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Peter Francis Jr.

THE STONE BEAD INDUSTRY OF SOUTHERN INDIA

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Although previously unrecognized, South India was once home to a major stone-beadmaking industry. At its zenith in the early centuries A.D., it exported beads eastward to other parts of Asia and westward to the Roman Empire. South Indian gems were of such importance to the Roman West that the region deserves the title of "Treasure Chest of the Ancient World." Research has identified the probable sources of nearly all the raw materials used, the lapidary centers, and the trade routes over which the finished beads would have traveled. Additionally, it has revealed that the principal participants in the industry were the Pandukal people, opening a new chapter on the widening understanding of this community.

STONE BEADMAKING IN INDIA

India has long been celebrated as a source of semiprecious gemstones as a result of the mass volcanism that followed its separation from the southern supercontinent of Gondwanda some 60,000,000 years ago (Wadia 1990:275-286). This resulted in deep lava flows known as the Deccan Trap.[1] Superheated water containing dissolved chemical substances percolated into cavities in the lava. As the water cooled, minerals precipitated in these cavities, leaving semiprecious stone deposits throughout the Indian peninsula.

India was an early leader in exploiting these mineral riches and turning them into beads. From about 4000 B.C., hard stones, notably carnelian, were being worked into beads at Mergarth, now in Pakistan (Jarrige and Meadow 1980:130-131). The culture that developed at Mergarth was a forerunner to the Harappan or Indus Valley Civilization (2600-1900 B.C.). This, the most extensive of ancient civilizations, exploited semiprecious stones from as far away as northern Afghanistan (lapis lazuli) and the Narmada River Valley (carnelian). Trade in these stones is very ancient.

Since Harappan times, the center of India's stone bead industry has been located around the Gulf of Cambay (Khambhat) (Fig. 1). The lower reaches of the Narmada River are rich in secondary deposits of gemstones washed out by water action and brought down the river. Lothal, a Harappan site near the head of the Gulf of Cambay, was a major lapidary center (Rao 1973).

The Romans have left written accounts of the stone-bead industry in this region. Both *Periplus of the Erythraean Sea* (Casson 1989), written by a Greek sailor in the mid-1st century, and *Geographia*, scribed by Claudius Ptolemy (Stevenson 1991) about a century later, outlined its major components. Early European visitors to India, notably Duarte Barbosa in 1514 (Dames 1918, I:142-145), expanded on the details of the trade. A.J. Arkell (1936) brought the industry to general scholarly attention. Evidence both from Western and Indian sources has been employed to build a history of the enterprise (Francis 1982). The study of the industry at Cambay continues to attract scholars (Kenoyer, Vidale, and Bhan 1991, 1994).

What has not been appreciated is that India was home to two major stone-bead industries. The western one, concentrated in the modern state of Gujarat, has received considerable attention and is well known. The other was located in the southernmost part of the Indian peninsula. It thrived for some two millennia and at times was even more vigorous in international commerce than the western one. It has gone unrecognized for a variety of reasons, but is well deserving of attention.

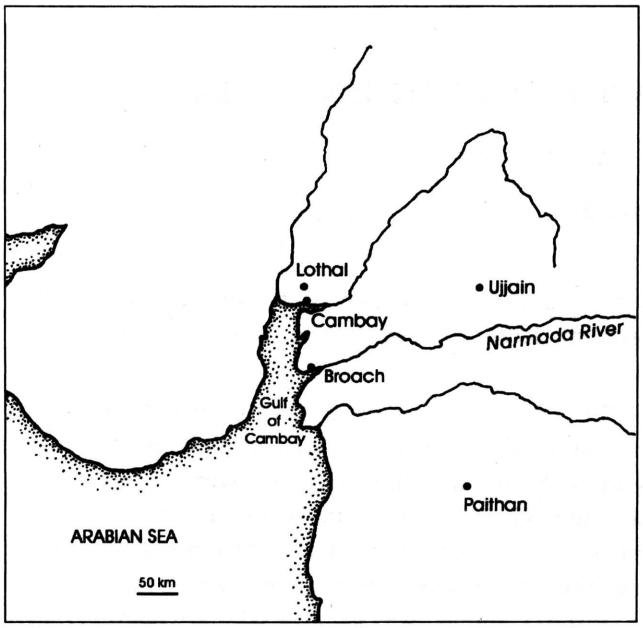

Figure 1. The region of the Gulf of Cambay showing sites mentioned in the text (drawing: D. Larsen).

THE SOUTH INDIAN STONE-BEAD INDUSTRY

The conditions for the growth of a stone bead industry in South India are similar to those in western India. The same geological processes that blessed northern regions with gemstones were also at work in the south. By the time of the development of the three southern Tamil Kingdoms (the Cola, the Cera, and the Pandya), in the late centuries B.C., international trade was officially encouraged and beads were an important export. The sources of raw materials were exploited, lapidaries founded, and trade routes established to move the beads to far-flung customers.

To examine South Indian stone beadmaking, we shall begin where the archaeological record opens, at the site of Arikamedu, in the Union Territory of Pondicherry, on the southeast coast (Fig. 2). Arikamedu lies along the last bend in the Ariyankuppam River shortly before it flows into the Bay of Bengal. India has few natural harbors along its coasts, so it was common for upriver areas to be used as ports.

Arikamedu is a celebrated archaeological site, probably the most famous in South India. It was discovered in the 1930s (Jouveau-Dubreuil 1940) and excavated three times in the 1940s; first by an amateur French team (Faucheux 1946; Pattabiramin 1946; Surleu 1943, 1946), then under the last British director-general of the Archaeological Survey of India, Sir Mortimer Wheeler (Wheeler, Ghosh, and Devi 1946), and then by a French team lead by Jean-Marie Casal (1949). Directed by Vimala Begley of the University of Pennsylvania and K.V. Raman of the University of Madras, the most recent excavations took place between 1989 and 1992 (Begley 1993, 1996).

