
Vadnagar Through Children's Eyes: A Case Study of Terracotta Toy Wheels

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Abstract: Children bring delight to every family and society, ancient or contemporary. They symbolize the innocence and moral goodness of any society regardless of its decade of existence. However, the archeological evidence of children in ancient culture is hardly apparent, except for the existence of toys. Toys are crucial artefacts discovered during archaeological excavations, providing unequivocal evidence of the coexistence of children and adults. Toys found in excavations are significant in many ways; they showcase the artistry, the technology, the time taken to build such miniature objects. One of the prevalent type of toys found in of most excavations are the toy wheels. Wheels are the most significant accomplishments of humans through history. The utilization of wheeled transportation facilitated the quick expansion and the establishment of extensive cultural connections. Toy wheels have been found in nearly all excavated sites, regardless of whether they date back to the Harappan period or the early historic period. And similar to all technological progressions, the wheels have also undergone several stages of development. Through the terracotta toy wheels found from the Vadnagar excavation, to trace the evolutionary progression of wheels across the seven cultural periods of the thriving town.

Keywords: Toy Wheels, Terracotta, Stone, Potsherds, Animal Figurines, Vadnagar, Cultural Periods

Introduction

Artefacts contain symbolic, communicative and social aspects of a community. They can fulfill numerous symbolic roles and facilitate a wide range of interpretations. However, meanings are not embedded in the artefacts rather is assigned or attributed by individuals in specific cultural contexts. Though children represent roughly half of the most human society, their actions, performances and existences are frequently ignored in archaeological studies. In the facets of artefacts relevant to children, toys especially are imbued with the meanings that depend on their social context. Children are very important part of the society, as they influence and shape the lives and relationship of everyone they come in contact with. However, toys serve as an important bonding mechanism between adults and children, as toys mimic elder's actions without real world consequences. (Baxter 2005).

Archaeological excavations often provide a limited number of toys, primarily consisting of anthropomorphic and animal figurines, rattles, toy carts, and wheeled toys. Gonul (2021) states that children's imagination is sometimes the source of toy production, as they create toys inspired by objects. For example, the toy carts used during that time were replicas of the carts utilized by grown-ups. Typically, carts are commonly pulled by a pair of horses, mules, or bulls positioned in the front. Nevertheless, this present study will focus on the toy wheels that were uncovered during the excavations undertaken at Vadnagar during the field season of 2019-2022. Wheels have consistently held significant importance as an invention throughout multiple cultures throughout history. As communities transitioned to a sedentary lifestyle, the invention of wheels proved to be immensely beneficial for transferring materials between different locations.

Archaeological evidence suggests that the earliest recorded use of the wheel is depicted on a limestone relief in Mesopotamia. This relief indicates the utilization of a cart that dates back to 3500 BCE (Cheesman, 1969). The first recording of wheel usage was in the shape of a porter's wheel. Later on, more evidence was discovered that supports the fact that wheeled vehicles were used for transportation in South Turkmenistan. This evidence dates back to the mid-4th millennium BCE (Kenoyer, 2004). The absence of evidence for carts or chariots in archaeological investigations before the finding at Sinauli is likely attributed to the fact that these materials are perishable in nature. However, their portrayals can be traced by analyzing the widespread toy wheels that have been found in many locations.

The ancient sites in Indian subcontinent, including Dholavira, Mohenjo-daro, and Harappa, reveal a diverse range of toy wheels. These include disc-shaped wheels, plano-convex wheels, and biconvex wheels with both single and double hubs, all of which have been uncovered from ancient deposits. Findings have indicated the presence of attempts to develop wheels with hubs at these Indus Valley sites. Various types of wheels have been discovered at different archaeological sites in the ancient Indus Valley civilization. Discoidal wheels have been found at Kara-Depe and Altyn-Depe sites dating back to 3200/3100 BCE and 2800/2700 BCE, respectively (Kenoyer, 2004). Additionally, wheel with hub on single side, plano-convex shape has been recorded at Harappan levels, such as at Kot-Diji dating to 2600-1900 BCE. Furthermore, wheels with short truncated conical hubs at one end of the perforation and flat on the other side have been documented at sites like Shortughai in Afghanistan (Francfort, 1989), Chanudaro (Mackay, 1943), Nausharo in Baluchistan, and Lothal in Gujarat. Some sites, like Chanhudaro in Sindh, have reported toy wheels in flat, disc, plano-convex, and biconvex shapes (Sankalia, 1958 and Brown, 1943).

From the early historic cultural deposits, biconvex shaped wheels have been recorded from Navdatoli, indicating a transitional intermediate stage between wheels with hubs on only single side or both sides. Through the examination of these wheels from Navdatoli excavation has shown the progression of wheel design from wheel with hub on single side to biconvex wheel and finally to wheels with hubs on both sides has been

observed (Sankalia, 1958). The examination of the evolution of the wheels reveals that disc shaped wheel was the initial attempt. Subsequently, the wheel with hubs on both sides was developed. This type of wheels offers the benefit of reversible fitting, with the hubs providing less area for friction between the wheel and the body of the vehicle (Sankalia, 1958). In the pursuit to attain the perfect wheel, there have been multiple intermediate stages involving flat wheels with no raised hub discovered from the sites Lothal, Kuntasi and ChanuDaró.

