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Geological Significance of Artefacts in Sri Lanka: Evidence From the Abhayagiri Vihara, Anuradhapura

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Introduction

The Abhayagiri Vihara Complex is situated about 85 metres above mean sea level to northward from the ancient city of Anuradhapura. The complex site extends about for 200 hectares and the terrain is generally flat to slightly undulating. Bedrock consists of rocks of the Wanni Complex and outcrops as ridges and turtlebacks. The superficial deposits of the depressions are alluvial and gravel, sometimes interbedded with cultural layers. The Abayagiri Vihara was established by the King Vattagamini Abhaya (103 BC and 89 -77 BC). Towards the 7th century AD, this Vihara had developed as a national and international centre consisting of four Mulas (faculties), namely, Uttara Mula, Vahadu Mula, Kapara Mula and Mahanetpa Mula, with branches established in South and Southeast Asia.

Archaeological explorations in this region began in the 19th century and continue up to today. S.B. Burrows made some valuable investigations at this site and conserved a stone gatehouse, now known as 'Burrows' Pavilion'. The results of his findings were published in 1886. In 1894, J.G. Smither prepared several excellent drawings of some of the monuments in the Abhayagiri Vihara Complex and its surroundings. H.C.P. Bell, E.P. Ayrton, A.H. Longhurst, S. Paranavitana and C.E. Godakumbura carried out different types of investigations of this Vihara Complex from 1890 onward. They brought to light evidence of buildings, different kinds of artefacts made of and carved from stones, metals, clay and sand. This paper records and seeks to make preliminary observations regarding the geological significance of these artifacts made during the period November 1991 to December 1994. The secondary data were collected from the unpublished recent reports compiled by the Abhayagiri Vihara Project.

Observations :

Stone objects

During the last fifteen years, a large number of artefacts have been collected from extensive excavations at the Abhayagiri Vihara Complex. The materials of all artefacts are geologic material mainly rocks, metals, precious and semi precious stones, clay and sand, which were the main materials used in making buildings, utensils, vessels, instruments and ornaments. The results are shown in Table 1.

An examination of the artefacts makes it clear that rocks of Precambrian to Quaternary age as well as different kinds of materials have been used in their manufacture. According to Cooray (1994), the Precambrian rocks of Sri Lanka are divided into several units, namely, the Highland Complex (metasediments and charnockitic gneisses), the Vijayan Complex (gneisses, migmatites and granitoid rocks; the Wanni Complex (gneisses, migmatites, granitoids and charnokitic gneisses); and the Kadugannawa Complex (mainly amphibolitic rocks). Beside these, the Tonigala and other granites are subordinate but important rocks in the Precambrian units.

The Highland Complex consists mainly of granulite facies rocks characterized by even sized, interlocking granular minerals developed under high grade metamorphic conditions; they extend from the southwest to the northeast across the Central Hill Country. Amphibolite facies rocks of the Vijayan and Wanni Complexes occur on either side of the Central Highland Complex belt. Hence, 9/10 of Sri Lanka is made up of these very hard crystalline rocks which form an ancient, stable part of the earth's crust known as Indian Plate. Later Jurassic, Miocene, Pleistocene and Holocene sedimentary deposits rest on the Precambrian rocks.

The rock carvings of moonstones, stone pillars and columns (Figure 01), foot prints, chattra (umbrella) and urinal stone (Figure 02), balustrades and different kinds of guardstones (Figure 3) reveal the skill and proficiency in selecting suitable rocks by the stone masons. For these constructions and makings, stone masons often selected pinkish to reddish granite and granitic gneisses containing a high percentage of SiO2 and Al_2O_3 from the Wanni Complex that occupies the greater part of the Anuradhapura, Kurunegala and Puttalam districts. These rocks, with their high proportion of the resistant mineral quartz, lack of regular joints and fractures, and their medium grained texture are extremely durable and strong (Cooray, 1984).

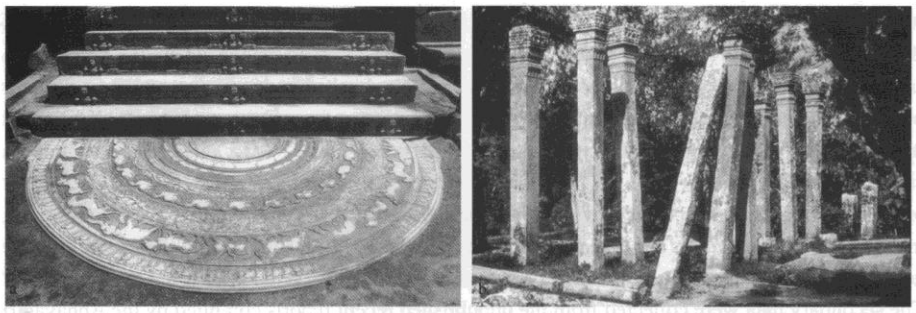
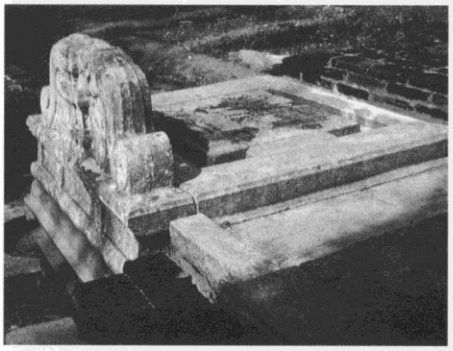