The initial interest in Arikamedu was that Romans had once traded there. A great many beads and bead wasters were excavated and picked up from the site, most being housed in the Pondicherry Museum. This material confirmed that there had been a major stone-bead industry (as well as glass) at Arikamedu, but its wider implications were not understood.

The stone beads are intriguing from several standpoints. One is that Arikamedu appears to have been the first place to have used, or more properly, to have altered certain stones, including the production of black onyx by chemically modifying banded agate, and creating citrine or golden quartz by heat-treating low-quality amethyst.

A crucial point is how the stones were worked. All references to stone beadmaking in India are based on the process used in the western industry and still observable today in Cambay, the modern lapidary center (Fig. 3a-d). After an initial heating to make the stones easier to flake, they are chipped into roughouts by being held against an iron point and hit with a hammer made of water buffalo horn mounted on bamboo. Then they are ground; traditionally against stones but in the last few decades against electrically driven lapidary wheels. Next, they are drilled, a process involving double-tipped diamond drill bits powered by a bow drill. Polishing follows, traditionally done by hand against fine-grained surfaces for faceted beads or tumbled in leather bags for round beads. This stage has also been mechanized in recent years.

Some beads were made at Arikamedu in the same way, but about half those of crystalline quartz (rock crystal, amethyst, and citrine) and a quarter of the beads of microcrystalline quartz (agate and carnelian) were made by a different process (Fig. 3e-h). It also

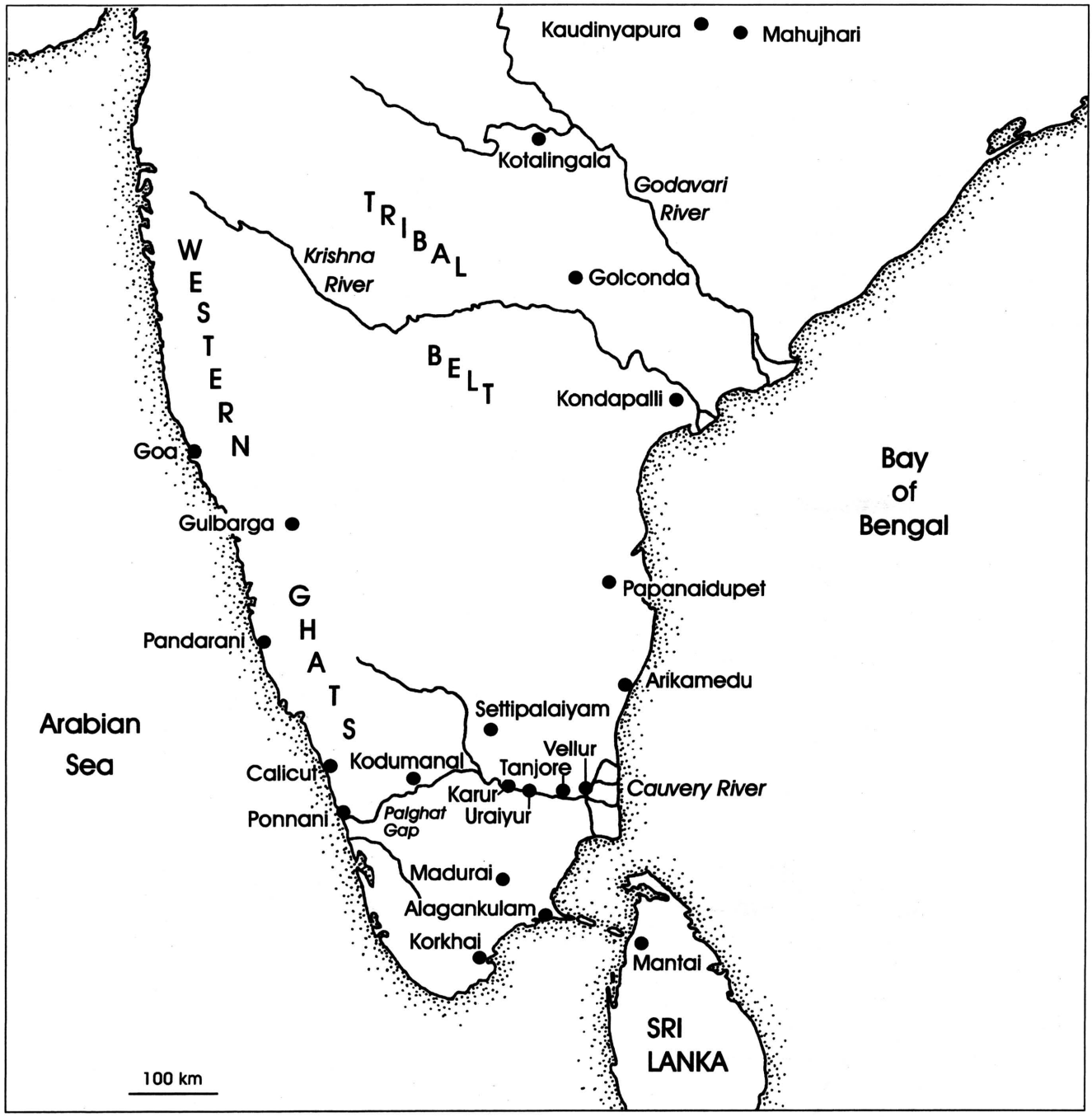

Figure 2. Southern India showing sites mentioned in the text (drawing: D. Larsen).

began with the chipping of roughouts. The roughouts were not ground, however, but pecked by being repeatedly hit with a pointed implement to shape them (Pl. VA top). The precise way in which this was done has not been determined. They were then polished, and drilled.