Wheels from Vadnagar

Vadnagar (23° 47' N, 72° 38' N') is an ancient town situated in the Mehasana district of Gujarat. The recent excavations have unveiled evidence of the town's uninterrupted habitation over a period of 2750 years (Sarkar et.al, 2023). The presently inhabited settlement is located atop a 20–25 meter deposit of an archaeological mound. The majority of the town is surrounded by a fortification which has been built and maintained by successive periods throughout different eras.

The Archaeological Survey of India, Excavation Branch V, Vadodara, has undertaken the present excavations in Vadnagar since 2016. The excavations were carried out in the field seasons from 2016 to 2019, and subsequently from 2019 to 2022. The excavations were carried out in various localities inside and around the town, including Locality A, B, C, and D, Valmiya no Mahad, Brahman Sheri, Ambaghat, ESL (Eastern bank of Sharmistha Lake), and the South-western bank of Kotha Ambaji lake. The 25 m archaeologically rich deposit of Vadnagar has been classified in seven different cultural periods based on structures, ceramic assemblage as well as the cultural material, dated from pre 2nd century BCE till 18th/19th century CE. They are as follows-

- Period I (pre 2nd century BCE; pre-Rampart period)
- Period II (2nd century BCE to 1st century CE; Rampart period)
- Period III (1st century CE to 4th century CE; Kshatrpa period)
- Period IV (5th century CE to 9th/10th century CE; post-Kshatrpa period)
- Period V (10th century CE to 13th century CE; Solanki period)
- Period VI (14th century CE to 17th century CE; Sultanate – Mughal period) and
- Period VII (18th/ 19th century CE; Gaekwad/British period)

The archaeological excavations conducted during the field season of 2019-2022 at Vadnagar have documented a total of 157 toy wheels. There are four toy wheels made of stone and a total of 153 terracotta wheels have been reported. The analysis and typological classification of the entire collection of wheels have been undertaken by analyzing the shapes and positions of hubs with perforations for the axle. Figure 1 illustrates the classification of wheels.

Classification of TC Wheels

The entire collection of toy wheels has been usually grouped based on the shape of the wheel. Consequently, the toy wheels have been classified into four distinct groups:

- Disc shaped toy wheel
- Plano-convex toy wheel
- Biconvex toy wheel
- Wheels dressed out of potsherds

