopotamia, and we can only establish a connection between 6.5 mana and 6 1/3 sigulu. Moreover, 8 mana and 40 mana are comparatively easily divisible numbers but this kind of multiple is not used at either the sigulu or mana level. Units of 11 mana, 14 mana and 28 mana have absolutely no meaning as multiples in a system based on multiples of 60, and we can say that a direct relationship cannot be recognized between the Iran-Afghanistan system of weight and that of Mesopotamia.

Now let us attempt a comparison with the Indus system:

\[
\begin{array}{ccc}
1650g &=& 2000 \times (1780g) \\
3150 &=& 4000 \times (3424) \\
4020 &=& 4800 \times (4109) \\
4080 &=& 4800 \times (4109) \\
5475 &=& 6400 \times (5452) \\
6809 &=& 8000 \times (6785) \\
6975 &=& 8000 \times (6785) \\
13590 &=& 16000 \times (13717) \\
16642 &=& 18000 \times (16020) \\
19000 &=& 24000 \times (20544)
\end{array}
\]

From this chart one can see that the Irano-Afghan system of weight corresponds extraordinarily neatly with that of the Indus system. First there is a problem with multiples, and the figures of 2000 \(\times\), 4800 \(\times\), 8000 \(\times\), 16000 \(\times\), 18000 \(\times\) and 24000 \(\times\) are not included in the previous chart dealing with the weights of the Indus system. However figures of 1/10 or 1/100 of their value are included in the system, and it is not unnatural for a weight of this multiple to exist. In actual fact, only one example of each weight of 6400 \(\times\) and above
has been found, and there is a possibility that a weight of a little smaller size existed among them. Moreover, on the point of discrepancy in average values, the 8% variation in the figure of 3150g, and the 7.5% variation in the value of 19000g is fairly large but as in the other cases the discrepancy is within 3.5%, it is clear that the Irano-Afghan system of weight and that of the Indus were basically the same.

**Conclusions.**

We have reached the conclusion that the system of weight which extended from Iran to Afghanistan is basically consistent with the Indus system. So was this system established under influence from the Indus region? That cannot be considered. The Irano-Afghan system of weight was already es-
tablished in the fifth millenium B.C. and possessed a history which was far-and-away older than the Indus one. It is hard to say that the origin of the Indus civilization has been perfectly resolved, but it is not difficult to imagine that it was established on the premise of the agricultural cultures distributed among the mountain regions of Afghanistan and Pakistan. It is thought accordingly that the Indus system of weight too was created refined under the influence of a system established in Iran and Afghanistan. It is also well-known that the Dilmun system was basically consistent with the Indus system, (Rao, 1986), and so the Irano-Afghan system of weight was their common ancestor.

Thus was the Mesopotamian system of weight established without relation to these? We cannot yet find any trace of the system of weight in Mesopotamia at Ubaidian or Protoliterate period, and it seems impossible to me that the system of weight emerged suddenly under Sumerian dynasties without any ancestor. The writer himself thinks that the idea itself for the Mesopotamian system of weight is of Iranian origin, and it only appears to be completely different because it adopted the system of multiples of 60.

Why was this kind of system developed in Iran and Afghanistan? That is without doubt because it was found to be indispensable to the long-distance export trade in metal-ore, semi-precious stones, and especially in tin from western Afghanistan to the great consumer regions.

Decorative designs suggesting gods appear on the weights dealt with in this paper. Perhaps these were not included among those for everyday use but became instruments to indicate authority. The reason is that under the system of the trading cities of Iran of the third millenium B.C. a tribal leader or chief controlled trade, and it was imagined that the standard of weight required for trade was guaranteed by divine authority. The weights which were actually employed in everyday use were based on these standard weights, and were probably used in conjunction with stones from riverbeds, etc., which we can see in various bazaars even now.

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Vol. XXII 1986
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A CONSIDERATION OF THE ANCIENT NEAR EASTERN SYSTEMS OF WEIGHT

Handled Weight (A) made of chlorite

Vol. XXII 1986 33
1. Handled weight (B) made of bronze and lead

2. Handled weight from Ur
(© British Museum)
A CONSIDERATION OF THE ANCIENT NEAR EASTERN SYSTEMS OF WEIGHT

Handled weight of Mr. N. Schimmel's collection (© Metropolitan Museum of Art)

Vol. XXII 1986 35
Disk-shaped weight (C) made of lead