Two different stone-beadmaking methods were thus in use at Arikamedu. The initial chipping into roughouts was the same in both, but the next step differed. In one case the stones were ground; in the other they were pecked. Not only were these steps distinct, but in the grinding method the bead blank was

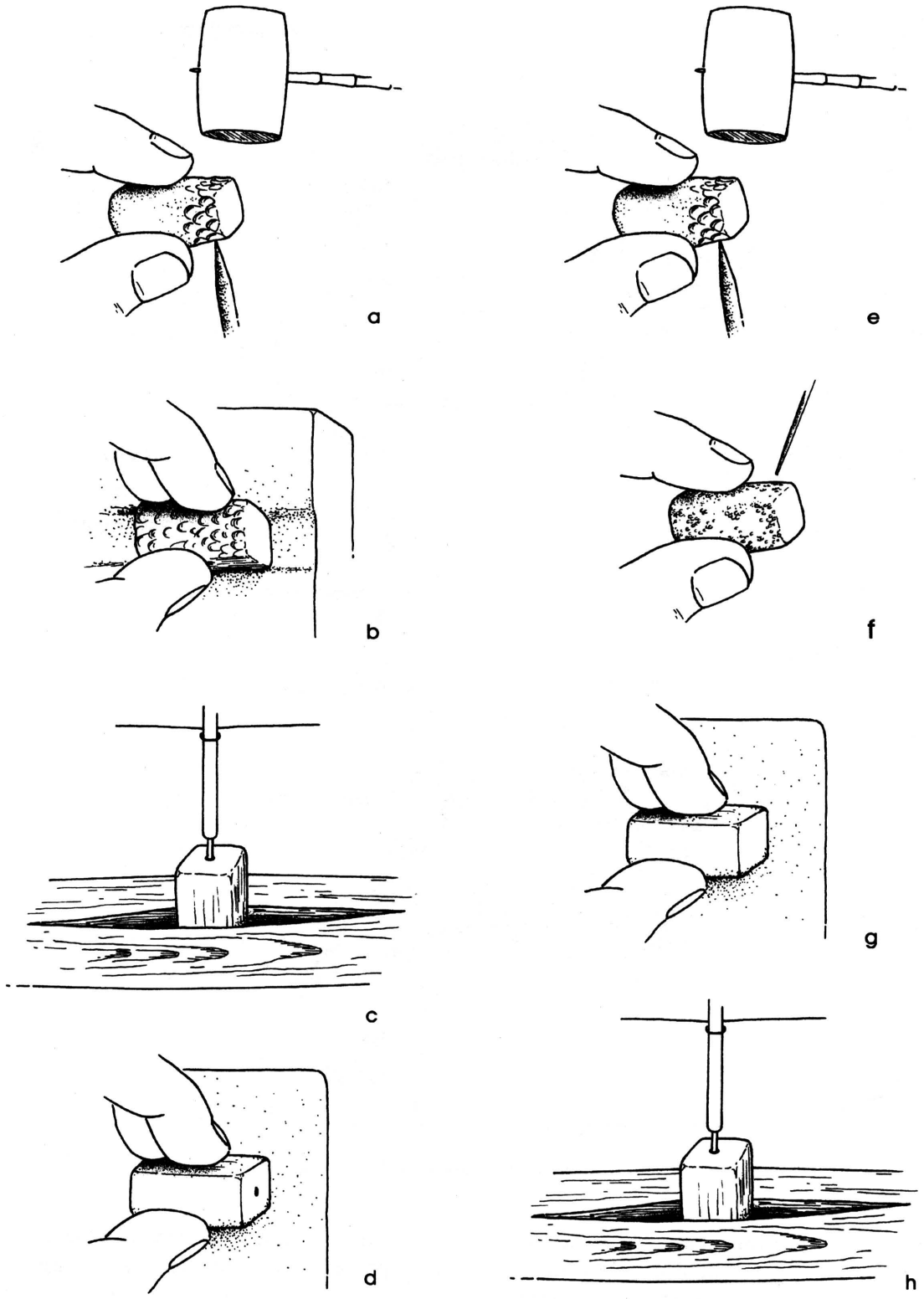

Figure 3. The steps of stone beadmaking. *a-d, the grinding method:* a, chipping; b, grinding; c, drilling; d, polishing; *e-h, the pecking method:* e, chipping; f, pecking; g, polishing; h, drilling (drawing: D. Larsen).

drilled next and then polished, while in the pecking method it was polished before being drilled.

Why should this be? When I first perceived this difference (Francis 1988), I had no definite answer. While the majority of the crystalline stone was worked by the pecking method and the grinding method was used for most of the microcrystalline stones, there was, nevertheless, considerable overlap between the groups. Perhaps the crystalline stones were easier to peck than grind, but had this been the only consideration, one would have expected a greater percentage of each material worked in one way or the other. Furthermore, this did not explain why the polishing and drilling steps had been reversed.

Another possibility was that the differences were chronological. The early excavators of Arikamedu were not interested in what was going on in the Indian city, but concentrated on the Roman connection. Nor were they very interested in beads. The data preserved from the 1940s excavations tell us little about the chronological position of the beads. What evidence did exist suggested that the two methods were used concurrently. The 1989-1992 excavations confirmed that the two methods were used concurrently throughout the history of the site.

A third possibility was that there were two different beadmaking traditions or "schools" operating at Arikamedu. The facts best support this hypothesis. Stone beadmakers from western India may well have been attracted to the flourishing lapidaries at Arikamedu, but another group of stone beadmakers was present as well.