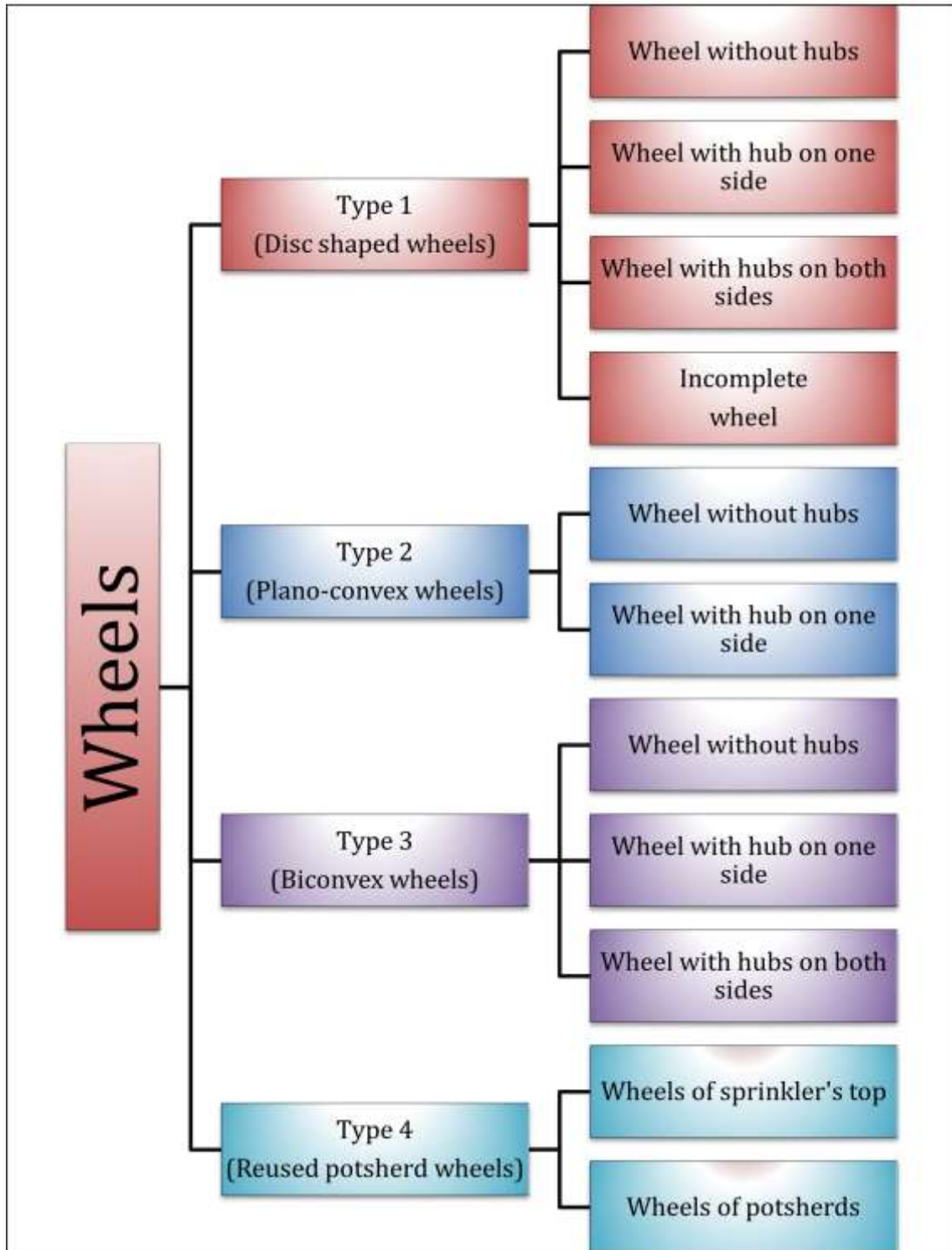


Figure 1: Typology of the wheels found from the excavations at Vadnagar 2019-2022

Table 1: Distribution of the types of toy wheels with respect to cultural periods of Vadnagar

Wheel Types	Period								Total
	II	IIIA	IIIB	IVA	IVB	V	VI	VII	
Type 1		2	1	6	7	29	18	3	66
Type 2		3		1	4	13	13	3	37
Type 3	2	4	6	10	2	13	5	1	43
Type 4				2	3	4	2		11
Total	2	9	7	19	16	59	38	7	157

Disc Shaped Toy Wheel

The disc shaped toy wheels have cross section of disc shape with perforation and flat end. The material used to prepare type 1 wheels are terracotta, potsherds and stone as well. The type 1 toy wheels have been reported from early Kshatrpa period (period IIIA) down to the Gaekwad period (period VII) (Figures 2 and 3, Table 2).

- a. **Wheel without hubs:** The wheels in this type 1 category lack hubs on both sides of the perforation. There are a total of 58 reported specimens of wheels. Out of them, 40 are produced from reused potsherd, 14 are produced from terracotta, and 4 are made using stone. However, wheels without hubs have been reported from early Kshatrpa period (period IIIA) down to the Gaekwad period (period VII).
- b. **Wheel with hub on one side:** This type 1 category of wheel features a hub located at one side of the perforation in the center. There is only one specimen that has been classified under this category. It is made of terracotta and was uncovered from the Solanki period (period V).
- c. **Wheel with hubs on both sides:** This type 1 category of wheel with hubs on both sides of the perforation for the axle. There are two specimens that have been classified and both of them have been documented from the Solanki period (period V).
- d. **Unfinished wheels/Incomplete wheels:** Within the type 1-wheel category, there is a particular type that does not have a perforation in the center of the wheel. The disc-shaped artefacts exhibit faint evidence of pecking marks located at the center of the disc/wheel. There have been reports of 5 partially formed wheel-like objects from the late Kshatrpa period (period IIIB), early post- Kshatrpa period (period IVA), and late post- Kshatrpa period (period IVB).

All four varieties have been classified based on their respective cultural periods and are displayed in Table 2.

Plano-convex Toy Wheels

The toy wheels in the type 2 category feature a plano-convex cross-section. There are a total of 37 specimens that have been classified. The specimens have been reported from the early Kshatrpa period (period IIIA) down to the Gaekwad period (period VII). The

categorization of type 2 wheels (plano-convex section) is analyzed in the cultural periods of Vadnagar illustrated in the Table 3 (Fig 4, 5 and 6)



Figure 2: Type 1 toy wheels- Disc shaped- Wheel without hubs: Sl. no. 1-7, 12, 13, 15-26; Wheel with hub on one side: Sl. no. 8; Wheel with hubs on both sides: Sl. no. 9, 14; Incomplete wheels: Sl. no. 10, 11

