

TRADITIONAL GEMSTONE CUTTING TECHNOLOGY OF KONGU REGION IN TAMIL NADU

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(Received 26 March 2003; revised 25 June 2004)

The paper discusses the traditional gemstone cutting technology in the backdrop of archaeological and literary evidence and its continuity through the ages to its present status. This traditional craftsmanship is studied with reference to present-day bead making in Kongu region of Tamil Nadu. It analyses the complex procedures involved in bead-making such as cutting, polishing and boring of the gemstones. The various processes and skills involved in making such beads are studied. The present socio-economic status of artisans is also studied.

Key words: Gemstones, Kongu country, Raw material zones, Sāṅgam literature, Traditional tools and technology, Socio-economy.

INTRODUCTION

The art of gemstone cutting occupies a unique place in human history due to its economic value and aesthetic appeal. The art of cutting and engraving hard semi-precious stones have been the most refined aspects of minor art in India. There has been a continuity of tradition from antiquity to modern times in this art and in the associated mythology and symbolism¹. This continuity is well attested by the finds in the archaeological excavations. The technology, however, involved in such gem cutting could not be fully discerned without the study of present day traditional gem cutting.

The present paper discusses the art of gemstone cutting in the backdrop of the basic archaeological and literary evidences and its continuity through the ages to acquire its present form. The traditional craftsmanship is studied with

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reference to present-day bead making in Kangayam in Tamil Nadu by analysing the complexity of the work involved today. Skills involved in making such beads as well as the present socio-economic status of artisans are studied in order to assess their material and social value.

The Kongu – the Study Area

The area selected for our study is traditionally and historically known as Kongu region. It comprises the present day districts of Erode and Coimbatore and occupies an area of 15,603 sq.km (Fig.1 and 2). The region is bounded by the river Bhavani on the north, the Western Ghats on the west and south, the river Amaravati on the southeast and the Kaveri on the east. The whole region is bisected by the river Noyyal. The upland region lying between $76^{\circ} 39'$ and $77^{\circ} 56'$ of east longitude and $10^{\circ} 12'$ and $11^{\circ} 57'$ of north latitude rises gradually from 122-183 m along the Kaveri to 366-457 m in the west. This sloping plain is gently undulating throughout except in the black cotton soil tracks of Udumalaipettai, Palladam and Coimbatore taluks. Though such is the general configuration of the land, the region is interrupted here and there by small hillocks. They consist of an assemblage of crystalline rocks of gneissic series, which form the basement complex upon which later geological deposits were laid down. The gneissic rocks have veins of quartz and limestone, which are both nodular and crystalline.

Mineral

The mineral wealth of the region played a dominant role in the international trade during the early historic period. Padiyur, a tiny village 14 km northwest of Kangayam on the Tiruppur road was formerly celebrated for aquamarine or beryl. These semi-precious stones were in great demand among the ancient Romans. Pliny, a Roman historian of the 1st century AD said that the best beryls had a peculiar sea-green tint and came mostly from India, they being seldom found elsewhere. In this connection it may be noted that from June 1819 to June 1920, Health, a retired British civilian, mined for beryl at Padiyur on a contract with the British Government and obtained, 2,196 stones weighting 22 lbs². Such quantities are seldom found elsewhere (Fig.3).

