Transitions in the Stone Beadmaking at Khambhat: An Ethnohistorical Survey

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INTRODUCTION

Archaeological, historical, literary, scientific, technological and ethnographic evidence suggests that the present-day state of Gujarat in India has been active in producing stone beads in general, and of carnelian in particular, for the last 5000 years. The most intriguing fact about the Gujarat beads is that neither the style and shape of the beads have changed much in all these years nor the production technique has gone through any drastic makeover. Starting from the early Common Era, one gets reference to the export of carnelian from Bharuch. The base for this craft and trade shifted and got cornered to the city of Cambay in the medieval period and along with this increased the reference to the same. Starting from the 18th century, many scholars have been documenting the ethnographic aspects of this bead industry at Cambay/Khambhat with various objectives. The index work of recording the sources of raw materials as well as the then existing process of beadmaking was initially done by the surgeons/enthusiasts/amateurs having interests in minerals, ethnography and trades. Next, the geologists and economists gave ample references to this cottage industry while documenting the rich mineral resources and economic importance of the area. This was followed by the compilers of various gazetteers who elaborated this ancient craft in their records. With the discovery of Harappan Civilization followed by a series of excavations at sites like Harappa, Mohenjo-daro and Chanhu-daro in
the 1920s and 1930s, which yielded rich evidence of ancient stone beads as well as their production, archaeologists started to study the ethnography of beadmaking in order to interpret the various aspects of Harappan beadmaking. Meanwhile, the work of Horace C. Beck on beads from across the world brought the study of beads to the forefront of archaeological investigations. Eventually, archaeologists started referring to the Cambay bead industry to understand their archaeological finds. A detailed ethnographic recording of the entire cycle of this cottage industry in 1960s as part of the census opened the door for future scientific studies. In the 1980s and 1990s, bead specialists and ethno-archaeologists made landmark contributions on this ancient craft, and one among them took the study of drill impression to its zenith. By revisiting the available literature and observing the present-day beadmaking activities, this chapter attempts to record the transition and shifts that have taken place in various aspects of this ancient craft of Gujarat, such as the source of raw materials, the technology, trade and organization since this craft was reported for the first time. This transition is what anthropology aspires for before the contemporary becomes archaeology.

THE PORT OF CAMBAY

In ancient and medieval times, there were two principal trade routes in India that captured all the trade activities to foreign countries such as Persia, Arabia, Safala and China. One of these was through the ports of Gujarat on the western coast and the other through the ports of Bengal on the eastern coast. On the western coast, various places came into prominence as centres of trade and commerce at different periods of time depending on their importance as sea ports. While Bharuch was initially an important port, it was later replaced by Vallabhi and yet at a later stage, the importance was shifted to Surat or Cambay.

The port of Cambay is situated at the head of the gulf, known as the Gulf of Cambay. Various foreign travellers, geographers and merchants have described Cambay as one of the greatest and richest cities of India, a position which was retained till the beginning of the 19th century. It was at Cambay that the akik/carnelian industry reached the pinnacle of prosperity and survived till present time despite depression and competition to which it was later subjected.

The port of Cambay began to decline in the early 19th century due to many reasons. Apart from the sifting of the head of the gulf in the early 19th century, the weakness of the Muslim rulers as a naval power and the supremacy of Europe over the seas contributed to the decline of Cambay. The competition among the Portuguese, the Dutch and the British to divert all trade to their area of prominence also played a defining role in the downfall of the port. The construction of B.B. & C.I. Railway in 1863 from Bombay to Ahmedabad sealed all sea and land trade that formerly passed through this sea port.

THE CITY OF CAMBAY (KHAMBHAT)

The city of Cambay or Khambhat (22°9' and 22°41' N, and 72°20' and 73°5' E) falls in the present district of Anand (carved out of Kheda/Kaira district in 1997). It lies on an alluvial plain at the north end of the Gulf of Cambay. It is bounded on the north by Matar in Kaira, on the east by Borsad in Kaira and Petlad in Baroda, on the south by the gulf, and on the west by the Sabarmati River.

Since the Harappan times, the region (if not the present-day Khambhat town) has been an important commercial centre. The textile and the lapidary craftsmanship have been flourishing in Gujarat for more than 5000 years and the antiquity of the same in the region of Cambay is not very late either. Today, Khambhat displays the only surviving traditional stone bead industry where craftsmen have not only been producing stone beads for generations with traditional technology, perhaps the major part of it continuing from the Harappan times, but have also maintained the styles.
EARLY REFERENCES

Historical records inform us that the region of Cambay has always been important in the commerce between India and other parts of Asia, Africa and Europe. Mention of agate/carnelian products from Gujarat is found in references starting from the beginning of the Common Era made by foreign travellers who came to India at different time periods. The first reference of the export of agate, carnelian and onyx to Egypt from Barygaza [Bharuch] is found in Periplus (c. 60 CE).

The port of Cambay became the principal port of Gujarat after the fall of Somnath in 1024. In the 10th (Al-Masudi), 11th (Al-Biruni), 12th (Edrisi), 13th (Marco Polo), 14th (Ibn Batuta) and 15th (Major) centuries, carnelian products were not listed under major export items from either the port of Cambay or that of Bharuch. It was only with the Portuguese taking control over the sea trade of Cambay from the kings of Gujarat in early 16th century that the stone crafts of the regions got more exposure. It, however, remained so even after the decline of Portuguese power and also after the arrival of the British in Gujarat in 1608.

The 15th century travellers make only a casual reference to agate as one of the products of Cambay. Early in the 16th century, the agate trade seems to have gained importance. Varthema (1510) visited the area in 1503-1508 and reported about the exploitation of two mountains of carnelian diamond, respectively situated at about 70 and 100 miles from Cambay. The real clue that the lapidary industry was firmly established at Cambay can be availed from the reference to an Abyssinian medicant by the name of Bawa Ghor, who started an akik factory at Nimodra (Limodra) near Rajppla where raw materials were available in plenty. The export to the African coast was done under the supervision of his brother Bawa Abbas through the Cambay seaport (Fig. 1). In due course of time, in the beginning of the 17th century, the establishment from Nimodra was shifted to Cambay, where the artisans got ready welcome and encouragement (M.L. Dames, editor of the book of Durate Barbosa).

Fig. 1. Southern view of Cambay town in 1772 (after Trivedi 1961).
The preliminary operations of sorting the stone and exposing them to fire in order to develop the colour were continued to be performed at Limodra. However, for cutting, polishing and working up, they were taken to Cambay. Barbosa landed at Cambay Port in 1534 and mentioned the agates and carnelians as some of the chief trade articles from Cambay. He also wrote in 1534 that at the ports of Arabia and Africa, there was a prosperous trade of akik articles and Ghors were one of the chief articles of imports. He further goes on to describe Cambay beads as some of the important articles of trade brought from India to the Red Sea and the east coast of Africa by Mohmmmedan [Muslim] sea-faring traders. Seydl Ali (1557) also speaks of profusion of carnelians from Cambay. Towards the close of the 16th century, Caesar Frederic (1585), in his summary of imported and exported items from Mecca and Cambay with Barks, lists great carnelians, garnets, agates and bloodstones of Cambay. In the beginning of the 17th century, there was a separate street in Goa consisting of shops for precious stone, and all the workers there were from Cambay (Pyrad de Lavall 1611). Tavernier (1675) corroborates this claim in 1651 and also mentions that agate cups are hollowed at Cambay. Ali Muhammad Khan (1748) mentioned Ratanpor and Kapadvanj agates that were made into vases, rings and necklaces; he mentions they were sold at Cambay and Surat and were also exported from Surat. Forbes (1894) during his visit to Cambay in 1783 found that agate manufactures formed a valuable part of the town’s trade.

PREVIOUS WORKS ON BEADMAKING AT CAMBAY
A good number of ethnographic and trade observation works have been done on Cambay lapidary right from the third quarter of the 18th century. The use of the then prevailing local names for the city, stone, tools and activities in these works is indeed intriguing. Maintaining those local names as much as possible, converting the descriptions to points and tables and incorporating relevant figures, this chapter summarizes most of the work independently in the following pages.