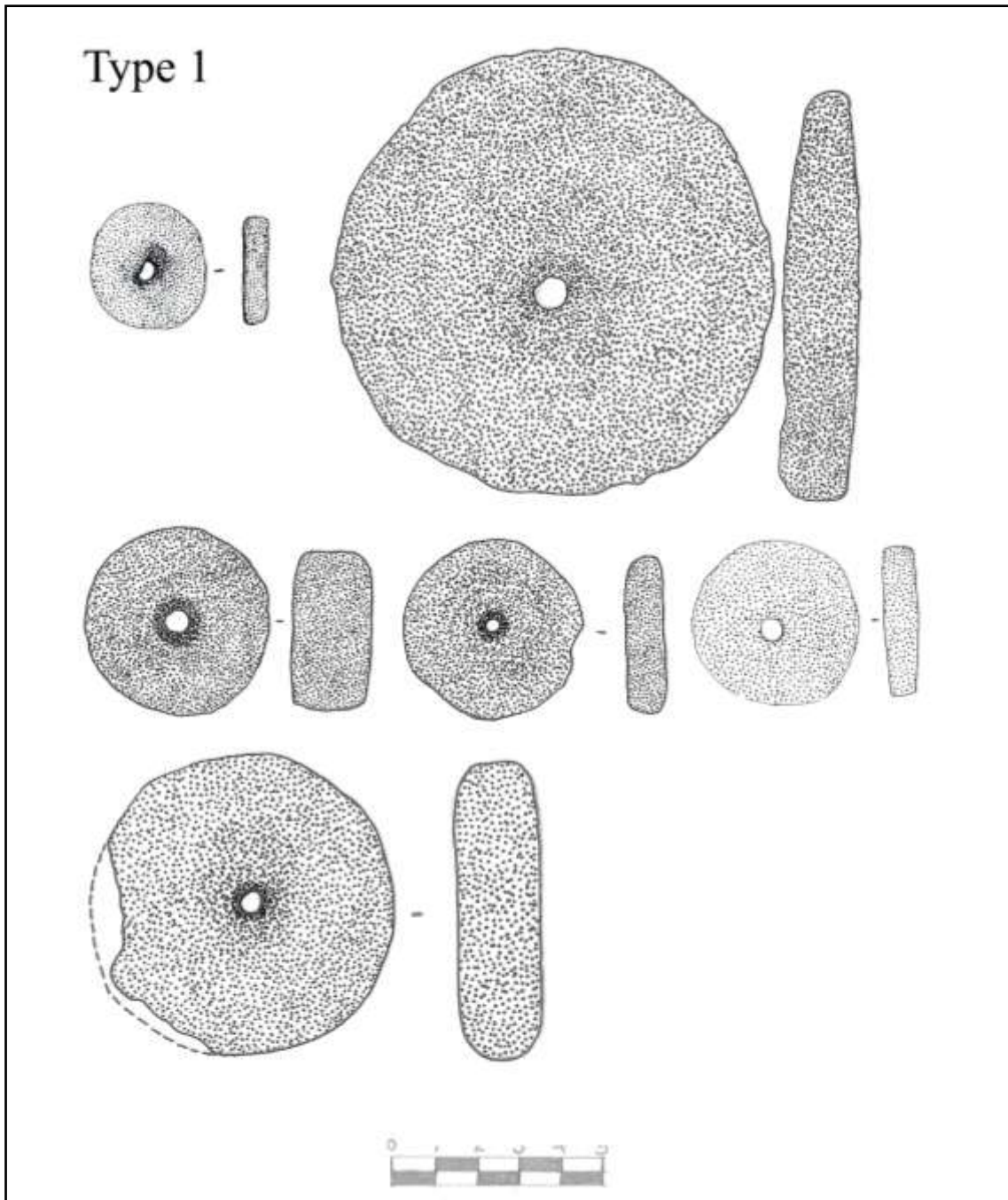


Figure 3: Type 1 toy wheels- Disc shaped- Wheel without hubs: Sl. no. 18, 21, 24, 17, 26

1. **Wheel without hubs:** The subcategory under type 2 consists of five specimens that lack a hub at the side of the perforation. The specimens have been documented from the early post-Kshatrappa period (period IVA) to the Solanki period (period V).
2. **Wheel with hub on one side:** There are 32 specimens in the subcategory of type 2 toy wheels. All of the specimens possess a hub on one side of the perforation. The findings extend from the early Kshatrappa period (period IIIA) to the Gaekwad period (period VII).

Table 2: Distribution of the sub categories of type 1 wheels (Disc shaped wheels) with respect to the cultural periods of Vadnagar

Type 1 Wheels	Period							Total	
	II	IIIA	IIIB	IVA	IVB	V	VI		VII
Wheel without hubs		2		5	4	26	18	3	58
Wheel with hub on one side						1			1
Wheel with hubs on both sides						2			2
Incomplete			1	1	3				5
Total		2	1	6	7	29	18	3	66

Table 3: Distribution of the sub categories of type 2 wheels (Plano-convex shaped wheels) with respect to the cultural periods of Vadnagar

Type 2 Wheels	Period							Total	
	II	IIIA	IIIB	IVA	IVB	V	VI		VII
Wheel without hubs				1	3	1			5
Wheel with hub on one side		3			1	12	13	3	32
Total		3		1	4	13	13	3	37

Biconvex Toy Wheels

The type 3 category of toy wheels consists of 43 examples that have a biconvex cross section. This group of wheels has been unearthed dating back to the Rampart period (period II) and continuing to the Gaekwad period (period VII). The categorization of type 3 wheels (Biconvex section) is analyzed in the cultural periods of Vadnagar illustrated in the Table (Figures 7 - 9).

1. **Wheel without hubs:** Within the type 3 toy wheels subcategory, there have been 22 reports of specimens without hubs at the perforation. The toy wheels have been unearthed in the cultural deposits spanning from the Rampart period (period II) to the Gaekwad period (period VII).
2. **Wheel with hub on one side:** Only one terracotta specimen from the Sultanate-Mughal period (period VI) has been found in this specific subcategory of type 3 toy wheels.
3. **Wheel with hubs on both sides:** This specific subcategory of type 3 toy wheels comprises a total of 20 specimens of wheels that were found in the cultural deposit. These wheels date back to the early Kshatrapa period (period IIIA) and continue until the Sultanate-Mughal period (period VI).