THE PANDUKAL PEOPLE

The Pandukal people are usually known in the archaeological literature as "Megalithians," from misguided analogies of some of their burial practices with those found in Europe. The term "Megalithians" has many problems, and I have adopted Leshnik's (1974) suggestion of calling them Pandukal (*pandukal* being Tamil for "old stones," again taken from their burial practices).

For a long time, these people were only known from their grave sites. They would expose the dead for some time and then gather the cleaned bones and bury them, often in cists or sarcophagi, marking the tombs with stones. Sometimes these were very large stones (megaliths), but often they were just stone circles.

This burial practice is believed by some scholars to be intrusive to India and these people were possibly outsiders. They may have entered what is now India early in the second millennium B.C. and were settled in the central peninsula by the middle to late second millennium. Another early date for them (905-780 B.C.) is at Korkhai, at the very tip of the peninsula, once the center of pearl fishing (Moorti 1994:4-5).

As the Pandukal people moved into South India, they introduced several traits: horsemanship, iron and gold technologies, and stone beadmaking. Their distinctive, though not unique, pottery is known as red-and-black ware, a finely polished ceramic produced by firing the pots in an upsidedown position. They also used a unique symbolic or writing system, not yet interpreted.

The work of archaeologists at Deccan College, Pune, and Tamil University, Tanjore, in the last few decades has given us a more complete idea of the life (as opposed to just funerary practices) of these people. Twenty-five years ago there were no known habitation sites connected with the Pandukal people. Dozens have since been discovered.

A picture of the lifeways of the Pandukal people is now emerging. Their village economies were not agriculturally based. Rather, the villages were crafts centers, specializing in iron smithing, gold smithing, and stone beadmaking. Despite the wide range of tools they made, plowshares were not among them. Pandukal diets relied on meat. The meat was supplied by large herds that must have grazed over considerable territory. The herds were tended by the young men of the community, whose extensive horse riding is evidenced by the trauma to their leg bones (Deo 1983; Leshnik 1974; Moorti 1984-1985, 1994; Rajan 1990:98).

PANDUKAL BEADMAKING

The earliest identified Pandukal beadmaking site is Mahujhari in the Vidharba region of Maharashtra and dates around 900 to 700 B.C. (Deo 1973). Agate was widely used there, cut from nodules gathered along nearby rivers. The pecking technique was employed to form them into beads (pers. obs.).

The site of Kodumanal in Periyar district, Tamilnadu, was founded by around 500 B.C. (Rajan 1990). Kodumanal is very close to quartz (and probably amethyst) sources, as well as beryl and sapphire deposits. Beads excavated from Kodumanal included those of carnelian, yellow carnelian, onyx, quartz crystal, and amethyst (Pls. VA bottom, VB top). All were made by the pecking technique. The products were quite beautiful, particularly the quartz and amethyst beads, which were often faceted and highly polished by hand (pers. obs.)

Kodumanal can be identified with Kodumanam which is mentioned in the *Padirruppatu*, a work of the Tamil *Sangam* literature (ca. 300 B.C. to A.D. 300). It was famed for its goldsmiths. At least some of the gold used by the jewelers probably came from the melting of Roman gold coins found as "hoards" in particular abundance around Kodumanal (Wheeler 1954:137-145).

A distinctive Pandukal bead is the "etched carnelian," decorated with indelible white lines added by means of an alkali. The technique dates back to the Indus Valley Civilization. By the Early Historic Period (ca. 500 B.C. to A.D. 500), there were two regions in India that were making beads with characteristic designs. They have been designated northern and southern (Dikshit 1949), the latter now understood to be Pandukal. Unperforated etched carnelians of the "southern type" have been found at Pandukal levels at Kaudinyapura (Dikshit 1968:88-89) and Mahurjhari (Deo 1973:32). K. Rajan (1992:pers. comm.) believes the numerous etched carnelians at Kodumanal were locally made and I believe the same was true at Arikamedu, where the beads are common in local Pandukal graves.

Kodumanal is also apparently the lapidary at which lapis lazuli was cut and distributed to South Indian sites. This precious blue stone is rare in northern India except in the west, but is found at many sites in the south (Pl. VB bottom). Unworked pieces at Kodumanal suggest local cutting. The stone would have been exported from its source in northern Afghanistan through the Indus River port of Barbarikon, as reported in the *Periplus* (Casson 1989:75), sent to Muziris (see below) on the southwest coast of India, and then on to Kodumanal for working. The large number of Pandukal etched carnelians from northern Afghanistan that are now on the antiquities market were apparently part of this exchange.

By the second century B.C., Pandukal people settled at (and probably founded) Arikamedu. K. Rajan (1992:pers. comm.), the excavator of Kodumanal, puts the decline of beadmaking activity there to the period between 150 and 100 B.C. There may have been a physical movement of beadmakers from Kodumanal to Arikamedu.

THE SOURCES OF THE GEMSTONES

A variety of raw materials were worked into beads at Kodumanal and Arikamedu. Northern sources have been suggested for the stones worked at Arikamedu (Wheeler, Ghosh, and Devi 1946:123), as well as for the carnelian used at Kodumanal (Rajan 1990:102). There are sources closer to the lapidaries than these, however, and a mechanism for bringing them to the beadmaking centers can be postulated.

The rock crystal, amethyst, and beryl worked at Kodumanal were locally obtained, and Kodumanal could have furnished quartz and amethyst to Arikamedu. Arikamedu itself has no deposits of gemstones because it is situated on a deep alluvial bed (Pascoe 1973, III:1896-1897). Other sources must be sought for the remaining stones employed at Arikamedu and for the carnelian and agate at Kodumanal.