EIGHTEENTH CENTURY
The first ethnographic documentation of Cambay beads was carried out in 1787–88 by Dr. Hove. During his visit, the entire town of Cambay was abandoned and the houses were pulled down as a result of exorbitant taxation by Nabob [Nawab], except the English factory where the lapidary work used to take place. Dr. Hove succeeded in seeing the polishing and making of carnelian beads only after convincing the dealer that he being a physician could not harm their business even remotely. He observes:

The carnelians [carnelians] are mainly exported to Mocca [Mocha/Mokha, a sea port in Yemen]. The stone is dug from the bank of Narbadah [Narmada] or from the city of Cooly (Rajpeopla) [Rajpilia], and imported to Bhanuch [Bharuch], where it is prepared in the sun and in fire for bringing the desired colours. From Bharuch it is exported to Cambay, where it is polished and adapted for the different markets: Europe and Mocha imports the tablets for making seals, China prefers pearl and sphere shaped carnelians, whereas the octagonal shaped are exported to Guinea Coast, and Mozambique. The polishing is monopolized by the dealers in Cambay. Both the precise labour price of this craft and the process of this art are kept very close though there are a great many number of polishing units.

Carnelian beadmaking process [Fig. 2], as observed by Dr. Hove, is as follows:

1. The boys bring the stone and hammer it off against a horizontal piece of iron, with buffalo-horned hammers with the greatest exactness.

2. Polishing of the stone goes through three stages. The first polish is done on hard sandstone, turned by a man by means of two leather straps, whilst the other is polishing the chiseled roughout to remove the roughness. The second polisher refines the same and the third finishes it by correcting the angles or any other fault that he finds.
3. For each stage the polishing stones vary in their compactness.
4. The polisher suspends a jar with water with a small cavity in the bottom, through which the water drops gradually on the polishing stone, while at work.
5. Each of these three polishers pursues his own branch, and is totally unacquainted with the next.
6. The drilling is a specialized job, to do which people are brought up from their youth. This is performed by a diamond, which is set in iron, and secured inmoveable, to which the proposed object is applied, and drilled.
7. Each of these operators receives two rupees per day, which is indeed very high wage.

NINETEENTH CENTURY
In the early 19th century, Milburn (1813) wrote:

tone to three inches diameter roundish and oval Cornelian [carnelian] stones are brought to Europe from Cambay. They are of close compact texture, and when cut, of a bright glossy surface; their colours are red, white, yellow and variegated. The deep red coloured, free from cracks, flaws, and veins, and the larger and thicker carnelians is most in demand, great quantities being consumed in the manufacture of seals, and other trinkets. The white are scarce, and when large, thick, of an even colour, free from cracks, flaws, are also valuable. The yellow and variegated are either rejected or needed very less. The carnelian necklaces, ear-rings, and other trinkets from Cambay are also imported.

Fulljames (1838) gave the account of the carnelian mines of Rajpîla Hills in 1832. By that time, some of the villages like Minodrah had already exhausted the work of firing of stones for deepening the colour. The abandoned places were littered with pieces of various coloured agates. The description goes as follows:

Miners are found at a distance of one and half Kos [kilometers] from Rutunpoor [Rotampur]. The road and the nala [drains] to the mines are strewn with agates. To the left of the road on the summit of a high hill covered with jungle, stands the tomb of the peer [Baba Ghor's]. The people residing there are Sedics [Siddis] or Negroes
[East African], but claim to have born and brought up in Ratanpur whilst their father migrated from Broach [Bharuch].

More than thousand men work in mines and in Ratanpur, chiefly Coolies [Kolis] and Mussulmans [Muslims]. Each man collects a maund and a half of good stones daily. The shafts of the mines are about four feet in diameter, so that the miners, in going up and down, do not require the assistance of ropes, etc. They cut niches in the sides of the shaft for their toes to rest upon, and by pressing [pressing] their backs firmly against the sides, they carry out mining work without much danger or difficulty.

The average depth of the shafts is 30 feet. The galleries run off in every direction, or wherever the miner’s fancy leads him to dig. Their height is five feet, and their width about four. The roof is arched, and the soil is stiff clay, in which the stones are imbedded. The galleries seldom extend more than 100 yards in length, but many of them join those of other mines. To each of the mines there are 13 men attached, who work in turns; there is a fixed mandate for each man to send up so many baskets full of earth and stones, before he calls the day. All the people employed in sorting, seat around the mouth of the shaft, and try each stone by chipping off with another stone [Fig. 3]. From the appearance of the fracture, they are able to judge whether the stone is good or not: the finer and more compact the stone, the better it will be when burned, and the blacker it appears at first, the redder it will become after undergoing the same operation.

![Fig. 3. Miners sorting the stones on the mouth of the mine (courtesy Posschi 1961).](image)

![Fig. 4. Agate mining, Ratanpur (after Trivedi 1961).](image)

The stones are brought up by means of rude roller, or pulley, supported by four pieces of wood, let into the ground. A small iron pick, a few bamboo baskets and one rope, compose all the implements of the miner [Fig. 4].

Each miner on his return to Ratanpur in the evening carries a basket full of good stones, when they are spread out on the ground and exposed to the sun. They are thus collected for a whole year, and turned over every four or five days: the longer they are exposed to the sun, the deeper or brighter, the colour becomes when the stone is polished.

In the month of May the collected and dried stones undergo the process of burning, which is affected by placing the stones in black earthen chatties or pots. The pot is placed with the mouth downwards, and a hole is broken in the bottom; a piece of broken pot is then placed over this hole, and the whole is covered with sheep’s dung, as no other material is said to answer the fuel in this operation. The pots are arranged in single rows, and the fires, which are always lightened at sunset, are allowed to burn till sunrise when the pots are examined, and, should there appear any white spots on the surface of the chatty, it is considered that the stones are not sufficiently burned, and they are allowed to remain for a short time longer. After this process the stones are re-examined. Those that have flaws, etc. are thrown aside, and those that are not sufficiently burned are laid by for next year’s burning; the rest are sold and exported to different workshops.

Fulljames noticed that almost all the stones were cut and polished at Cambay and the work that was done at Bharuch had discontinued. The import and export taxation to and from Cambay was very...
high. Majority of the agates brought were turned to beads of every variety, size and colour. They were mainly exported to the African and Arabian coasts, and also to the island of Zanzibar and Mozambique, where they were bartered for ivory, gold dust, Rhinoceros horns, etc.

The beadmaking process described by Fulljames is more or less the same as observed by Dr. Hove. However, the following additions or differences are worth noting:

1. An iron pin [spike] is driven into the ground with a sharp point upwards for resting the stones to chisel [Fig. 5], whereas Dr. Hove mentioned this to be a horizontal piece of iron.

2. The operation of chiselling of stones for beads is performed chiefly by women, boys, or young girls.

3. The polisher has a large slab of hard sandstone before him, placed in a sloping or inclined position and with a clamp made of two pieces of wood with a joint at one end and two nails in the centre, by which the stone is held, he works the stone over the surface of the slab, constantly changing its position, so that in a very short time it becomes round [Fig. 6].

4. The driller makes the drill by means of diamond dust and water. The drill is supported on a small frame, and worked by a long bow backwards and forwards.

5. The carnelian beads are finished by putting a number into a bag, in which they are shaken together.

A detailed investigation on Cambay's stone crafts was carried out by Augustus Summers (1859). He, being the then senior apothecary surgeon at Cambay, had for long the first-hand information owing to his day-to-day observations and interactions with bead craftsmen and dealers. Thus, the data is more authentic. Combining this work with the above information, one gets a complete picture of the lapidary cycle at Cambay that existed before the Ahmedabad–Bombay (now Mumbai) train tract started operating in 1863, which thenceforth changed the mode of transport vis-à-vis trade. As Summers observed:

Though the trade of universally known Cambay stones has reduced considerably lately but still enjoys the second position after cotton from this vibrant export port of Cambay. The 14 merchants from Baniya and Borah community purchase the finished products from lapidaries and export them to Bombay (Mumbai), Diddah (Jeddah), and other ports.

The raw materials were brought mostly from different parts of the Gujarat (Table 1).
Table 1: Source of raw materials as recorded by Summers.