Figure 4: Type 2 toy wheels- Plano-convex shaped (Obverse)- Wheel without hubs: Sl. no. 30-32, Wheel with hub on one side: Sl. no. 27-29, 33-41



Figure 5: Type 2 toy wheels- Plano-convex shaped (Reverse)

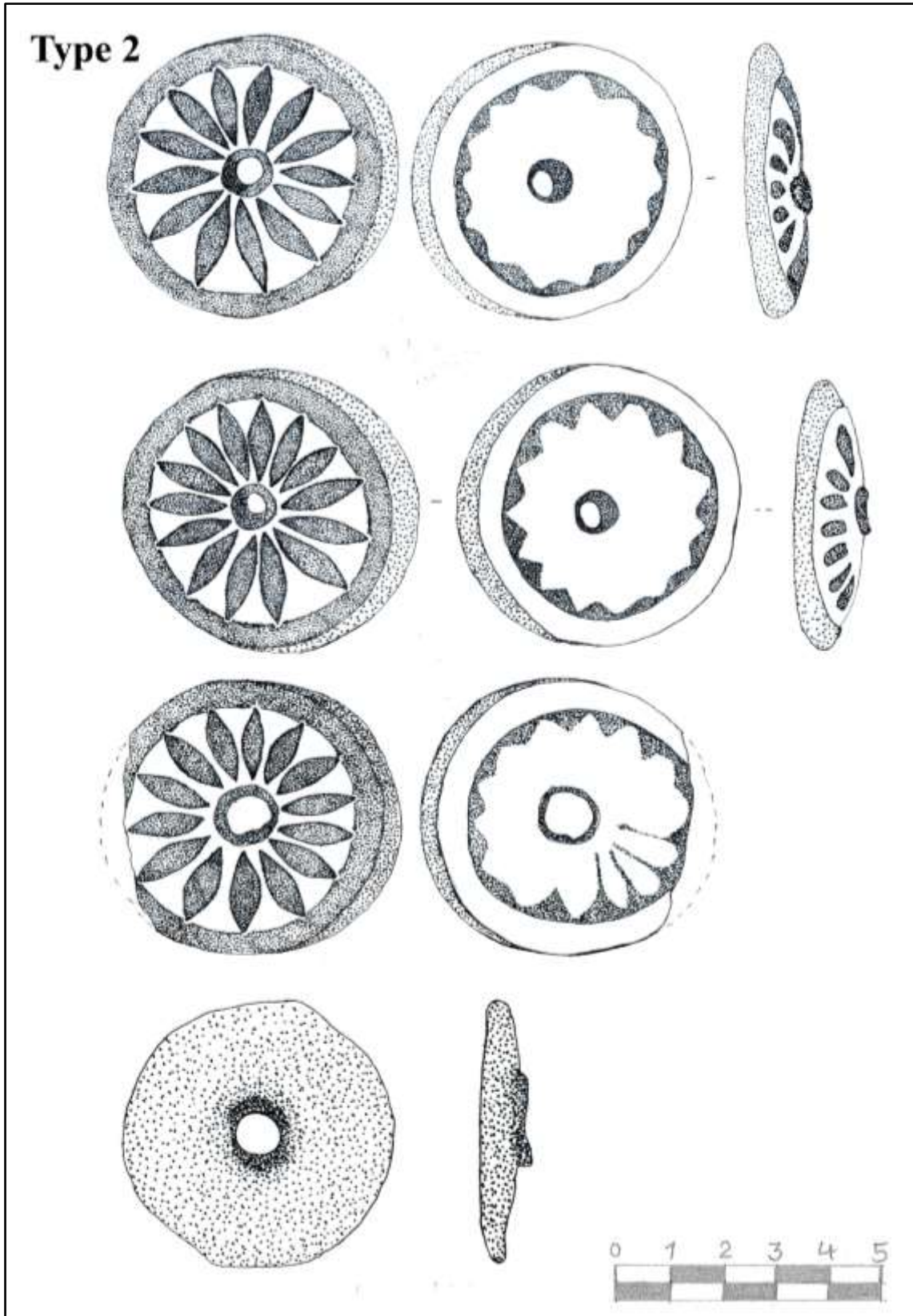


Figure 6: Type 2 toy wheels- Plano-convex shaped (Obverse and reverse)- Wheel with hub on one side: Sl. no. 27-29, 36



Figure 7: Type 3 toy wheels- Biconvex shaped- Wheel without hubs: Sl. no. 42, 43, 46, 47, 50, 53, 54, 57, 58, 59; Wheel with hub on one side: Sl. no. 56 and Wheel with hubs on both sides: Sl. no. 44, 45, 48, 49, 51, 52, 55.

Table 4: Distribution of the sub categories of type 3 wheels (Biconvex shaped wheels) with respect to the cultural periods of Vadnagar

Type 3 Wheels	Period							Total	
	II	IIIA	IIIB	IVA	IVB	V	VI VII		
Wheel without hubs	2	1	3	6	1	6	2	1	22
Wheel with hub on one side							1		1
Wheel with hubs on both sides		3	3	4	1	7	2		20
Total	2	4	6	10	2	13	5	1	43

