

GOLD INGOT BEARING INSCRIPTION :

New Evidence from Abhayagiri Vihāra, Anurādhapura, Sri Lanka on Ancient Technology & Science (Preliminary Survey)

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Excavation at Abhayagiri Vihāra, Anurādhapura which is being carried out by the Unesco/World Food Programme—Sri Lanka Cultural Triangle has recently brought to light a gold ingot bearing an inscription indicating its weight. The ingot, having a maximum diameter of 7.22 c.m. was found in a good state of preservation, at a depth of 300 cm, in a pond, to the Southwest of the Abhayagiri Stūpa. This pond is located in the Mahanetpā-mūla, one of the four *mūlas* which existed at the *vihāra* towards the 7th century A.D.¹ This is a unique find. A similar artifact—a gold bowl with a lid—which was presented by King Rājādhirājasinha who ruled in Kandy in the 18th century to the Temple of Tooth Relic in Kandy bears an inscription to the effect that, it and its cover weighed 462 *kaḷaṇḍas* and 9 *madaṭas*.² However, the original lid is missing and the bowl is worn out.

In the vicinity of the pond, at which the ingot was unearthed a number of foundaries have already been discovered. Those foundaries contain furnaces, crucibles, slags, charcoal, metal scrap, earthenpots, Buddha images and image fragments, and bronze objects etc.

The inscription reads *eksiya dekaḷaṇḍayi*, which means one hundred and two *kaḷaṇḍas*. When weighed scientifically as stated below the object weighed 438.10 grams which is equivalent to 54.76 gold pounds. Hence, it can be safely concluded that the ancient *kaḷaṇḍa* weighed 4.30 grams. The letters employed to write the inscription may be attributed to the later centuries of the Anurādhapura period. Thus, the object may have been cast after the 7th century A.D.

According to the ancient weights

3 <i>amu āṭa</i>	=	1 <i>tala āṭa</i>
3 <i>tala āṭa</i>	=	1 <i>vī āṭa</i>
8 <i>vī āṭa</i>	=	1 <i>madaṭiya</i>
20 <i>madaṭiya</i>	=	1 <i>kaḷaṇḍa</i> ³

Kahāpana (*kahavanu*) is synonymous with *kalaṇḍa*⁴

New materials found from Abhayagiri,⁵ Sigiri⁶ and Dambulla region and Samanalawewa⁷ etc. have helped in clearing the doubts as to whether the metal used in making objects in ancient Sri Lanka or the objects themselves were imported to Sri Lanka in ancient times, and established the fact that smelting and casting were done in different parts of the country itself. It is also a fact that a lucrative import - export trade with countries such as Arabia, Rome and far eastern countries which operated through the famous silk route was a major factor responsible for the fairly extensive use of gold in the Island.

The ingot was first examined microscopically to determine any surface cut marks or any indication of corrosion products such as patina formation to see whether impurities such as Copper is present. Microscopic examination did not reveal any patina formation nor any plated appearance except letters inscribed and few crack marks and a small pit.

This was next examined by x-ray radiography using a portable x-ray radiograph. The x-ray photographs indicated no internal pits or pores except small crack mark and air bubbles indicating molten metal would have been poured to a mould after which the solidified ingot would have been taken out. In order to determine the gold content of the lump it was decided to measure the specific gravity of the lump (as x-ray photographs indicate no pores) by the well known method of Archimedes. Special attention was paid to avoid any air bubbles adhering to the object when weighed in water.

Result was as follows :-

Weight of the lump	—	438.10 gms
loss in weight in water	—	26.10 gms
(neglecting the weight of the light string)		
specific gravity of lump	—	16.7854

When compared to S.G. of 100% pure gold which is 19.32 it indicates the object is an alloy of one or several metals. The specific gravity of the ingot when compared with the table (available at the Govt. Analyst Department) S.G. Vs percentage weight of gold gave a value of 86.4736% of gold. Alloying metals considered in the table were silver, copper and platinum which is used in gold manufacture in modern times. As the object is heavy it is suspected to be alloyed with lead. Hence a new calculation is needed to determine the percentage of the weight of the gold. The percentage of gold was calculated by the following relationship and lead being the only other constituent was found by difference. The error percentage of the method is about 1%⁸

$$\% \text{ gold} = \frac{D_a \cdot D_x - D_a \cdot D_d}{D_a \cdot D_x - D_b \cdot D_x} = 100$$

Where D_a is the specific gravity of pure gold (19.32)

D_b is the specific gravity of pure lead (11.35)

D_x is the specific gravity of the lump (16.78)

Using the above method the percentage of gold is

$$\% \text{ of Gold} = \frac{19.32 \times 16.7854 - 19.32 \times 11.35}{19.32 \times 16.7854 - 11.35 \times 16.7854} = 78.496$$

Since the exact composition of the metals is not determined, (at least qualitative identification) it is important to get the Average Value of the 2 methods which is 82.484% Au (gold) or in crt 19.7963 20 crt.

We can therefore say that the object is made of 20 crt gold.

Further examination should be carried out in order to get the accurate gold content using either (1) x-ray florescence spectroscopy or (2) Neutron activation analysis.⁹

As this object was found, near the metal smelting furnaces, this ingot would have been used in gold plating of statues and other objects made in the site. It is also possible that this could have been used in the preparation of Ayurvedic medicine. All these could be determined by analysing the trace elements of the gold present in the objects found during excavation and the trace elements of the artifacts found. The addition of another metal may be intentional, perhaps to make the cast objects stronger and also to make castin geasier.

References :

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6. Seneviratne, Sudharshan 'The locational significance of early Iron Age sites in intermediary transitional eco-systems: a preliminary survey study of the Upper Kala Oya region, North-Central Sri Lanka', in the *Settlement Archaeology of the Sigiriya-Dambulla Region* (Editors: Senake Bandaranayake, Mat Mogren, Seneviratne Epiawatta, (Colombo, 1990), pp. 121-141.
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9. Please note that these examinations were done very briefly and a detailed examination will be carried out in the future.