<table>
<thead>
<tr>
<th>Stone, heliotrope or bloodstone</th>
<th>Local Name</th>
<th>Source</th>
<th>Taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasper, heliotrope or bloodstone</td>
<td><em>Lida Chantudar</em></td>
<td>Bang Hill, near Tankarra village in the territory of King of Murvi, 12 mile north of Rajkot</td>
<td>For permission to collect 8 annas for 1 maund (40 pounds); 2 annas per bullock load for passing through the King's territory; Rs. 4.50 per load for bullock hire to Cambay; town duty of 8 annas per bullock-load (3 maund)</td>
</tr>
<tr>
<td>Moss agate</td>
<td><em>Sawa Baji</em></td>
<td>Near the village of Tankarra in the territory of King of Murvi and at Bud Kotra about 3 miles from Tankarra</td>
<td></td>
</tr>
<tr>
<td>Common agate</td>
<td>Semi-transparent one is named <em>Dhola</em> and cloudy and streaked is named <em>Jomna</em></td>
<td>Near the village of Mahidpore, three miles from Tankarra, in the territory of Rajah of Murvi</td>
<td></td>
</tr>
<tr>
<td>Agate, Kupperwange</td>
<td><em>Karriah</em></td>
<td>Kupperwange village in the Kaira district and in the bed of the river Majaim, between the village of Amlala and Mandwah, about 15 miles from Kupperwange</td>
<td>The Bhils find these stones and sell to a Borah and Mandwah traders, from whom lapidaries purchase them at Rs. 3–12 per maund depending on their quality, brought on donkeys, 10 maund of stone is valued at Rs. 100, on which a duty of Rs. 4 and 8 annas is charged at Cambay</td>
</tr>
<tr>
<td>Veined agate</td>
<td><em>Doradar</em></td>
<td>Rhanpore and its adjacent villages, named Darpila and Ninama, in the Ahmedabad district near Danduka</td>
<td>Rs. 2 fee per cart-load (40 maunds) to Govt. authorities and another Rs. 2 as Cambay town duty</td>
</tr>
<tr>
<td>Chocolate stone</td>
<td><em>Katiah</em></td>
<td>Rhanpore, near Duuduka and at Tankarra village in the territory of King of Murvi</td>
<td>From Tankarra on bullocks at the rate of Rs. 4.50 per load, from Rhanpore in carts at Rs. 15 per cart load, besides a government fee of Rs. 2 per cart-load</td>
</tr>
<tr>
<td>Chrystal</td>
<td><em>Phattak</em></td>
<td>Tankarra village in the territory of the King of Murvi</td>
<td>Pays same duty as the other stones in the territory of King of Murvi</td>
</tr>
<tr>
<td>Variegated stone</td>
<td><em>Mi-mariam</em></td>
<td>Dhokawarra in the Ram, about sixty miles north of Deesa</td>
<td>Brought by cart</td>
</tr>
<tr>
<td>Lapis lazuli</td>
<td><em>Rajahwarud</em></td>
<td>Imported at Cambay from Bombay, and is brought from Persia and Bokhara</td>
<td></td>
</tr>
<tr>
<td>Jet-stone or Obsidian</td>
<td><em>Kula phattar</em></td>
<td>Imported at Cambay from Bombay, and is said to occur on the hills at Bokhara, and at Aden</td>
<td></td>
</tr>
<tr>
<td>Blue-stone</td>
<td>Ferosa</td>
<td>Imported at Cambay from Bombay and is said to be prepared in China</td>
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<td></td>
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<tr>
<td>Carnelian</td>
<td>Ghar - Depending on colour Light brown - Dhola; Pale yellow, rose - Gulabi; Deep yellow, red - Lal; mixture of cloudy brown and yellow - Abkasi; Pinkish purple - Naflamani; Brown - Emni</td>
<td>Base of the hills of Bowa, Bandur Abbas and Rajpura in the territory of King of Nadode, who is tributary to his Highness the Gaikwar</td>
<td></td>
</tr>
<tr>
<td>Onyx or dark coloured Carnelian</td>
<td>Mora or Bowa Gori</td>
<td>King of the Nadode farms the quarries to native contractors with an annual fee of Rs. 2000-2500 for the sole privilege of collecting stones</td>
<td></td>
</tr>
<tr>
<td>Cat's eye</td>
<td>Chasumdar</td>
<td>Bowa Gori and Abbas Hills or at their river base</td>
<td></td>
</tr>
<tr>
<td>Rori</td>
<td>Lassunia</td>
<td>Bowa Gari and Bandur Abbas hills or at their base</td>
<td></td>
</tr>
</tbody>
</table>

Summers identified the community of miners and collectors of the stones to be the Bhils who used to bring the day-long quarry output in the evening to Rattanpore [Ratanpur] village and then transferred the same to the contractor. The process of baking of stones for deepening the colour described by Summers is similar to what was described by Fuljames. He, however, provides some additional information:

In two feet deep and three feet broad pits/trench, the pots containing the agitation are arranged in a single row and baked. The fuels used are the fires of goat and cow-dung. The baked stones are once a year carted to Nemodra [Limodra], and conveyed in canoes down the river to Broach [Bharuch], from whence they are brought in boats to Cambay.

Specialized articles were produced for specific regions in large quantities. For example, two kinds of carnelian articles are made for China (exported via Bombay to the valuation of Rs. 50,000-60,000 annually), Mogul goods (large and small, worn as armlets and dress ornaments) and Dhol (necklaces, each containing fifty plain polished round beads); and veined agate in the form of rings, wristlets, armlets and necklaces are made for the Mocha [Yemen], Dijdah [Jeddah], and Mecca [Makkah]. They are packed up in chests, also in bales with cloths, and exported to Bombay, and Veraival Bunder near Diu, from where they are shipped to their destination.

Since Summers used local names for different tools in his description of the process of beadmaking and the description is complete in nature, the complete process has been presented here below:

1. Stones are broken into pieces of desired size.
2. An iron spike named khondia is driven into the grotto.
3. Stone is placed on a pointed point and chipped with a horn hammer till rounded.
4. Rounded stone is passed on to the polisher.
5. First the polisher fixes a number of symmetrical sizes in a pair of wooden or bamboo clamps and rubs them on a coarse and hard polishing stone called dholia.
6. Second, the polisher secures them in a wooden clamp, rubs them against a grooved polishing board named *pattimar*, on which is smeared a composition of emery and lac, turning the beads round so that every part of the surface gets polished and assume a globular form.

7. The third and final polishing is given putting several thousands of beads into a stout leather bag, about two feet in length and from 10 to 12 inches in diameter, with some emery dust and very fine powder, named *warry* (the sediments from the carnelian deposited in an earthen dish particularly filled with water, during the process of drilling holes in the beads, which is always collected and dried), the mouth of the bag is then tied up, and a flat leather thong or tape is passed round its centre, after which it is rolled by two men seated at opposite ends of a room, towards each other, from 10 to 15 days; during which time it is kept moistened with water [Fig. 7].

8. With this bright polish the bead blank is passed to borers to drill the holes.

9. The driller uses a steel drill tipped with a small diamond, during which process the spot is fed with water drop by drop and passed through a thin narrow reed or metallic tube.

Summers further describes:

There exist about 75 large and 25 small ornament manufacturing workshops in Cambay. Two thousand people are engaged in these units. There is a *Akkia* (lapidaries) *jumut* (panchayat) which has 100 *Akkias* (master artificers or heads of establishments), 300 *Gassias* (workers on lapidary wheels); 200 *Dhollas* (polishers on rough and hard polishing stones); 50 *Puttimmers* (polishers on wooden frames), 100 *Badars* (borers who are employed in the drilling processes), total 750 members. Besides these more than thousand people consisting of men and boys, both Hindus and Muslims are employed in the different shops as day-labourers, in chipping, cutting slabs, etc. These specialized sub-craftsmen never encroach on works of other sub-craftsmen.

Hamilton (1857) stated that in 1854, merchants' vessels sailed to Bombay every autumn from Jeddah (Jidda), and there were 1500 Indian resident at Jeddah including many of the wealthiest merchants. He also recorded having seen carnelian beads for sale in their shops.

Campbell (1880) gave the most detailed account of the history and ethnography of the production cycle of stone beads at Cambay, as was practiced in
1878, along with the then organizational structure of the guilds.

The term 'Cambay Stones' includes two classes of gems: (i) agates found in different parts of Gujarat within a radius of about 120 miles of Cambay and (ii) stones brought from outside Gujarat to be worked by its lapidaries.

The description of the mines and mining process as given by Campbell is similar to that of Fulljames, with the addition that the average output of two men working from eight to ten hours is from 10 to 40 pounds of stones.

Campbell identifies the three stones which are not baked, namely (i) Onyx, called mora or bawa ghor (dark with white veins and greyish white with dark veins); (ii) cat's-eye, called cheshamdar or dota; and (iii) yellow half-clear pebble called rori or lasania. For the rest of the stones, the process of the baking is same as was described by Fulljames, while the fuel used for baking was goat and cow dung, as was mentioned by Summers. The description of the mode of transportation of stones to Cambay from Ratnagiri, which used to take place towards the end of May, is also the same as was described by Summers. Campbell's description goes as follows:

The annual auction fee for right of working the Rapipla mines has been increasing with years as the average for the last four years (1873-1876) has been Rs. 3200 compared with Rs. 890 in the twenty previous years. The contractors are generally Baroda and Cambay merchants, Vannias and Bohoras by caste.

Four agates, the common, the moss, the Kapadvanj, and the veined, rank next to the Rapipla carnelians. The common agate is of two kinds, a white-half clear stone called dota or cheshamdar, and cloudy or streaked stone called jamo. Source of raw materials remains mostly from different parts of Gujarat, besides a few which are imported from far off places (Table 2).