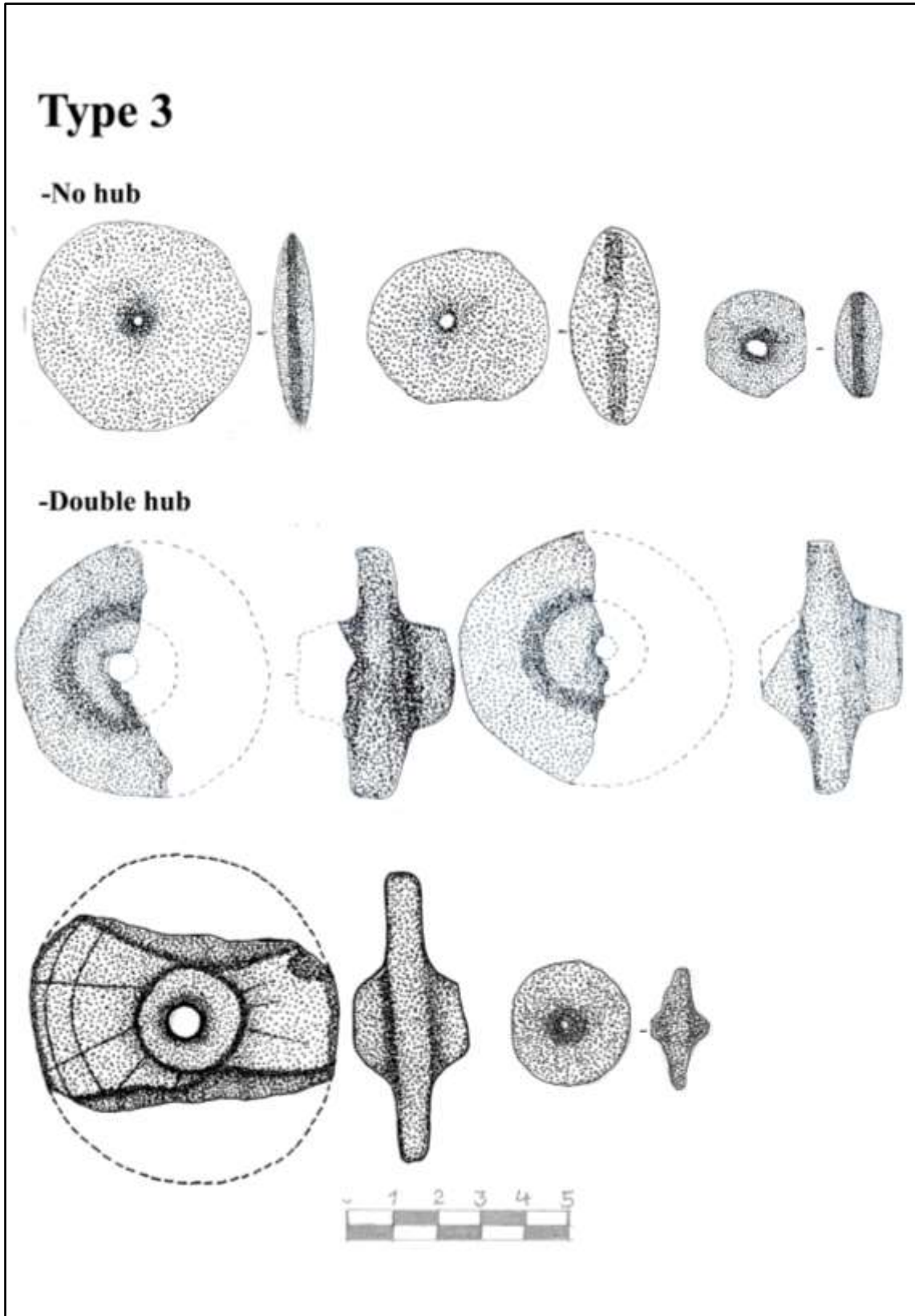


Figure 8: Type 3 toy wheels- Biconvex shaped- Wheel without hubs: Sl. no 46, 43, 47;
Wheel with hubs on both sides: Sl. no. 51, 55, 52



Figure 9: Type 4 toy wheels- Wheels dressed of potsherds: Wheels dressed out of sprinkler's rim: Sl. no. 60-65; Wheels dressed out of potsherds: Sl. no. 66-68

The categorization of type 3 wheels (Bionvex section) is analyzed in the cultural periods of Vadnagar illustrated in the Table 4.

Wheels Dressed Out of Potsherds

The type 4 category of toy wheels consists of 11 specimens that have been dressed out of potsherd. They have been uncovered within the cultural deposit dating from the early

post-Kshtrapa period (period IVA) to the Sultanate-Mughal period (period VI). The distribution of this type has been shown in Table 5 (Figures 9 and 10).