The nearest source for carnelian is to the north, along the banks of the Godavari and Krishna rivers. These rivers, like the Narmada, have washed down stones from the Deccan Trap lava flows and deposited them near their mouths, a fact long observed (Newbold 1846:37). All the carnelian worked at Arikamedu was brought in as river-worn pebbles.

The source for Arikamedu's agates, always worked into black onyx, appears to be different, however. Raw agate at the site is in the form of chunks, not pebbles. Many similar agate chunks have been found together at the walled site of Kotalingala in the Karimnagar district, Andhra Pradesh, which is dated to the 5th to 2nd century B.C.[2] Kotalingala was built on the banks of the Godavari River. Evidently, a vein of

banded agate nearby or perhaps up the river was exploited by the Kotalingala lapidaries. The same source could also have served Arikamedu and Kodumanal.

The region between the Krishna and the Godavari rivers is a major source for two other stones. Golconda (Ellore) is the classical site for diamonds which were not then worked as gem stones, but used industrially to drill stone beads. Nearby at Kondapalli in the Guntur district, Andhra Pradesh, is a celebrated source for almandine garnets (Bauer 1968:304).

In sum, the Krishna-Godavari doab[3] is an area within easy reach of Arikamedu and provides carnelian, agate, almandine garnet, and diamonds (for drilling). Rock crystal, amethyst, and its derivative, citrine, probably came from Kodumanal. This accounts for all the stones worked at Arikamedu except for prase, whose source has not been identified, and hessonite garnet, which was obtained either from Sri Lanka or Vietnam (Francis 1995:6-7). Furthermore, this doab is the only part of India that supplies the principal minerals used for coloring the glass made at Arikamedu: wad (bog manganese), an impure manganese ore often containing cobalt, and free copper (Francis 1996).

During the early centuries of Arikamedu's existence, the Krishna-Godavari doab was relatively unsettled. It had no urban centers and only a few villages. It is within the area that Leshnik (1974:19-21) called the "Tribal Belt," occupied by the Pandukal herdsmen and other nomads. The young Pandukal herdsmen were in a perfect position to scout out raw materials for use by the artisans of the group. Many Pandukal sites are located at iron- and/or gold-bearing areas which may have been initially identified by these riders. The cattle keepers could also have discovered sources of semiprecious stones and brought the material back to the lapidary centers. I do not suggest that the equestrians dug the stones out of the ground themselves; they probably exploited local tribesmen to do the dirty work, much as the Bhils[4] do to this day for the western Indian industry.

TREASURE CHEST OF THE ANCIENT WORLD

Who were the consumers of these gemstone beads? Certainly, there were local customers. Stone beads are common in both Pandukal and urban Tamil sites, but the industry was also geared toward export.

On stylistic grounds, stone beads from South India can be identified in several Southeast Asian sites of the last few centuries B.C. and the early centuries A.D. These include flat onyx pendants found in Thai sites (pers. obs., National Museum, Bangkok) and at Oc-eo, Vietnam (Malleret 1962:214-215), as well as collar beads in the "Buni complex" near Karawang, Java (pers. obs., National Museum, Jakarta). Other stone beads in Southeast Asia may also have come from southern India, but more work needs to be done for this to be confirmed.

A major buyer of South Indian stone beads was the Roman Empire. Comparing the stone beads made at Kodumanal and Arikamedu with those most treasured by the Romans leads to this conclusion. In his *Natural History*, Pliny the Elder discussed gemstones, often mentioning their Indian origins:

1. "Beryls are produced in India and rarely found elsewhere" (Eichholz 1962:225).
2. "[The rock crystal] of India is preferred to any other" (Eichholz 1962:239).
3. "Here the first rank is held by the amethysts of India" (Eichholz 1962:239).
4. "The best [garnets] are the 'amethyst-colored stones'.... Many writers state that the Indian stone is brighter than the Carthaginian" (Eichholz 1962:239-241).
5. "There are also many other kinds of green stones. A member of the common class is the prase.... India produces... these stones..." (Eichholz 1962:255-257).
6. "Formerly, as is clear from the very name, sardonyx meant a stone with a layer of carnelian resting on a layer of white.... Stones that have now usurped the name... lack all trace of the carnelian of the Indian stone [and] come from Arabia...." (Eichholz 1962:233). This marks the change in fashion from the West Indian sardonyx to the South Indian (not Arabian) black onyx.
7. "[Second only to diamond] in value in our estimation comes the pearls of India and Arabia" (Eichholz 1962:213).

Not only are these Indian stones, but they are all but exclusively South Indian stones: the beryl of Kodumanal; the almadine garnets, prase, and black onyx of Arikamedu; and the pearls of Korkhai. Rock

crystal and amethyst are found elsewhere in India, but sites in the north are very poor in these stones compared to their contemporary South Indian counterparts.

TRADE ROUTES

The chief port used by the Romans in this trade was Muziris, on the southwest coast. The *Periplus* describes it thus: "Muziris, in the same kingdom [the Cera], owes its prosperity to the shipping from Ariakê [roughly Gujarat] that comes there as well as Greek shipping. [It exports] all kinds of translucent stones, diamonds, sapphires..." (Casson 1989:81-83).

The site of Muziris has never been precisely located. Casson (1989:296) places it near Cranganore, but this has not been verified. Nonetheless, it remained the chief trading port of South India for the Western world for centuries. Musaeus, Bishop of the Dolens, in an account of perhaps the 4th century declared it, "Muziris the Mart of all India on this side of the Ganges..." (Ambrose 1905:240). It figures prominently on the Peutinger Table, probably a medieval copy of a 3rd-century Roman map. It is, in fact, the most important city on the map east of Antioch (Stuart 1991).