Figure 01: Moonstone (a) and ornamental friezes (b) made out of Tonigala granite at Abhayagiri Vihara Complex (CulturalTriangle of Sri Lanka, CCF, 1993).

Tonigala granite, which is pink to reddish, was also used for these purposes. The stone masons never selected biotite and hornblende biotite gneisses for carvings, grinding stones , rock entrance (Figure 4), Bat Oruwa (Figure 5), vahalkada carvings (Figure 6) and other fine stone work. In the Abhayagiri Vihara Complex pickaxe and hammer could not be used for proper carving of biotite and hornblende-biotite gneissic rocks because of their lack of a uniform texture. Furthermore, such rocks decay easily. However, dolomitic and calcitic marbles were commonly used to make the Buddha images, asanagara and guardstones, balustrades and pillars (Table 1). These rocks were sometimes obtained from marble bands along the foothills of the Dambulla, Matale and Kurunegala areas.



a

b

Figure 02. Urinal stone made out of granitic gneiss (a) and seated Buddha made out of marble (b) at Abhayagiri Vihara Complex (Cultural Triangle of Sri Lanka, CCF, 1993).

Figure 03. Fine sculptures of Nagaraja guardstones made out of granitic gneiss at Abhayagiri Vihara Complex (Cultural Triangle of Sri Lanka, CCF, 1993).

Clay objects

Pottery is a main artefact at the Abhayagiri Vihara Complex. The shapes are varied and can be categorized into several classes. These include fine wares, for example fine polished ware, fine creamy ware (small cups), and small bowls and their lids; medium wares (small bowls, cups, and lamps); wheel turned wares and crude wares (large coarse ware vessels). The pieces of fine ware and glazed pottery show that the materials used in making these objects are montmorillonitic clay and fine sand. The material of the medium ware is similar to that of the materials of the fine ware, but the large coarse ware vessels have been made from fine to coarse sand with montmorillonitic clay. The porous nature of the pottery indicates that the organic matter had been decayed or burnt during the burning process.

The tiles can be divided into two main groups: glazed and plain tiles. The glazed tiles are of different colours and highly damaged. They are made from montmorillonitic clay with fine sand. The colour of the plain tiles is also variable (pinkish brown and very light yellow to dark red), and they are also made of similar materials.

Bricks are also of two types: plain bricks and ornamental bricks. The dimension of the plain bricks is variable. Lengths vary from 22 cm to 44 cm, widths vary from 18 cm to 25 cm, and thicknesses vary from 5 cm to 14 cm. Some bricks are burnt and some are unburnt. The rectangular type ornamental bricks are quite different from the plain bricks. Lengths vary from 98 mm to 106 mm, widths vary from 64 mm to 113 mm and thicknesses vary from 38 to 50 mm. The bricks have been made from clay, clay with fine sand and clay with coarse sand, including quartz pebbles; ornamental bricks are generally of clay with fine sand. The clay of the bricks has a high proportion of iron mineral and a low refractoriness.

Figure 04: Entrance of the residence of chief monk made out of granitic gneiss at Abhayagiri Vihara Complex (Cultural Triangle of Sri Lanka, CCF, 1993).

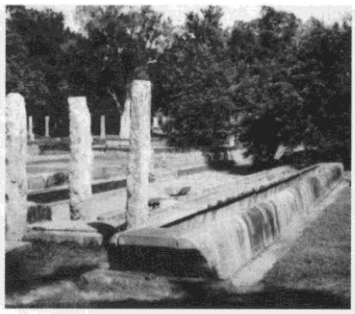


Figure 05: Bat Oruwa made out of granitic gneiss at Abhayagiri Vihara Complex

Figure 06: Vahalkada carvings out of granitic gneiss at Abhayagiri Vihara Complex

Clay discs and clay balls are the other artefacts among the clay objects. Some discs which may have been used either as token of some kinds of coins (Wickramagamage 1984) are mainly from clay or clay with fine sand. A large collection of balls of terracotta are found, with diameters varying from 1.5 to 2.6 cm; they made of clay which contained a high proportion of iron minerals.