Campbell divides the entire process of beadmaking to three parts—sawing, chiselling, and polishing—in which sawing is the addition to the earlier references.

**Sawing:** Stone is brought to a strong frame of two wooden uprights, joined at the foot by a cross board, and, at the top, by a strong rope doubled and tightened by a stick. The stone is then laid on the cross board and fixed firmly to it by a cement of coarse bees' wax and cloth fibres. The saw, a slight toothless iron plate in a light wooden frame, is then brought up, and according to the size of the stone, is worked by one or two men. To smooth its freshly

<table>
<thead>
<tr>
<th>Stone</th>
<th>Local Name</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Agate</td>
<td>North-east Kachiawar, near Mahedpur in Morvi, three miles from Tankara</td>
<td></td>
</tr>
<tr>
<td>Moss agate</td>
<td>Bhaji</td>
<td>Bud Kotha, three miles from Tankara in Morvi</td>
</tr>
<tr>
<td>Kapadvanj agates</td>
<td>Kapadvanj in Kaira From the bed of the river Manjarm between the villages of Amliyara and Mandava, about fifteen miles from Kapadvanj</td>
<td></td>
</tr>
<tr>
<td>Veined agate</td>
<td>Duradar</td>
<td>Ranpur in Ahmedabad</td>
</tr>
<tr>
<td>Jasper</td>
<td>Tankara in Morvi about 20 miles north of Rajkot</td>
<td></td>
</tr>
<tr>
<td>Chocolate stone</td>
<td>Rathia</td>
<td>Tankara in Morvi</td>
</tr>
<tr>
<td>Cambay crystal</td>
<td>Phatak</td>
<td>Tankara in Morvi</td>
</tr>
<tr>
<td>Best Cambay crystal</td>
<td>Madras, Ceylon and China</td>
<td></td>
</tr>
<tr>
<td>Lapis lazuli</td>
<td>Rajavat</td>
<td>Via Bombay from Persia</td>
</tr>
<tr>
<td>Black stone</td>
<td>Kala Phutar</td>
<td>Via Bombay from the hills of Bassora and Aden</td>
</tr>
<tr>
<td>Blue stone</td>
<td>Not true piroja</td>
<td>A composition imported from China in flat pieces</td>
</tr>
</tbody>
</table>
cut faces, a mixture of ground emery, fine sand, and water is allowed to drop into the cleft in which the saw works.

Chiselling: The description of the chiselling process is same as was provided earlier by Fulljames and Summers.

Polishing: The first polisher takes the chiselled nodule to a platform of 16x6x3 inches wooden board. In this platform are two strong wooden uprights and between the uprights an eight-inch-long and three inch diameter wooden roller is fastened into a head at one end. This roller works on an iron spindle or axle. On the one end, the axle is screwed and fitted with a nut to which certain plates or discs can be made fast. These grinding or polishing plates are made of emery mixed with seed lac. The emery (karanj) of greyish black colour is carefully powdered and glisters. The preparation of emery varies in fineness according to the nature of the work. For rough work the proportion is three parts of ground emery to one of lac; for medium work the proportion is two-and-a-half pounds of finely powdered emery to one of lac; and, for the finest works lac and carnelian dust (varti) are used in equal quantities. Besides the composition plates, a copper disc is occasionally used for polishing very hard stone, such as Ceylon cat’s-eyes. Fastening in its plate on the roller the disc best suited to the stone to be polished, the workman, squatting on his hams, steadies the machine with his foot. A bow, with its string passed round the wooden roller, is held in his right hand, and by moving the bow backwards and forwards, the roller and with it the polishing plate is whirled round while the article to be polished is held in the workman’s left hand, and, as it revolves, is passed against the outer face of the polishing disc [Fig. 8].

The other processes of polishing with the use of the dholias and pattimars as well as the leather bag treatment are same as had been described by the earlier workers. The drilling process also remains the same.

Campbell divided the Cambay agate ornaments prepared for exporting into three classes: (i) those suited for the Chinese, (ii) those suited for the Arabs, and (iii) those suited for the European markets. As he describes:

Chinese import the earlier described mugalagul (polished flat oval, square and like watch seals carnelian worn as armlets and dress ornaments), and dot beads.... The Arab market prefer ornaments (rings, necklaces, wristlets, and armlets) made of Ranpur agates, Ranpur carnelians, Cat’s-eyes, and bloodstone. The European market import models of cannon with carriage and trappings, slabs for boxes or square tables, cups and saucers...necklaces and bracelets.... Except a very small supply for the Sind and Cabul [Kabul] markets taken by the horse-dealers and other Afghans who visit Cambay, the whole produce is exported via Bombay merchants, dominated by Bohora caste, to China, Arabia, and Europe.

The trade in Cambay stones supports about 600 families of skilled workmen, and 500–600 unskilled labourers. The skilled workmen are all Kumbis, whereas the labourers are mostly Musalmans [Muslims] and Kolis. From the time of Summers (1851) there is a fall, from two to one hundred in the number of polishers of the rough stone, dolas. On the other hand the workers on the lapidaries’ wheel, ghastias, have remained steady at 300, the drillers, vindhars, at 100, and the polishers on the wooden frame, pattimars, at 50.
Each process is carried on in a distinct workshop. The head of each workshop, karkhana, is a well-to-do Khabi known as the karkhanaval. This headman, though generally not above working with his own hands, has under his, besides a varying number of labourers, from two to ten skilled workers. Contrary to the observations of Fulljames, Campbell categorically says women and children do not form any part in the skilled labour work. The craftsmen receive monthly wages each according to the work he has done; the unskilled labourers, many of them boys, are paid by the day or as their services are wanted.

In each branch of the craft the heads of factories form a distinct guild or panchayat. There is the guild of polishers on stone, dolia panchayat; of polishers of wood, pattimar panchayat; of workers on the lapidaries’ wheel, ghasia panchayat; and of drillers, vindhar panchayat. Above them is the dealer’s guild, akkia panchayat, in whose factories the work of sawing and chiseling is carried on. Over each of these guilds a headman, chosen by the votes of the members, presides. Any skilled worker, who raises himself to be head of a factory, may become a member of the guild of the branch of the craft to which he belongs. On joining a guild the new comer is expected to give a feast to the members, the expenses varying from Rs. 175–800. He is at the same time required to pay the Nawab a fee of Rs. 15–100.

From time to time the members of a guild hold a feast meeting from the collected common funds. When any skilled worker wishes to have his son taught the craft, or any new member wishes to join, he gives a dinner to the head of the workshop and to the other skilled workers.

On paying the Nawab a fee, and agreeing to meet the customary charges including a yearly subscription of Rs. 12, any member of one of the under-guilds may become a dealer, akkia. Breaching the guild’s rules is not taken kindly. For an example about four years ago, revolt against the heavy membership fee for guild, when certain polishers, ghastas, claimed the right to deal in stones without becoming members of the akkia guild, the regular dealers made sure non-members don’t get any business, thus were forced to leave Cambay.

Generally in each class one master worker undertakes the Nawab’s orders and for the same receives Rs. 50–60 from the guild funds. Among guild rules, one forbids master workers engaging the services of workmen belonging to another factory. The annual working calendar has certain holidays amounting to about two months in the year. Anyone who breaches the rules is punished by fines varying from Rs. 1.25–2.50.

Watt (1885), at a later date, reports:

Agate in India is mainly obtained from the mines of Rewa Kantha in the Bombay Presidency. Common agate comes from Kalihwar near Mahedapur in Morvi, three miles from Tankara; moss agate comes from Budkotra, also three miles from Tankara; and veined agate, the most valued Cambay agate, comes from Ramgar in Ahmedabad, its colour is readily intensified by artificial means. It is boiled in oil and then in sulphuric acid to heighten its colour. Red varieties are produced by boiling it in a solution of proto-sulphate or iron, thus very often forming carnelians. The principal source of carnelian is the mines of Ratnapur, about 14 miles from Broach [Bharuch].

Watt provides a similar description to that of Campbell with regard to the separation of stones for baking and the ones that did not require fire. The process of baking and transporting the stones to Cambay, as described by Watt, is similar to the ones described by earlier workers.