Muziris not only traded by sea but also inland. The Tamil poem *PuRam* says: "and the merchants of the mountains, and the merchants of the sea, the city where liquor abounds, yes, it is Muziris..." (Méile 1940:93). Ptolemy dimly perceived its connection with inland sites. He placed it on the Psuedostomus (false mouth or inlet) River, and wrote, "Between the Psuedostomus and the Baris rivers... [are] Punnata in which is beryl... [and] Carura regia Ceronothi [Karur, capital of the Cheras]" (Stevenson 1991:154).

Three routes can be suggested for the transport of gemstones to Muziris for trade with the Roman West. The route or routes used may have been partially determined by which ethnic group controlled this aspect of the trade. All of the routes may have been used at one time or the other, or even simultaneously. They are:

1. *An overland route in the hands of Tamilians.* The beads from Arikamedu would have gone up the Cauvery River past Uraiyur, the Cola capital, and on to Karur, the Chera capital. Pearls from the south would have traveled overland through Madurai, the Pandya capital, to Karur. From Karur, the goods would have gone up the Cauvery a short way and then up the Noyil River to Kodumanal, where its stones would be added. From there, travel would continue up the Noyil to the Palghat Gap in the Western Ghats and then down the Ponnai River to Muziris.
2. *A sea route controlled by the Tamilians.* Beads from Arikamedu would be shipped to Alagankulam and transshipped through the reefs and islands of "Adam's Bridge" in the Palk Strait to Mantai, in northern Sri Lanka. There, pearls would be added and the whole sent to Muziris. The beryl and other beads of Kodumanal would arrive at Muziris through the Palghat Gap and down the Ponnai River. The sea route is known to have been heavily trafficked between Muziris and Arikamedu and beyond, as described in the *Periplus* (Casson 1989:89).
3. *A land route controlled by the Pandukal people.* A heavily occupied belt of Pandukal settlements, several of them rather large in size, running from the Palghat Gap to the delta of the Cauvery River, has been identified by Moorti (1994:17). He has put forward the idea that it was involved in commerce, including trade with Rome. This route would have linked Arikamedu to Kodumanal, and beyond to Muziris. It would leave out the pearl trade (there are virtually no Pandukal settlements between Korkhai and Madurai), but this could have been linked to Muziris by sea. Pandukal horsemen could have taken gemstones along this route with considerable speed. It would have the advantage of avoiding the inevitable taxes that the Tamil kingdom capitals would have levied on the cargo if the first overland route described here had been used.

Whichever route or routes were used, they all required cooperation between the Pandukal people and the Tamilians, as well as between all three Tamil kingdoms. This is not hard to imagine when the large potential profits from this trade are taken into account.

THE INDUSTRY IN LATER TIMES

South India remained a source of semiprecious-stone beads for many centuries after the period of intense trade with the Roman West, which ended in the 2nd century A.D. Dionysius Periegetes in the 4th century wrote in his *Description of the Whole World*: "along the course of mountain torrents [Indians] search for precious stones, the green beryl, or the sparkling diamond, or the pale green translucent jasper [prase], or the yellow stone [citrine], or the pure topaz, or the sweet amethyst..." (Prasad 1977:199). All these stones are South Indian gems, except the "pure topaz," which cannot now be identified.[5]

In the post-Roman era, trade in these gems continued. The Muslim traveler Ibn Khurdadhbeh, writing of western India in the mid-9th century, said: "crystal is obtained from Mulay and Sandan" (Nainer 1942:198). Sandan has not been identified, but Mulay is a transliteration of *malai* or "mountain," referring to the region beyond the Western Ghats. The Chinese writer Wang Dayuan in the mid-14th century reported that precious stones (*ya-hu*) were available from Fandariana (Rockhill 1915:484). *Ya-hu* may be a transliteration of *yaqut*, Arabic for precious stones, often of the corundum group. Fandaraina has been identified as Pandarani on the southwest Indian coast, to which the stones would have come from across the Western Ghats (Hardie 1985:19).

Later, European visitors remarked on this region as a source of gemstones. When Vasco de Gama opened the way to India for Europe in 1498, he returned with a letter from the Zamorin of Calicut for the King of Portugal promising "precious stones in great quantities," among other goods (Birdwood 1891:163). In the same century, the Russian Athanasius Nikitin wrote of his journey from Gulbarga to Calicut: "I went to Kooroola, whence the akik [agate] is produced and worked, and from whence it is exported to all parts of the world. Three hundred dealers in diamonds reside in this place..." (Major 1857, III:30). Kooroola has never been identified. There is a Curula city in Ptolemy's *Geographia* (Stevenson 1991:150), on the southeast coast, but whether this is the same place is not known.

Subsequently, the German Sebastian Münster (1559:1065) wrote of "abundant beryl, chrystophrase, diamonds, carbuncles [garnets], many pearls [or beads] and gems," all South Indian stones. The Dutchman John Huyghen van Linshotan, in 1598, made the astonishing statement that no rock crystal was found in India, that it was all actually "berylo," but that chrisolites, amethysts, and agates "are in great numbers found in Cambaia and Ballagatte, and are brought to Goa, to be sold, whereof they make Beads, Seales, Ringes, and a thousand such like curiosities" (Tiele 1885, II:138, 141). "Cambaia" is Cambay and "Ballagatte" (*balaghat*) is a designation for "beyond the mountains," in this case beyond the Western Ghats. Another notice came from François Pyrard in Goa in 1611, who wrote: "The ships leave Goa towards October, and touch at Cochin for precious stones and spices..." (Gray and Bell 1888, II:175).