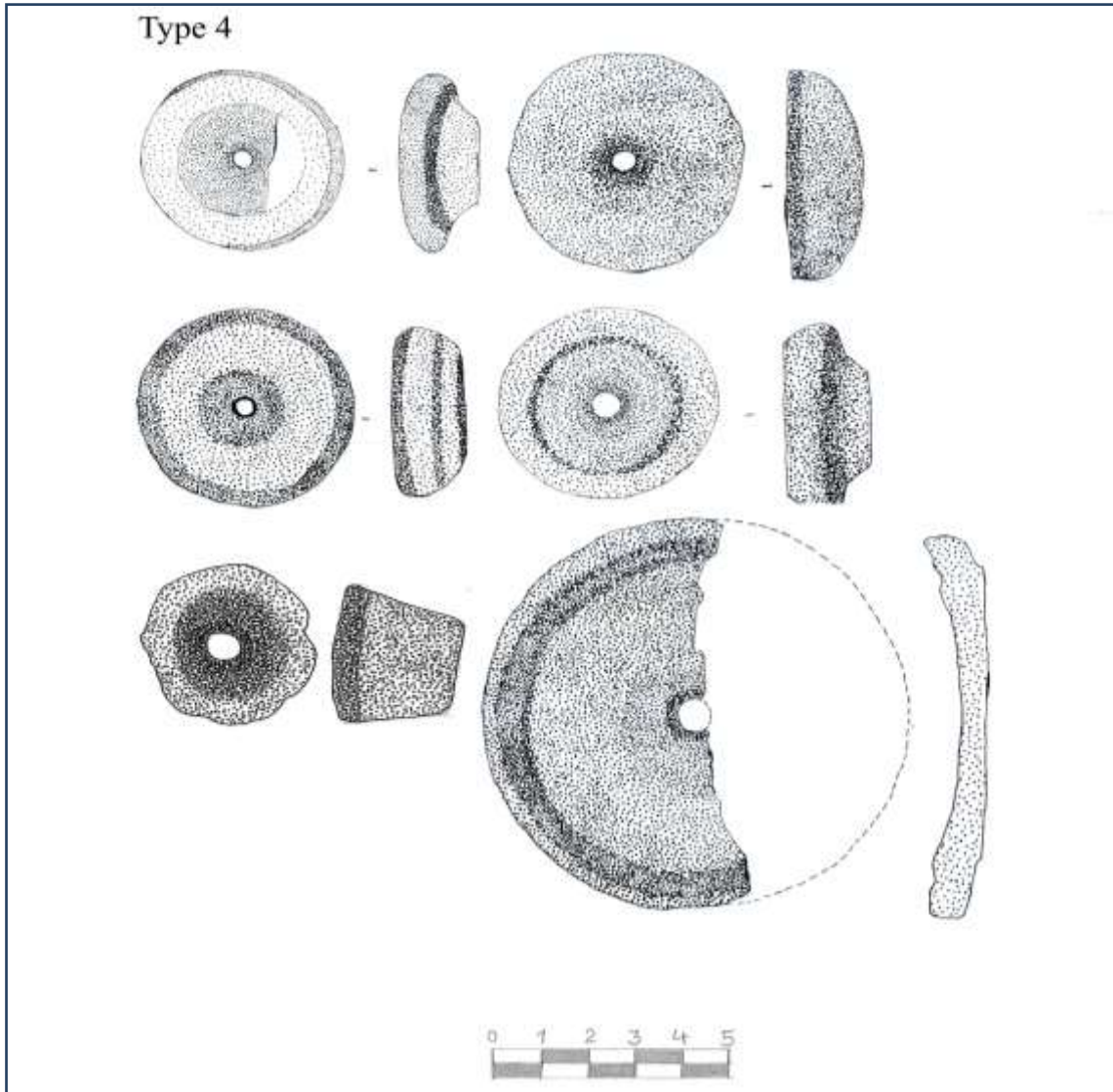


Figure 10: Type 4 toy wheels- Wheels dressed of potsherds: Wheels dressed out of sprinkler's rim: Sl. no. 61-65; Wheels dressed out of potsherds: Sl. no. 66

1. **Wheels dressed out of sprinkler's rim:** The subcategory of type 4 toy wheels is made using the rim of the sprinkler. The upper surface has been ground to produce a flat edge. There are a total of 8 specimens that have been recorded from the cultural periods that span the early post-Kshtrapa period (period IVA) to the Sultanate-Mughal period (period VI).
2. **Wheels dressed out of potsherds:** The subcategory of type 4 toy wheels is made using the body pieces and base of pottery sherds. Three specimens have been documented from the cultural deposits of the Solanki period (period V) and the Sultanate-Mughal period (period VI).

Table 5: Distribution of the sub categories of type 4 wheels (Wheels dressed out of potsherds) with respect to the cultural periods of Vadnagar

Type 4 Wheels	Period							Total
	II	IIIA	IIIB	IVA	IVB	V	VI	
Wheels dressed out of sprinkler's rim				2	3	2	1	8
Wheels dressed out of potsherds						2	1	3
Total				2	3	4	2	11

