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ARCHAEOMETERIC ANALYSIS OF STANDARDIZED WEIGHTS FOUND AT BUTH JO DARO SITE IN LOWER SINDH

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Abstract:
This research paper has been extracted from the PhD thesis of author on Buth jo Daro an Indus period site located in lower Sindh .Buth jo Daro site is at taluka Manjhand of district Jamshoro,65 km away from district headquarter on Indus Highway, the site was accidently discovered through digging a wider and deeper drain popularly known as RBOD through the site, millions of cultural objects were dumped in multiple heaps, author has made surface analysis to identify the important archaeological artifacts laying on surface of the site. Particularly this paper is emphasizing the important discovery of weight system found from the site of Buth jo Daro, proving this how this weight system continued, through weight statistics of Indus Civilization continued in South Asia more specifically in SINDH.
Key words: Buth jo Daro, weighing system, Mohen jo Daro, Indus Civilization.

INTRODUCTION:

Indus civilization is the ancient well planned urban civilization had thousands of towns and settlements during 3rd and 4th millennium BC based on Indus River supported through sustainable economic factors, trade, agriculture, goods production and redistribution. Sale and purchase was established on sophisticated statistics of weight system throughout the Indus civilization. Indus along with accurately measured infrastructure for urbanization, parallel had weight based commodities through their smart valuation and weight system. Weights in Mohen jo Daro, Haraapa, Lakhen Jo Daro and Buth jo Daro has indigenous weighing formula which was continued since Indus period and up to modern times in Sindh. In this paper the weighing mechanism in Mohen jo Daro and Buth jo Daro is discussed in detail to prove continuation of Indus weight system in Sindh,

Previously plenty of weights have been discovered from small to large houses at Mohen jo Daro, reason behind stone weights at every house suggests that even after purchasing the goods weights were confirmed at home, from large size to small weights were even used, small weights were used by jewelers mostly. Most of the weights found at Mohen jo Daro were in cubical shape, Mr Hemmey has done detailed research on the weights found at Mohen jo Daro. Weights discovered at Mohen jo Daro are of different shapes and sizes, i. cubical, ii. Spherical with flat bottom and top, iii. Cylindrical shape with flat top and bottom, IV. Weights along with hole made for suspension, v. Barrel shaped, VI. Conical, vii. Hemispherical, mostly the weights are found from the DK and VS areas (Ernest Mackay)*.

Most of the weights were slightly damaged due to long term usage, minor edges were damaged, chert was the preferred material for stone weights, 162 out of 220 weights were made of chert, 14 stone weight are made of unidentifiable material, 11 weights are probably of granite whose color is black, remaining 8 stone weights are made by hard black stone material. According to Dr. Fermor these barrel shape weights are made of quartzite, agate weight are 10 in number and 1 stone weight is of Jasper made, weights made of soft stone material such as 13 stone weights are made of lime stone, one is made of alabaster, one is of slate stone made and 7 are made of steatite. (E.J.H Mackay)**

Weights in Mohen Jo Daro (source: google.com)

TABEL I-WEIGHTS AT MOHENJO-DARO

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Designation	No. of Specimens	Mean Weight Observed	Mean deviation	Limits	Ratio.	Calculated Value.	Difference between Cols.3 and 7	Remarks.
N	1	1375 gm.	-----	-----	1600	1370 gm.	5	
L	2	272.95	2.25	270.70—275.20	320	273.92	---.97	One Weight in Class L is a corrected Value.
K	1	174.5	----	------	200	171.2	3.3	
J	6	135.97	.88	134.59—137.81	160	136.96	---.99	
H	6	54.21	.26	53.81—54.50	64	54.78	---.57	
G	26	27.29	.24	26.85---29.00	32	27.39	---.10	
F	32	13.79	.26	13.49---14.90	16	13.70	.09	= 211.4 g.t.[1]
E	22	6.82	.09	6.31---7.27	8	6.85	---.03	
D	9	3.40	.03	3.24---3.51	4	3.42	---.02	
C	9	2.28	.04	2.24---2.33	1 × 8	2.28	.00	-----
B	5	1.77	.06	1.69---1.86	2	1.71	.06	-----
A	1	.87	---	---	1	.856	.01	-----

Buth jo Daro Weighing statistics: is obtained through the discovery of the lime stone weight balls, total 8 in Number, used as weight stones by traders for purchasing and selling goods. Ball No.1 weighing 480 / 12= 40 unit 8, Ball No.2 Weighing 240/12= 20 unit 4, Ball No.3 weighing 180/12=15, unit 3, Ball No.4 weighing 90/12=7.5 unit 1.5, Ball No.5 weighing 80/12=6.66 unit 1.3, Ball No.6 weighing 60/12= 5 unit 1. The weight content is divided by 12 mean whose average ratio is 1:4:8.