A remnant of the industry continued through the end of the 19th century. W. Francis (1985:67), in the *Imperial Gazetteer* published in the 1890s, said that quartz was worked at Settipalaiyam in Coimbatore District and amethyst was exploited near Vellur in Tanjore District. Bauer (1968:477), writing in 1903, identified quartz beadmaking in Vellur. John Anthony and I have visited these villages, as well as the jewelry centers of Tanjore (Thanjavur) and Tiruchirappalli (ancient Uraiyur), and have found no beadmaking or memory of it in any of these places.

THE HIDDEN INDUSTRY

The South Indian stone-bead industry was probably at its height during the late centuries B.C. and early centuries A.D. It flourished during Roman times, when trade between India and the West, via Egypt, was most significant. It survived for many centuries thereafter, as shown by notices in Arab, Chinese, and European sources. Whether it was as strong in this later period as it had once been is difficult to judge from the scattered references that exist.

Yet, this industry has remained unknown. Why should this be? The last European mention of stones exported from South India is in the 17th century, about the time Arikamedu was abandoned (Francis 1996). It appears that the glass beadmakers of Arikamedu went to Papanaidupet, the village where glass beads are still made in the ancient manner. The fishers and farmers of Arikamedu settled less than a kilometer away at Virampattinam, the modern village by the site, which preserves the name of the original town.[6] The stone

Figure 4. Section of Ptolemy's map of India showing the western portion. Barygaza empor(ium) at the lower left is modern Broach and erroneously sits on the northern bank of the Namadus (Narmada) River. Upstream at the upper right is Ozene regia Tiascani (Ujjain, capital of Tiascani) (from a map published by the Government Photozincographic Office, Poona, 1880).

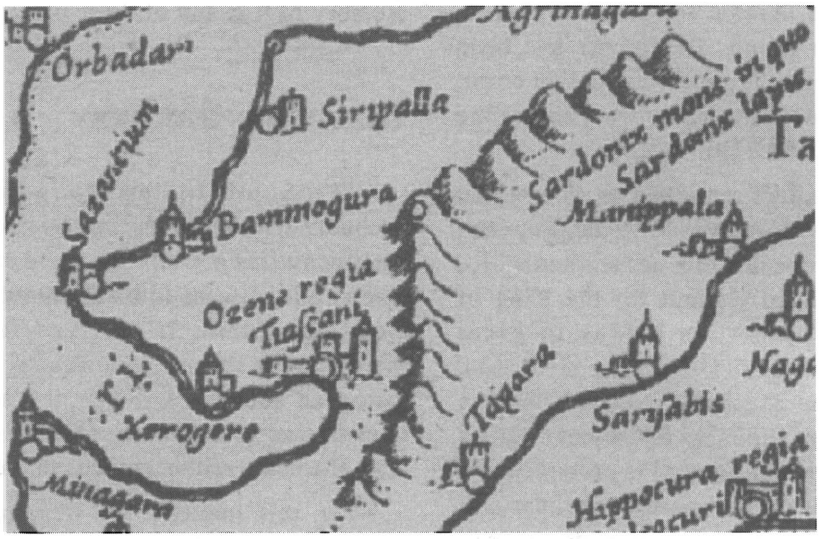

Figure 5. Another section of Ptolemy's map. Ujjain (Ozene) is center left. A mountain range is in its vicinity and ends with the "Sardonyx Mountain in which is the sardonyx stone." In truth, the source of the stones is across the river from Broach (from a map published by the Government Photozincographic Office, Poona, 1880)

beadmakers seem also to have left, migrating to other centers in South India, but never regaining their former status.

Visitors, writers, and officials of the British Empire preserved much of what is known of India as the subcontinent came under Imperial sway. Stone beadmaking in the South was apparently of such minor importance that it attracted little attention. In contrast to the agate-bead industry of western India, the weak remnant of the southern industry was not recognized for its historical role.

This "blind spot" is of great antiquity. The Romans had a good idea of the workings of the western agate-bead industry. The *Periplus* correctly identifies Broach (Barygaza to the Romans) as the port from which beads cut at Ujjain (Ozênê) were shipped westward. Paithan (Paithana) in modern Maharashtra was said to be the source of the stones (Casson 1989:83), but this is highly unlikely. Kingdoms generally hostile to Malwa, of which Ujjain was the capital, controlled Paithan, and the mines of Ratanpur were far more accessible to Ujjain.

Ptolemy's map (Figs. 4-5, cf. Fig. 1) shows an understanding of the political facts of the region. Broach (Barygaza) was the port on the Narmada (Namadus) River. Upstream was Ujjain (Ozzene), the capital of the kingdom. Beyond was a mountain range with the "Sardonyx Mountain" at its extremity.

But there were some misunderstandings. Ujjain is not on the Narmada and the stones come from the riverbed, not a mountain, but this was a common misperception. The greatest error was in placing the Sardonyx Mountain far inland, when the true source of the stones was just south of Broach. I suggest this is a case of Indian disinformation.[7] Had the Romans known that the stones were obtained right across the river from the port they were using, they might have been tempted to go and buy them there themselves, eliminating the Indian middlemen. With the Sardonyx Mountain indicated as being so far inland and the prevailing Indian opinion of this country as being inhabited by tigers, snakes, and "communities of vile caste," the Romans would not have been inclined to attempt a visit to the source.

Yet, there was no understanding of the mechanics of the South Indian stone-bead industry. All the Romans knew was the importance of Muziris as a port. Ptolemy places "Putanna in which there is beryl" vaguely inland. The importance of Arikamedu (the Podukê of the *Periplus* and the Poduca of Ptolemy) was never recognized. The land connections that bound Arikamedu, Kodumanal, and Muziris were lost on the Roman geographers.