TWENTIETH CENTURY

Arkell (1936), though based his papers on his experience at Sudan, a series of answers to questionnaires obtained via post from various bead traders and enthusiasts, and Horace C. Beck’s research queries, published a very important note obtained from an Indian merchant, Messrs. Ranchodlal, Girdhurlal & Co., Bombay, dealing with Cambay lapidary for generations. However, the latter seemed to have had access to the work of Summers and Campbell and provided the same information to Arkell. Messrs. Ranchodlal, Girdhurlal & Co. added that in recent years the bead industry had been seriously interfered by the artificial agates of Europe and advocated for introducing modern appliances for grinding and polishing to keep the natural stone bead industry of Cambay functional. This claim was supported by the answer of British Legation (Minister) at Jedd to one of the queries of Arkell that at that point of time nearly all the agate beads and all the carnelians obtained at Jedd were imitations that were imported from Danzing and Germany, though a small quantity of agate beads.
imported from Cambay could occasionally be found in the market.

Having the work of Arkell in hand and his own study on etching technique (1933), Mackay (1937, 1943) looked at the bead and bead waste finds at Chanudharo very intelligently. He could not only identify the wastes at various stages but also could more or less recreate the beadmaking tradition of 3000 BCE, which was not much different from the description given by earlier researchers discussed above. However, there was a marked difference in materials of drill bits at Chanudharo, which were of a typical stone with a hardness of 7 in Moh scale, same as that of carnelian. Using abrasive such as emery or crushed quartz and by designing the drill in a manner to hold the abrasive while drilling, the Harappans could drill the carnelians successfully.

In post-Independence India, the ethnographic genius was visible in the work of Trivedi (1961). For the first time the entire cycle of stone bead production at Cambay was presented illustratively and the work recorded the details of the processes, which were about to disappear from the scene or which had just been discontinued. It also gave the then prevalent local terms for the different craftsmen, processes, and tools.

Trivedi divided the entire process from mining the raw materials to making the finished products in six phases: (i) mining, (ii) sun-heating and firing, (iii) cutting and shaping, (iv) roughing and smoothing, (v) polishing, and (vi) drilling.

As far as the process of quarrying is concerned, there were no noticeable changes that could be seen. However, Trivedi graded the finds into three categories: (i) the best one known as tukdi, (ii) the medium type known as gir, and (iii) the lowest quality known as khadiya. The mode of transporting the stones had, of course, changed from water route by boats to surface route by truck or trains from Jhagadia or Lajippla to Cambay.

The source of raw materials had not changed either, but three new mines were added, which were discovered by M/s. Good Earth Industries of Jamnagar at Mardak Beyt in the little Rann of Kutch covering an area of 2100 acres. With the advancement in communication, there was increase of exploitation of raw materials from far-off places rather than only from Gujarat.

Baking of stones was done more at Cambay than in the villages of the miners. As the terraced roof and tins had become common, the quarried stones were now spread and exposed to the sun on the terraces or corrugated iron sheets on house roofs (Fig. 9). The direct heat of the sun used to dry the internal wetness of stones. Without the actual heat treatment of the sun, the stones used to get cracked into pieces while working on them and material were wasted. The two methods which were followed for firing the dried stones for colour, as described by Trivedi, are as follows:

Bhasal: A trench two feet deep and three feet wide is dug in a dry ground or field. Some now have trenches build of bricks and cement. About an inch or one and a half of ash layer is spread at the bottom. The stones heated in the sun are placed on this layer of ash and covered with alternate layers of ash on which goat and cow dung cakes, pieces of charcoal and saw dust are spread. Three or four such layers are arranged one upon the other, so that the

Fig. 9. Sun-heating agate stones on a terrace (after Trivedi 1961).
stones get evenly heated from all sides. The heating process is applied for three days continuously, where after the baked stones are taken out and those which are not properly baked are baked again till they take natural colour (Fig. 9).

Handla: This method involves the process of firing the stones in earthen pot in a pit, which is similar to the ones described by earlier workers.

Stones change their colours gradually in the former method, while transformation of colour into red is very quick in the latter. On the whole, the bhasla method is preferred because the material is properly baked according to the requirements. Repeated baking is the key to bring the desired colour. The temperature at which changes take place is between 300 and 450 degrees Celsius.

In the stages of cutting (chiselling) and shaping, no noticeable change was observed by Trivedi. The iron spike on which the stones were chiselled with buffalo horn hammer was known as sink with shingadi. Sawing was, however, necessary in case of large-sized Tiger and Mardak stones, which were cut into convenient pieces with a toothless saw. The workers engaged in cutting and shaping were known as bhangiya or khondiya who worked in a group of four to six individuals.

Smoothing the surface and polishing were done with two methods: (i) with the help of electricity and (ii) by hand. In the first method, the emery or carbaramundi wheel, working with the electric motor of ½ HP, was rotated in circle. If the articles were rough and thick, the wheel was given greater momentum, and less if thin. This wheel was fixed to a wooden plank of 6 to 8 inch in length at a height of about 3 to 4 feet. This frame was known as charak. Two or three workers could operate at a time. The worker kept one small earthen vessel filled with water by his side and the articles were dipped in water before they were put on the emery wheel, which helped in avoiding the powder to be inhaled by workers. If water was not used, the wheel could move more rapidly giving better wadh or cut and greater output (Fig. 11).

The second method known as saranyas involves the use of hands was on the verge of extinction. This works with the help of the bow-shaped stick with a strong cotton string or leather belt known as vojar. There were only three such establishments, of which one was in Gandharapwada and two in Pakhaliwad.

There were four different types of lapidary wheels required for grinding and hand polishing. One of them was Ghat-ni-saran that was used for removing the unevenness of surface and giving a correct shape to the stone. Another one was known as Naram or soft saran that was used to make the surface smoother. The remaining two types were used to give the articles appropriate glaze and polish. The persons engaged in polishing were
known as opiya, a term derived from the word op, which in local parlance means shine or lustre.

The traditional method used on saran or lapidary’s wheel, pattimar or polishing against wooden board and in leather bag were, for the most part, replaced by mechanical methods.

There were two establishments where polishing were mechanized. The latest innovation was that the leather bag containing beads, emery dust, leather pieces and fine carnelian powder was placed in a barrel of crude oil or tar. The barrel was supported with axle on both ends or with an iron rod in between, and with a pulley at one end. There was a pulley also on the electric motor of ¼ or ½ HP, connected with a leather belt of about 20 feet in length. The barrels were three to four in number. Three of them were made of tin and one of copper. The finished articles were rotated in these drums in turn and finally transferred to the copper drum, in which the proportion of polishing material used to vary. The barrels were rotated mechanically and within two to three days, the bead blanks were polished (Fig. 12).

The men who bore the beads were known as vindhar or suri, derived from the local words vindhavu or saravu, which mean piercing a hole from one end to another. There were only five establishments of vindhar in the town of Cambay, two belonging to the Rana and three to the Baraiya castes. But the farmers of seven neighbouring villages—Nagra, Neja, Kali-Talavadi, Kansari, Sakkarpur, Chhatardi, and Nana-Kalodra—with a radius of five miles around Cambay used to undertake this work as subsidiary occupation.

About 100 households or 300 workers were engaged in this work and they belonged to the Rajput, Rana, Baraiya-Koli, Waghari, and Chunara castes. As they owned small landholdings, they supplemented their income by undertaking this work which used to give them livelihood for 12 months. The male members were mostly within the age bracket of 9 to 12 years up to 45. Except the monsoons, when they were busy with agricultural operations, drilling was their principal occupation.

The technique of drilling, as described by Trivedi, involved boring holes through beads by a diamond-tipped steel drill. The details of this technique are as follows:

In order that the beads to be holed are gripped properly, they are fixed between two forks in a wooden clamp and kept in position by an iron ring, so that the beads do not get loose and remain properly fitted. This is known as bhimthi. Round beads are kept in the hollow crevices on the wooden frame, which in colloquial terminology is known as khamaur.

After making the drilling points on top and bottom of the bead, the craftsman takes it up for drilling. The drill is encircled by a bow-shaped string fastened on a thin stick known as dhandodi, held in the right hand. He holds the diamond tipped steel drill under a piece of coconut shell kept under his left palm. The drill is then turned to and fro, the pressure being regulated by the left hand passed under the left knee causing deformity in both these limbs. A small earthen pot known as daghulu or latodi is kept on a stand made of three bamboo chips arranged in cross order. Inside this pot is tamarind solution or water mixed with agate powder. A thin narrow metal reed (about 1½ ft. long), which is unusually an umbrella reed, is fixed in the side of the pot in a slanting position, so that the solution dripping from it helps drilling and prevents the diamond tip of the drill from slipping as well as from getting hot quickly. While drilling, the artisan inserts a portion of the drill in and out intermittently so that the water mixed with carnelian powder comes out from the hole and allows the drill to go ahead. After drilling midway, the bead is reversed if it is long and hard to complete the hole for the other half [Fig. 13].