Beads

The beads are of different dimensions and of different materials, e.g. synthetic paste, terracotta and semi precious stones (agate, etc..). The materials of several fragments of bangles, vessels and bowls are mainly glass. The glaze used for glazing of tiles, pottery, walls and pillars was a mixture of corals, shells and marble, sometimes with gypsum as well.

Metalic objects

Among the metallic objects are different coins mostly of copper, and sometimes of silver and gold. There are also nails, with or without head, splinters and chisels made of copper and iron. Iron has been produced locally, probably using the nodular masses of limonitic ironstone found on the surface in the Dry Zone. Gold plated copper hooks, brass ornaments and copper bowls are valuable artefacts, which were found at the excavation site.

Other materials

Pieces of mica, charcoal fragments, human and animal bones have also been found at the sites. The fragments of coral, particularly Acropora and Goniestrae spp. and shells (Carditidea and Cypracidae families) from old mortar indicate that such materials have been used as a plaster and to make paste, mortar or as glazing materials.

The present excavation of the stone paved terrace (salapatala maluva) at the Abhayagiri Stupa has brought to light a layer which contains quartz gravels and different kinds of garnet, spinel, tourmaline and amethyst. Transparent fragments of garnet and amethyst are found with quartz gravels. These points to the fact that gem mining had been undertaken in the time of the ancient Sinhalese kings along the valley of the Malwatu Oya.

Excavations during the last ten years and six months have brought to light a large number of different kinds of artefacts at the Abhayagi Vihara Complex. The skill in mainly geometrical forms, and the

Artefact	Materials	Texture	Remarks
Pottery (glazed)	Clay, clay with fine sand	Fine-grained to medium-grained; feel smooth and silky	No organic matter or ash; well compacted
Tiles	Clay	Smooth and fine grained (well compacted	Non-porous
Bricks	Clay, sandy clay and coarse sand	Fine to gritty Fine-grained to	Well compacted
Disks	Clay, clay with fine sand	medium-grained. Feels smooth and silky Smooth	No organic matter or ash; well compacted
	Clay with fine sand	Smooth and silky	Well compacted
Balls of terracotta	Clay		No organic matter or
Crucible		Fine-grained to	ash; well compacted
Pinnacles	Clay, granitic rocks	medium-grained; granular objects	No organic matter in clay
Spouts	Clay, clay with fine sand	Fine-grained to coarse-grained; feels smooth to gritty Smooth and fine	No organic matter, non porous; well compacted
	Kaolinite (from weathered feldspar)	Smooth and fine	Local and foreign
Ceramics	Synthetic paste; silty clay; carnelian	Rough	Local and foreignbeads are found
Beads	Iron ore		iron ore for this objects purpose sometimes obtained
Iron objects		-	from local deposits.
	copper	-	-
	gold	-	-
	-	-	-
Copper objects	-	-	-
Gold ornaments	Coral (*Acropora* spp.,		-
Bones	*Goniestrea* spp.);		
Charcoal	mollusks (*Carditidea* &		
Plaster, paste and	*Cypracidea* family	granular	
glaze etc.	Granitic rocks	-	-
	Dolomitic marbleCalcitic marble	granular	-
Gringing stones	Granitic rocks and		-
Statuesand	dolomitic marble	granular	
asanagara	granitic rocks	granular	-
	granitic rocks	granular	-
Pillars and doors	Dolomitic marble and granitic rocks		-

Table 1. Materials Used for Artefacts of the Abhayagiri Vihara Complex

accuracy of the carvings and fittings of any rock artefacts, technology and quality of the pottery, tiles and bricks of the Abhayagiri Vihara Complex are of far superior quality to the objects what we have and used today. Due to lack of radiometric dating laboratories and professionals in this field, it is not possible to clearly state the exact date of the objects and associated strata. This may be an obstacle to the study of the evolution of the Complex.

Conclusions

Archaeological explorations have brought to light evidence of buildings, artefacts and other objects made from and carved out of different kind of Precambrian rocks and minerals as well as Quaternary deposits. The skill in making geometrical forms, the accuracy of the carvings and the fittings of those artefacts far superior to the objects what we have today. Although, lack of radiometric dating of the artifacts is an obstacle to the study of the evolution of the Abhayagiri Vihara Complex, the far superior buildings, artefacts and different objects have national and global values.

Acknowledgement

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References

Archaeological Excavation and Documentation (unpublished reports). From 2nd report (1981 July December) to 20th report (1991 July December).

Cooray, P.G. 1984 *An introduction to the Geology of Sri Lanka*. National Museum Department, Colombo.

..... 1994 "The Precambrian of Sri Lanka: a historical review" *Precambrian Research,* 66,3-18.

Wickramagamage, C. 1983 *Abhayagiri Vihara Project First Report of the Archaeological Excavations at the Abhayagiri Vihara Complex* (September 1981, April 1982). Central Cultural Fund, Ministry of Cultural Affairs, Sri Lanka.