SUMMARY

An industry producing beads of semiprecious stones operated in the far south of the Indian peninsula for some two millennia. At least in the early centuries of its operation, it was a major exporter of beads to Southeast Asia and the Roman West. Despite its importance, its very existence has gone all but unrecognized. Romans and later customers knew only the port through which the beads were sold.

The industry was innovative. It was the first to produce black onyx and citrine, to drill beryl crystals, and perhaps to use double-tipped diamond drill bits. It also pioneered the use of certain bead styles, among them collar beads, flat pendants perforated through the top edge, multi-faceted stone beads, and particular designs of etched carnelians.

The principal actors in the industry were the Pandukal people. Their young herdsmen were likely responsible for scouting out the sources of raw materials and bringing them to the lapidary sites to be processed. The stone beadmaking centers were the Pandukal communities of Kodumanal and, later, Arikamedu. The wealth of stone beads and pearls was sent either by land or sea (or by both routes) to Muziris for export to the West, along with pepper and other goods, making the port an essential trading station.

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ENDNOTES

1. These lava flows are several kilometers deep in many parts of the Indian peninsula. They are collectively known as the Deccan Trap. "Deccan" is derived from Sanskrit meaning "the south," referring to the peninsula (Yule and Burnell 1902:301) and "trap" comes from the Swedish for "steps" or "stairs," due to the step-like shape of the lava flows (Wadia 1990:275).
2. This important site, excavated by V.V. Krishnasastry, still awaits full publication. The information presented here is from personal communication with Krishnasastry and personal observation.
3. "Doab," literally "two waters," refers to the region between two rivers. Compare "punjab," the region of five rivers.
4. Members of the Bhil tribe dig the stones along the Narmada River. The "Agastya Samhita" section of the *Garuda Purana*, probably completed before 500 A.D., says that carnelians were found in areas "occupied by communities of vile caste" (Shastri 1968:247). "Caste" in this case is a translation of *jati*, which means either caste or tribe. Ratanpur, "Village of Gems," is the traditional center of this mining. John Anthony and I have visited it several times since our first visit in 1981. In 1995, we found no one mining at Ratanpur, and were advised to go to Damlai, about 15 km away, where we found the Bhils occupied in their work. Bose (1908) went through exactly the same experience in the winter of 1907-1908. The Bhils, being nomadic and non-agriculturists, prefer to switch locales every once in a while.
5. The Romans usually referred to peridot as topaz (Eichholz 1962, X:250-253), but peridot is not available in India. Moreover, this was called the "pure topaz" and evidently meant some other stone, not now identifiable.
6. Arikamedu is an archaeological name meaning "mound of Arakan," as a statue of this Jain avatar was found there.
7. Several other such cases can be cited, such as gold-digging ants, diamonds retrieved from eagle nests, and the enormously exaggerated size of Sri Lanka.

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Peter Francis, Jr.
Center for Bead Research
Four Essex Street
Lake Placid, New York 12946-1236

Plate VA. *India:* **Top:** Pecked hexagonal-bicone-bead roughout from Arikamedu; surface find; each scale unit is 2 mm (photo: M. Kenoyer). **Bottom:** Onyx beads, including an etched specimen (to left of label) from Kodumanal (photo: P. Francis, Jr.).

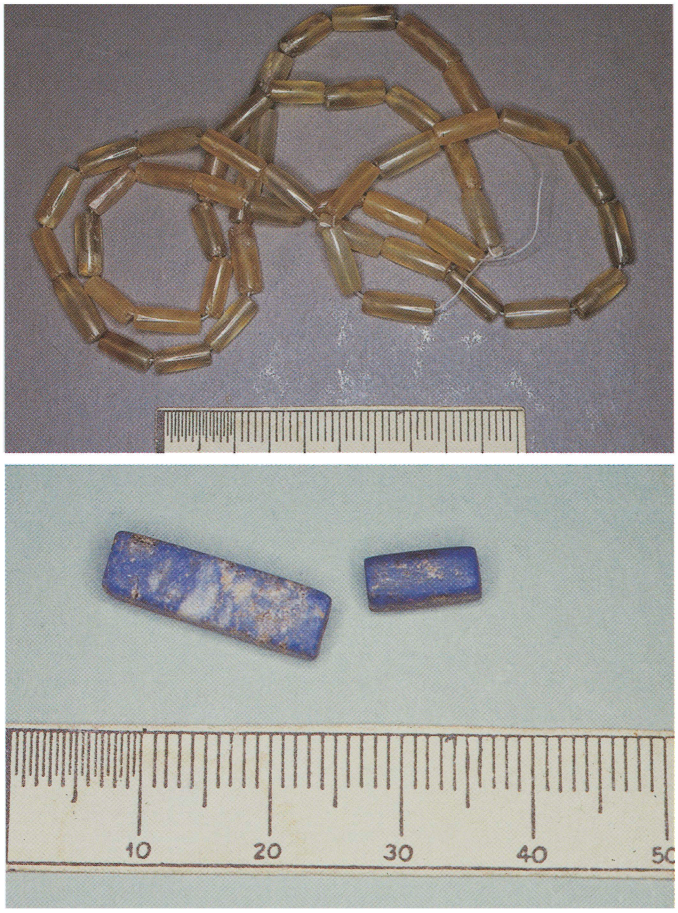

Plate VB. *India:* **Top:** Yellow carnelian beads from Kodumanal; scale is in mm. **Bottom:** Square tubes of lapis lazuli from Kodumanal. This is the most common shape of lapis bead found at South India sites (photos: P. Francis, Jr.).