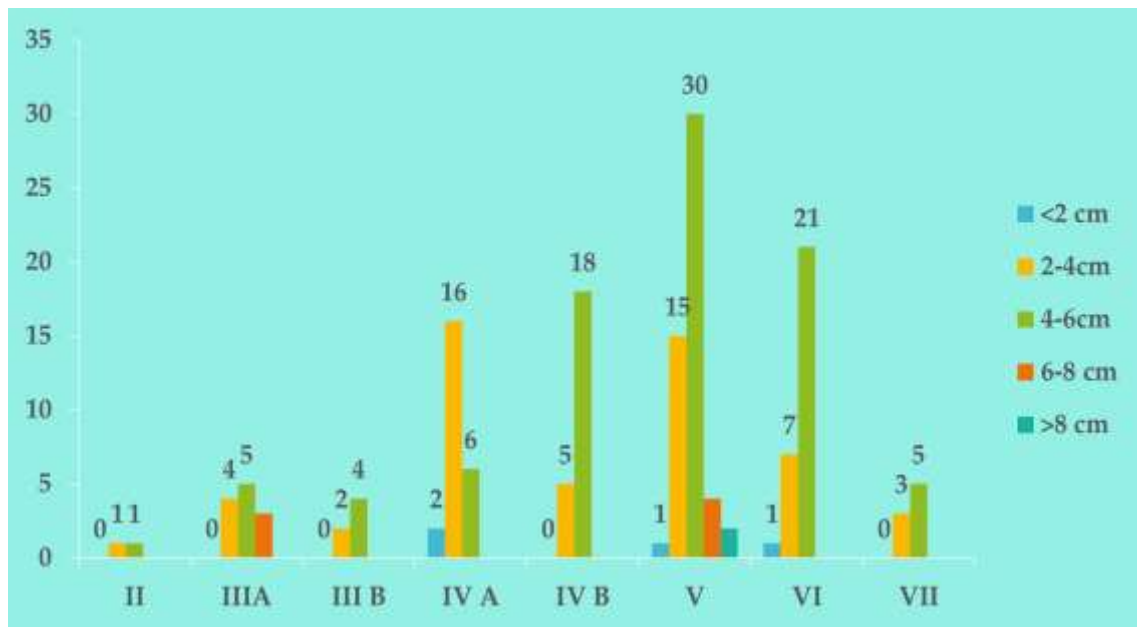


Figure 11: Graphical representation of Diameter ranges of the toy wheels

Discussion and Conclusion

During the excavations at Vadnagar field season 2019-2022, four types of toy wheels made out of stone, terracotta and potsherds have been reported. Among the 157 specimens of toy wheels recorded, majority of the wheels have been observed from the cultural deposit belonging to the Solanki period (period V), i.e. 10th-13th century CE. Interestingly, the biconvex sectioned toy wheel type has been recorded throughout almost all cultural periods, ranging from the Rampart period (period II) to the Gaekwad period (period VII). A remarkable specimen of a toy wheel (see Fig 8, Sl.no. 52) with a biconvex shape and hubs on both sides, featuring radial lines carved on both sides that resemble spokes, has been unearthed from the Solanki period (period V). All the wheels classified as type 3 are made of terracotta, with a few having a red slip on the surface.

The most prevalent variety of toy wheel is the disc-shaped type (type 1), with a total of 66 specimens unearthed in different cultural deposits. This toy wheel has been made using terracotta, stone, and potsherds. Disc-shaped toy wheels dressed out of potsherds have been documented from the early Kshatrpa period (period IIIA) to the Gaekwad

period (period VII). Toy wheels made from stones, on the other hand, have only been noted during the Sultanate-Mughal period (period VI).



Figure 12: Animal figurines- Horse and toy cart fragment

The earliest examples of toy wheels found in Vadnagar are biconvex in shape, crudely made, and do not have a hub (see Figure 8, Sl. Numbers 42 and 43). These wheels date back to the Rampart period (period II). Another intriguing finding regarding toy wheels

involves three specimens of plano-convex shape found from the Ambaghat locality, near the fortification wall (Locus: A1/33/94). These wheels have 14 spokes prepared on the convex side of the specimens and show evidence of similar spokes on the flat side (see Figure 4 and 5, Sl.no. 27, 28 and 29).

Subsequently, a total of 11 specimens of the toy wheels have been dressed out of the body sherds of pottery. The first sub category within comprises eight specimens derived from the rim of the sprinkler. The edges of the sprinkler's top have been grounded to enhance the movement. Additionally, the top already features a perforation at the center, facilitating its transformation into a wheel. The modified wheels from sprinkler's top are found in Red Slipped Ware, Kaolin Ware and Fine Red Slipped Ware. The other sub category under type 4 consists of three specimens that have been prepared from the pottery body part, with one specimen specially dressed out of the base of a bowl (see Fig 9, Sl.no. 67).

Apart from the type 4 category focusing solely on the potsherds modified into wheels, there is also another type of wheels comprising multiple potsherds modified into the shape to facilitate movement. The type 1 wheels have an assemblage of 66 specimens, with 40 prepared after modifying the potsherds. They first appeared during early Kshatrapa period (period IIIA) and significantly prevailing during Solanki period (period V) represented with 25 specimens. The practice of modifying potsherds into disc shapes remained prevalent until the Gaekwad period (Period VII). According to the diameter study conducted on the 157 specimens of toy wheels from the site has revealed that it ranges minimum from 0.5 cm to maximum up to 10 cm. Among them, the most of them fall under the diameter range of 4-6 cm from Solanki period (period V).

Aside from the toy wheels and terracotta bullock cart frame that were found during the excavation, a small number of animal figurines displaying signs of perforations on their legs were also recovered. These perforations suggest that the wheels might have fitted with axles through them. It is believed that the figurines with wheels were likely used by children who dragged them on the ground using a string. Similar specimens of wheel figurines have been reported from other sites such as Daimabad (Singh, 2009). One of the specimens depicts a water buffalo on a platform attached to four solid wheels, while another depicted a man is standing on a two-wheel chariot attached by a long pole to yoked oxen.

A fragment of a terracotta toy bullock cart has been found from the early Kshatrapa period (period IIIA). The frame is equipped with two horizontal and two vertical apertures for fastening the yoke between the animal figure and the cart. The frame, measuring 6.89x4.16x2.31 cm, suggests that it has been utilized as a small cart with wheel axles. Comparable terracotta cart frames have been unearthed at Dholavira (Bisht, 2015). In addition, besides the toy cart frame, a small number of animal figurines from the Solanki period (period V) cultural deposit have been noticed, featuring perforations in their legs. The finding implies that the toy carts might have been utilized in conjunction

with the figurines (see Figure 12). Bisht (2015) suggests that a large number of wheels, animal figurines with perforations, and toy cart frames found at archeological sites show that the younger population was highly engaged in recreational activities.

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