Fig. 12. Polishing in a drum (after Trivedi 1961).
Guild is an organization of past, wherein members of the craft participated irrespective of their caste or creed. However, one panch known as Jiiva Akikiya Panchi, organized entirely on caste basis by Leva Patidars, still exists in Cambay.

Possehl (1981) tried to find the unanswered queries of archaeological excavations yielding stone beads through his study at Cambay and Ratnapur. He used the commonly used archaeological terminology for the stages of bead production cycle.

The lapidary work at Cambay gradually included lapis lazuli, collected from the Badakshan region of Afghanistan, rose quartz from Tamil Nadu, fuchsite from Karnataka, and various corals and other siliceous stones from the west.

The extraction process of the nodules at mines, however, remains unchanged from the descriptions of last two centuries. Possehl adds to it the observations on the division of labour on the basis of gender. He observes that the workforce was made up of teams of three to five men and women. Men working with pick and hoe-like implement scooped the rocks and earth matrix into metal pans, which were then lifted to the surface. After the pans were dumped near the opening of the access hole, women sorted the valuable agates from the undesirable material. A second, more careful, sort used to take place at the villages and the material was then bagged in 50 or 100 kilogram lots for shipment by truck or boat to Cambay.

Possehl echoes the observations made by Fulljames way back in 1858 that the miners at Narmada were of African descent called Sidis, and he opines that this is a result of the lively commerce between India and Africa for at least the past two thousand years. The technique described by Possehl is as follows:

The knitting of the agate is done in two stages, the first of which roughs out the shape of the bead. This is then smoothed by finer chipping. The grinding operation is dispersed throughout Cambay in many different workshops. Both large units, with twenty to thirty grinding wheels and small units with only one grinding wheel, co-exist in the town. For polishing, about 100 kg beads are placed in a wooden drum with abrasive slurry and continuously turned, propelled by electric motors, until their surfaces have been smoothed and polished. This takes approximately a week [Fig. 14]. The process involves turning in slurry with a coarse abrasive at first and then with a finer powder.

Craftsmanship was independent of each other in various stages and sub-stages. Even chiselling [the first chipping] and sand chipping were done by two different men. Workshops for chipping, grinding, and all other works were different from each other.

The bead-man Peter Francis Jr. (1982) published a monograph on Indian agate beads, in which he gave a brief description of beadmaking at Cambay, besides the raw material quarry at Ratnapur.

Rao (1985), being a hardcore archaeologist, in his half-page note in the excavation report of Lothal,
brings three points and technical denomination to the focus other than the process elaborated here. These are as follows:

1. Not much force is used while striking for chiselling the nodule, while in the second reshaping controlled flaking is practised using pressure technique [Fig. 15].
2. Polishing is done in a rotary drum in which beads and sand are put together.
3. After boring, the beads are heated once again to obtain a deeper colour. Calcium and an oxidizing agent such as ferrous oxide, a common ingredient of the soil, are used in this process.

Since 1991, Mark Kenoyer, Massimo Vidale and Kuldeep Bhan have been contributing on the ethno-archaeological and scientific study of the stone bead craft at Khambhat through a series of
articles, to which Mark Kenoyer added the study of perforations and drill impressions using SEM, which have been very educative. Since all the three scholars have contributed papers in this volume, this chapter does not summarize their work.

PRESENT DAY

The total population of Kambhat Taluka is 99,664, whereas the population of Kambhat Municipality alone is 83,715 people (2011 census). Long before entering the town of Kambhat, one can find the wastes of the lapidary activities, while on the outskirts one sees the leftovers of this craft (Fig. 16). Two to three tons of stones are worked in Cambay on a daily basis (Fig. 17). Muslim lapidary craftsmen outnumber the Kolis and Ranas, whereas Patel dealers outnumber the Muslims.

A good number of direct busses run to many cities of Gujarat (Ahmedabad, Baroda, Bhavanagar, Maishma, Nadiad, Palanpur, Rajkot and Shelwaz)
Table 3: Source of raw materials in the present time.

<table>
<thead>
<tr>
<th>Stones</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amethyst</td>
<td>Andhra Pradesh</td>
</tr>
<tr>
<td>Amethyst, saphir crystal</td>
<td>Brazil</td>
</tr>
<tr>
<td>Black stone</td>
<td>Jamnagar, Gujarat</td>
</tr>
<tr>
<td>Blended agate</td>
<td>Gujarat</td>
</tr>
<tr>
<td>Carnelian, banded agate (doredar navrang)</td>
<td>Jhagadia, Bharuch, Gujarat</td>
</tr>
<tr>
<td>Fancy agate (chakarwala)</td>
<td>Kalavat, Jamnagar, Gujarat</td>
</tr>
<tr>
<td>Golden, white king</td>
<td>Rajasthan</td>
</tr>
<tr>
<td>Green</td>
<td>Karnataka</td>
</tr>
<tr>
<td>Jasper</td>
<td>Gujarat</td>
</tr>
<tr>
<td>Moon stone, white king</td>
<td>Rajasthan</td>
</tr>
<tr>
<td>Moss agate, blood stone, fancy agate, jaspar, black and white (kala sapheed), jhama, fancy jaspar</td>
<td>Aurangabad, Ahmednagar, Jalna, Maharashtra</td>
</tr>
<tr>
<td>Nylone mugose (Indian jade)</td>
<td>Mysore, Karnataka</td>
</tr>
<tr>
<td>Rose quartz</td>
<td>Kekri Gaon, Ajmer, Rajasthan; Andhra Pradesh and Bihar</td>
</tr>
<tr>
<td>Sajar (khayaldar), fancy agate, jhama (gawa)</td>
<td>Banda, MP</td>
</tr>
<tr>
<td>Saphir crystal</td>
<td>Odisha, Himachal Pradesh and south India</td>
</tr>
</tbody>
</table>

from the Cambay bus stop. The lapidary dealers and craftsmen prefer to use bus service than trains for trading. For trading to far-off places, however, they avail the Indian Railways facilities.

Mining process remains almost similar to what had been described for the 18th century, and as such has retained the traditional processes to the best possible manner. The horizon of the source of raw materials has increased with the opening of communications (Table 3).

At present, fewer carnelians are quarried and hence the firing for the colouring of carnelian is limited to Kambhat only. Whatever limited agates are found are preferably fired by the handa method at Kambhat than at Khar permissions. Digging trench is entirely replaced by the making of firing chambers in bricks, in which at least two to three rows of stone filled pots/tins are kept for baking, unlike the single row used in earlier times. Pots are not kept upside down as was done in the last two centuries but are covered with a lid (Fig. 18 a-b). Many a time flaked agates are put to secondary fire with handa method to deepen the colour homogeneously (Fig. 19). Two electric furnaces have been recently introduced at Kambhat (Fig. 20). It is likely that manual heating with the help of fire will be discontinued in the near future.

The cutting of bigger stones manually by two men has become a thing of the past and there exist more than 10 electricity-run rock-cutting units.

To cut rocks, they are placed and cemented on a platform (Fig. 21) before rolling under the motorized cutting blades (Fig. 22). This process leaves a deep groove on the sandstone platform on which the stones are cemented and cut (Fig. 23). Small stones are cut and shaped to dabka by holding the same in hand against the small motorized stone-cutting blades and grinders (Figs. 24 a-b). There are about 100 such small cutting and shaping machine units at Kambhat.
Chiselling of the stone takes places in two stages. In the first stage, craftsmen chisel the raw material by striking the same with buffalo-horned hammer on a thick slanting Iron spike. The second stage involves chipping of the stone; step retouching technique is applied where a comparatively thinner and more pointed iron spike is used.

Polishing done on bow run wheels (Jhunjun polish) has ceased to exist for the last 30 years. However, some craftsmen like Mr. Anwar Hussain
still retain the art, although only meant for display. Polishing still remains a manual art done with the use of hands. The only difference is that instead of the hand held bow, a $\frac{1}{2}$ HP motor runs the required polishing wheels against which the polisher holds the chipped stone blank to be polished while rotating the blank on a flow. The polisher uses four wheels, one after the other, in order to get the final polishing. These are: (i) the emery wheel (for shaping), (ii) the diamond wheel, (iii) the lac-silica wheel, and (iv) the wooden wheel with varnish being applied on regular intervals (Figs. 25 a-d).

Emery grinder wheels are bought from Jaipur and Mumbai and diamond wheels are procured from Jaipur. Lac-silica polishing wheels are made at Khambhat and in recent past, only two craftsmen have been producing this wheel: Anwar Hussain, a Muslim, and Vijay, a Rana.