Brief description of weight: Total weight of each ball is divided in 12 grams, which is equal to 1 tola, basic unit of tola, ana, Seer, system which was used in sub-continent up to 1960s until the implementations of Meter Kilogram Second system (MKS). 12 gram = 1 tola, 5 tola=1 ana, 4 ana = 1 Pao, 4 Pao = 1 Seer, 80 tola = 1 Seer.

The smallest weight unit were done through the seeds, for weighing the precious metals and stone was called "Ratti" it is gunja seeds weighing the 0.113/0.1241 grams and 8 rattis are in "Masha" This indigenous weighing system is supposed to be used at Buth jo daro and with some variations at Mohen jo Daro had binary weight system. Buth jo Daro having weight statistics makes it more trade engaged site.

Object No BD-532, divided by twelve gram gives 40 times of unit which is half seer, Object No BD-531 weighing 240 gram divided by twelve grams is 20 units of tola, which is 1/4th of seer or is pao, Object No BD-700 Lime stone round weight weighing 180 grams divided by 100 Rattis is divided by 15 times, which is ¾ pao or quarter to pao. Object No BD- 698 lime stone weight weifging 90 grams divided by one tola equal to 12 grams or 100 Rattis, proves 6.66 times or tola, Object No BD-530 Lime stone weight weighing 60 grams divided by 12 grams/100 Rattis which is 1/16th of seer or unit as aana. Object No BD-529 lime stone weight weighing 36 grams is equal to 3 tolas or 300/

297 ± 3 Rattis. Object No BD-528 weighing 52 grams divided by 12 which stands 4.333= 0.866 tola. Object NoBD-534 lime stone weight weighing 222 grams divided by 12=18.5 which stands 3.7.
Note: (Small weighing variations have been observed region wise like in Pakistan 12.5 gram per tola, during British it was 11.638 and India follows the 10grams per tola system particularly in Sindh one tola is equal 12 gram, thus I have used Sindh standard weight for tola in above ccalculations)

Unit Equivalent	
12 ana	1 tola
100 Ratti	1 tola
12 Masha	1 tola
10 Rattis	1Masha
5 tola	1ana
4 ana	1pao
4 pao	1 Seer
80 tola	1 Seer
40 Seer	1 Maund
8 Maund	1 Kandi
26.8 Maund	1 Ton

Table 2: Traditional Tola–Ana–Seer System -Fig No.01F Stone weights found at Buth jo Daro: source: Author

Weight Stones Analysis Found at Buth jo Daro
Table 3: Mean of Weights

Serial No	Object No	Given Weight (g)	Calculation (÷ 12)	Units Obtained	Ratio Component
1	532	480	480 ÷ 12	40	8
2	531	239	240 ÷ 12	20	4
3	534	222	222÷12	18.5	3.7
3	700	180	180÷12	15	3
4	698	90	90÷12	7.5	1.5
5	699	80	80÷12	6.66	1.33
6	530	60	60 ÷ 12	5	1
7	528	52	52÷12	4.333	0.866
8	529	36	36÷12	3	0.6

Weight statistics at Buth jo Daro shows the continuation of centralized similar weight system of Mohen jo Daro within entire Indus Civilization.

CONCLUSION:

Indus civilization along with his sophisticated architecture and technology is matchless, same in trade and commerce is considered pioneer of weighing system which was followed up to 60s along with minor modifications. Binary weighing system for smaller weights and decimal for heavier weighing made Indus merchants more reliable and prosper. Same lime stone weighing system at Buth jo Daro site has been discovered such lime stone weights are also have been discovered at Mohen jo Daro along with other stone weight materials, indigenously continuation of Indus weighing system based on same statistics of tola as the Buth jo Daro has which is mentioned above in tables No.2-3, In south Asia same indigenous weighing system was strengthened by Mughals and Britishers and later on weighing system after 1960s was based on Meter Kilogram Second (MKS) system. This centralized Indus weighing system

from Ratti to Maund is flawless weighing system of Indus and other ancient regions, except a small variation followed by regions has been noticed, but the valuation of basic indigenous basic unit is almost the same as it prevailed in Mohen Jo Daro.

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