In the lac-silica wheel, the craftsman puts the lac on a terracotta pan on slow fire and when it starts melting, he adds 180 to 600 mm silica (depending on what stone the craftsman intends to polish on the wheel) slowly and stirs the same until the liquid of lac and silica becomes comparatively thick. By applying a little oil, the craftsman pours the liquid on the floor and gives the same a circular disc shape with the use of a copper strap for size and polished stone for compactness. While it is still not hard, a perforation in the centre is made by using a measured stick.

In the wooden polish wheel, Alusri wood (also used for making match sticks) is preferred. Earlier this stage was done on a wooden wheel mounted with leather (Fig. 26).

The stand for polishing wheels is either made of thick wood or of cast iron to the size of almost 3 feet and the height of about 2 feet. A leather belt is attached to the bottom portion of an axel, which is fixed in the centre. The other end of the belt is attached to a $\frac{1}{2}$ HP motor at a distance of about 4 metre (Fig. 27).

Mass scale polishing is done by the electric-run wooden drum, as has been described by Posshehl.

In the recent past, many a time there have been attempts to hire craftsmen from Khambhat to other
cities like Bharuch, Pune and Ayodhya for polishing units, but none of these units survived for more than a year.

Since the 1950s to about 2010, most the household in Kambhat, having a person or two with interest in drilling or to support the family

Fig. 24. Cutting and grinding of dabkas (a: cutting; b: grinding).

Fig. 25. Polishing of bead blanks on rotating discs (a: emery wheel; b: diamond wheel; c: lac-silica wheel and d: wooden wheel).
Fig. 26. Leather-mounted polishing wheel.

Fig. 28. Electric drilling machine at work.

Fig. 27. Polishing unit at work.

economy, slowly and steadily acquired electric bead drilling machines (Fig. 28). However, now there are only three electric drilling units that are functional in Khambhat, while the rest have turned back to traditional hand bow drill method of using the diamond-tipped drill. This is more due to the fact that the electric drilling machine has been unsuccessful for long drills, while the higher cost of electricity has also contributed to some extent.

Traditional drilling of beads has been mastered by a few agriculturalists (who supplement their agricultural earning though this during off seasons)
from surrounding villages. However, this has remained an individual effort and no drilling unit can be found outside of Khambhat. The villages in which agriculturalists involved in drilling are: Ambakhar (3 km from Khambhat), Kharadi (4 km from Khambhat), Kali-Talavadi (5 km from Khambhat), and Nagra (6 km from Khambhat). Some agriculturalists in the villages of Sakharpur and Nana-Kalodra were also practicing this activity until a few years ago. However, with the death of the last drillers some seven years ago at Sakharpur a few years earlier to that at Nana-Kalodra, the activity has been discontinued there.

Drillers shape and mount the diamond heads (bought from Surat) on the steel drill rod, which is hafted to a cylindrical polish wood (Fig. 29). For making the first dimple or punch on both the ends of the polished/shaped bead blank, the driller first uses the single diamond-tipped drill and then, replacing the same with a double diamond-tipped drill, he carries out the drilling with a bow drill on a stand in the identical procedure that has been practiced since this craft has been known (Fig. 30 a-b).

In the drilling process, the agate powder is regularly mixed with the water pot kept on tripod as the driller dips the drilled and, many a time, the half-drilled bead in the pot again and again to clear the hole. The agate powder mixed with water drips in the drilling process and gets collected in the bowl kept below. This collected mix is again poured in the pot on the tripod and thus the vari is accumulated in the base pot and the bowl. Tamarind solution is mixed with the water in the pot when the drill is to be made on unfired stone to avoid the breaking of the diamond tip.

Stones other than carnelians are artificially coloured by soaking the same in different acids (Table 4) for a time period varying from 15 to 30 days (Fig. 31). This is preferably done during the summers, but never in rainy season, when the stones are dry and are without any moisture.
Table 4: Acids used for bringing different colours in the stones.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Acid used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqua</td>
<td>Copper nitrates</td>
</tr>
<tr>
<td>Black</td>
<td>Sulfuric + Glycerin + Water</td>
</tr>
<tr>
<td>Blue</td>
<td>Potassium ferrocyanide</td>
</tr>
<tr>
<td>Green</td>
<td>Ammonium dycromate</td>
</tr>
<tr>
<td>Lemon</td>
<td>Potassium chromate</td>
</tr>
<tr>
<td>Orange</td>
<td>Chronic</td>
</tr>
<tr>
<td>Parrot</td>
<td>Copper chloride</td>
</tr>
<tr>
<td>Pink</td>
<td>Potassium permanent</td>
</tr>
<tr>
<td>Red</td>
<td>Iron + Nitrate</td>
</tr>
</tbody>
</table>

The use of Orgon chemical has been increasing in recent years. This is one chemical that can be poured in a mould in layers, mixing the different colour stone chips in between, to produce beautiful stone artefacts.

The export via Mumbai has been very limited for some decades now due to the door-step courier services available to the craftsmen and dealers at Cambay. The modern amenities have facilitated direct export of items to places in USA, Australia and Canada from Cambay itself. Now, neither any lapidary products from Cambay (Fig. 32) are exported to China nor any raw materials are imported from there. But many finished Chinese lapidary products have started replacing local products at Cambay, which the tourists find cheaper. From 1975 onwards, Mozambique and other coastal African countries have put an unofficial ban on the import of lapidary product from Cambay. The local dealers at Cambay believe the reason for such a decline to be a change in the policy of the respective governments of those African countries.

The hexagonal carnelian beads (Fig. 33), which the Africans have always bought, were exchanged mainly with African gold and the governments are not forthcoming now to allow their gold to go out of the country in such exchanges.

Fig. 31. Artificial colouring of the stones using various acids.

Fig. 32. Carnelian, agate and other stone beads from Kambhat.

Fig. 33. The famed hexagonal carnelian and other beads from Cambay.
At present, carnelian beads are produced with customized design (oval and hexagonal shaped) only for the various communities of Nagaland state in Northeast India (Figs. 34 a-b). For the last 50 years or so, Banaras Beads Limited in Varanasi has been replicating these shapes in glass for the same market.

Now, there are only four independent beadmaking units, each one having 15-20 craftsmen working under the unit. However, a number of independent craftsman practise different lapidary activities on their own. There are 150 craftsmen working on wheels for cutting the stones, 50 on emery and diamond polishing wheels, 50 on wooden and lac wheels, and 30 involved in drilling.

Labour charges in this cottage industry are always decided on “per unit/piece” rather than on per day basis. The charges for cutting big stone are Rs. 80 per kg, whereas for small stones (dabka) the charges are Rs. 1 per piece. Rounding the dabka is charged at Rs. 1.30 per piece. Other charges are as follows: chiselling 1st stage at Rs. 1 per piece; chipping and stage at Rs. 1 per piece; shaping on emery wheel at Rs. 1.50 per piece; polishing on diamond and wood wheel at Rs. 3.5-4 per piece; driller at Rs. 5-6 per piece (as an exception, master craftsman such as Pratap Bhai of Nagara, who is famous for traditional way of drilling, charges Rs. 30 per piece).

In the last 30 years, women of Khambhat have also started working in polishing and chipping. A few women from Sakarpur work on emery wheel and a few more on cutting machine for small stones at Sakarpur and Amen Samant village.

By 2000, all forms of guilds had ceased to exist, not even in symbolic form. Anwar Hussain has been a lapidary craftsman who heats, chips, chiels and polishes stones for bead since 1995 and has learned the art from his father (who was born in 1950), but has never been a member of any guild. There are a good number of such multi-tasking craftsmen now in the town of Khambhat. Thus, the guild rules and restrictions that the craftsmen of one sub-specialized craft are not allowed to encroach the work of other sub-specialized crafts no longer exist. The taboo that was very vehemently followed earlier has lost its power for some years now.

Present Nawab, Mr. Mirza Zafar Ali Nazmesani, aged 75, is the last Nawab and still lives in Khambhat, but has no role to play in the lapidary industry. However, whenever he visits the craftsmen, the latter gift him the best specimens. The Nawab sometimes gives some money in return.
Though the training in lapidary craft is still hereditary in nature, yet two attempts were made by Mr. Anwar Hussain—once in 2008 and again in 2011 with the support of a Central Government scheme—to run a six-month training programme with 10 students in each batch. The teacher got a monthly payment of Rs. 10,000 and students got a monthly stipend of Rs. 2000.

TRANSITION

Dr. Hove brought the knowledge of bead-making at Khambhat into limelight for the first time to the rest of the world. Fulljames gave the details of quarrying and baking of stones to his level best. Summers discussed in detail about the source of raw material apart from a detailed description of bead-making and polishing by using local names and terminologies. Campbell talked about the organizational structure of the beadmakers, i.e., the guilds. Hamilton brought to our notice the heavy export and use of Cambay carnelian products and the position of the merchants dealing with the same in the Arab world. Watt revealed the use of oil and sulphuric acid to brighten the colour of the stones. Arkell informed how the European replicas were affecting the Cambay products. Mackay emphasized on the importance of studying the contemporary beadmakers to interpret the archaeological finds in a better manner. Trivedi not only provided minute details of the lapidary activities and presented the same with illustrations, but also dealt in detail with the drilling process. Possehl, Francis, and Rao, as well as Kenoyer, Vidale and Bhan, of late, have described the bead crafts with universally accepted archaeological terminologies besides emphasizing on the application of ethnographic archaeology and science in the study of beads. All this have helped bringing the study of beads in South Asian archaeology to the level next only to ceramics.

A gently waving alluvial plain, Cambay has no rocks but a few pebbles. Yet it has been the lapidary of the best stones for the world for thousands of years. Strategic location of a place in terms of communication is an important aspect, as good as the source of raw materials, for any craft to take the form of such a large-scale international trading centre. Summers, who gave the first detailed account of the source of raw materials and expenses incurred on the same to bring to Cambay, did not mention much about the raw materials that were bought to Cambay from out of Gujarat, except for lapis lazuli, obsidian and blue stone, which used to reach Cambay via the Bombay route. With the betterment in transportation, larger amount of stones were being brought from other states in India, which kept on increasing by every decade. Before the railway track between Ahmedabad and Bombay was laid out, the transportation of raw materials to Cambay from their sources and that of the finished products from Cambay to the trading centres of Bombay and Vapiwul Bunder near Diu was done with the help of animals. For transportation to far-off places, river and sea routes were utilized, and boats and canoes were the principal mode of transport. With the introduction of railroad and the development of roads and communications facilities, the mode of transport first shifted to buses and trucks and now to various courier services.

Although there have been many source zones of Indian agate, Rajpipla remains the place that has retained its unique position as an important centre of agate supply (Fig. 35). There has hardly been any change in the process of mining the agates in Ratanpur since they were first reported. The only change that can be seen has been in the selection of places for fire working and its process. Khambhat is now preferred more as the place for firing than Ratanpur.

The knowledge of different techniques for brightening the colour of the stones among the Gujarat miners is an age-old art. Almost all the references made about the techniques mention two
forms of baking of stones to get the desired colours: either directly in the trench, i.e. bhasla or by keeping the stones in a pot, i.e. handla. However, the use of oil and sulphuric acid for bringing brighter colours has also been in practice for centuries—to not surprise Dr. Watt in last quarter of the 19th century. Firing in the brick-made chamber above the surface has now become the trend than in a dug-out trench. Although the bhasla method had become popular in the mid-20th century, the only method practised today is handla. Nowadays, soaking in different acids for a long time is practised for bringing different colours to the stones.

Fulljames' observation that only sheep dung (whereas others referred to goat and cow dung) was used for fuel in baking the stone, and also the fact that stones which were not burned sufficiently were laid to be used the next year, appears more of an observation of a particular baking group than a general practice. Otherwise, one has to believe that baking was a one-time activity in a particular locality done by a particular group every year. Apart from Fulljames, nobody else mentioned about the covering of the holes of the pots before firing and evaluating the status of baking with the checking of white spots during the firing process.

Motorized cutting machines have been introduced in chiselling and shaping. However, chipping of nodules is still done on iron spikes with the help of buffalo horn hammer, which has been the traditional method for centuries now.

The high, unparalleled standard of polishing and drilling has been the trademark of Cambay lapidaries, which has brought the universal status to these products as 'Cambay Stones'. Thus, it is but natural for the craftsmen to resist every early attempt to record the polishing and drilling in details. This is visible in the works of Dr. Hove and Fulljames, who appear to have not had complete access to the entire polishing and drilling units but had only been informed about the practices. Otherwise, neither Dr. Hove would have written that chiselling was carried out on a horizontal piece of iron, nor would Fulljames have written that the final
polishing was done by shaking a number of beads together in a leather bag and drilling was done with the help of diamond dust and water. Their detailing would definitely have been elaborate with many steps involved, if they had observed the processes with their own eyes. However, the observation made by Dr. Hove on the polishing on sandstone, where a man uses two leather straps without any bow strap, is interesting as this is the only reference that states that in the 18th century, too, there was some kind of rotating used for the grinding and polishing stone bead blanks in a horizontal manner than vertical, an option that was not really explored till the electric motor was brought into use.

There has been a big change in the grinding and polishing methods. It has first shifted from clam hand-held nodule grinding and polishing on sandstone slabs and wooden boards to hand-held bead blank against the bow drill run on different ratios of emery wheels. The emery wheels have been now replaced by motorized emery, diamond and wooden wheels. Vury and emery powder have been the components in this grinding and polishing stages throughout its history.

The final polishing which used to be in a leather bag has been completely discontinued. After going through an intermediary phase of being rotated in a tin and copper barrel, now for some decades, it is being done in motorized wooden barrel. All this while, the grinding mixtures have remained the same, with the use of vury, emery, and fine silica.

There has been absolutely no change in the drilling of long beads. It has always been done with the use of hand, a method known as the bow drilling method with the use of diamond-tipped drill bits. However, nobody actually noticed the use of double diamond drill until the last quarter of the 20th century. For the drilling of small and thick beads, electricity-run drilling machines were so rampantly used that they became an integral household item in the town of Kambhat by end of the last century. However, they are on the verge of disintegration, due to excessive costs involved with this drilling machine, craftsmen are now gradually shifting back to the traditional bow drill.

The payment for labour has always been on the basis of 'per unit/piece' rather than on a daily basis. The export of products is now carried out directly from Kambhat owing to the availability of courier services. In earlier times, the export was done mainly via Mumbai or other trading centres.

Everyone from Dr. Hove to Prof. Posselt advocated that the sub-craftsmanship in the bead work was entirely compartmentalized and one was unacquainted with the work of others. This scenario is gradually changing in the present-day Kambhat. Craftsmen are now trying to master all activities of beadmaking such as baking, chiselling and polishing. However, drilling continues to remain a specialized craft.

It is interesting to note that the local terminology for different crafts has changed over a period of time. This is perhaps the effect of the community (religion and caste) with whom the earlier researchers had interacted. Besides, it is an established fact that more communications with the outside world leaves its mark on local terminology with regard to practices and tools. The town of Cambay has been one of the few cities in India that has had a long and continuous contact with the outside world on a day-to-day basis.

The fact that the admission fees for memberships to now obsolete bead-related crafts guilds were in the form of a few hundred rupees in mid-19th century speaks about the volume and importance of the lapidary production and trade. A hundred rupees in 1850s, which became close to Rs. 200 to begin with and could be as high as Rs. 800 required to be spent on initiation dinners—in the fourth quarter of the 19th century, was indeed a very big amount.

The preference to gender and age of the working class at Kambhat has changed all the time according to the need of the time. Fulljames recorded that the chiselling of stones was performed mainly by women, boys or young girls; however,
there is no other supporting references to anyone else in this regard. Campbell was categorical that women and children did not perform any duties in the skilled labour work. At present, women, girls and children form an integral part of the workforce with regard to chiselling of stone as well as in the cutting, shaping, and polishing units at Khambhat and its surrounding villages.

This is one of the ancient crafts which is secular in its theme and has not been controlled by any particular community or caste for a long period of time. Communities from different origins from all walks of life have worked. Ranging from the Bhils to the Kolis, the Kanvis to the Baniyas, the Bohras to the Patils as well as the Muslims—all have worked together in this craft at different stages. The craft of beadmaking and its trade, indeed, puts a question mark on the hegemony of the caste-controlled classes or occupations of the traditional Indian societies.

NOTES

1. Agate, in Gujarati, is called ghar and when worked up as carnelian, it is known as akik.
2. Throughout the chapter texts inside [ ] is the insertion of the author.
3. Baba Ghor, a 1500 CE saint from Ethiopia, had led a large contingent of Muslims to settle in the town.
4. Limoda is within four miles of the mines.
5. Lapidary products by the Unit established by the Baba Ghor used to be known as Ghor articles.
6. The admission fee for membership to this panchayat was in the form of a few hundred rupees, which was spent in dinners.
7. Stones are brought to the Cambay dealers by merchants, who, paying a royalty to the Morvi Chief, hire labourers, generally Kolis, to gather them.
8. These are picked up by the Bhils and sold to a Mandva Bohora, who then disposes them to the Cambay stone merchants from 6s. to 24s. for Rs. 3-12 per man.
9. Later this typical stone, out of which the drill bits were made, was named after the first name of Mackay, i.e. Ernestite.

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