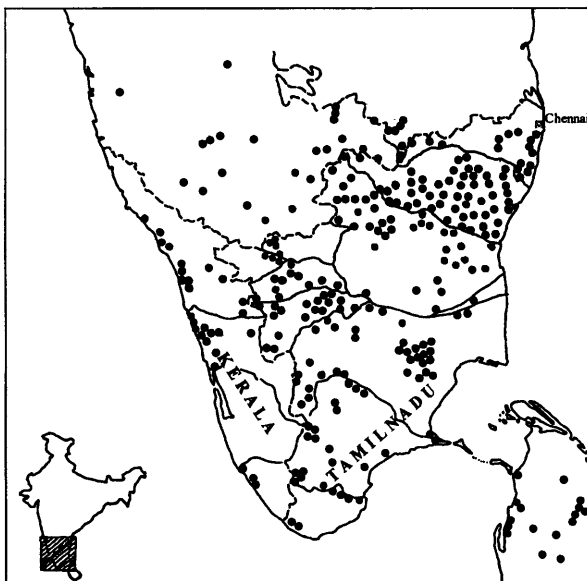


Fig. 1. Archaeological Sites in Tamil Nadu

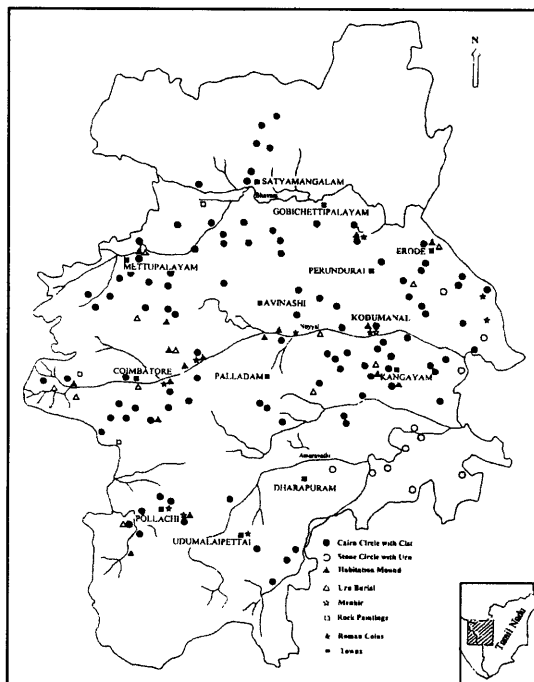


Fig. 2. Archaeological Sites in Kongu Region

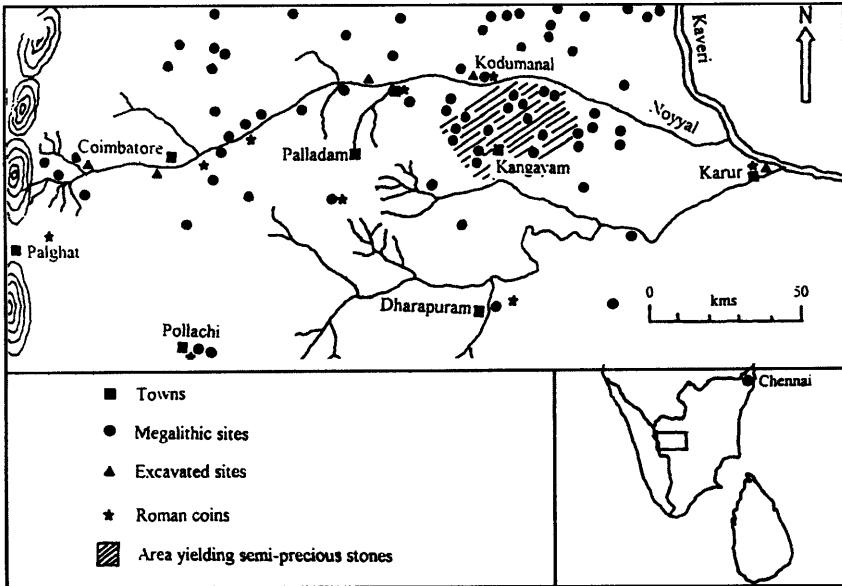


Fig. 3. The map showing the semi precious stone yielding zones

The sapphire bearing hillocks Sivanmalai and Perumalmai lie 15 km southeast of Kodumanal and about 5 km west of Kangayam on the Kangayam-Tiruppur road. Besides these two stones, rock crystal, popularly known as *venkacāṅkal* (white stone) is found in abundance in this region. The quarrying of quartz by the Tamil Nadu State Mineral Department is still in progress near the village Arasampalayam and Vengamedu, about 5 km respectively north and south of Kodumanal, a megalithic habitation-cum-burial site on the left bank of river Noyyal. It is interesting to note that some of the megalithic monuments in the area (Kodumanal, Siviarpalayam and Vairamadai) had quartz boulders placed as a part of their cairn heaps. The usage of quarried quartz boulders in the megalithic circle clearly indicates that they were in use early as the 5th century BC (Fig.4)³.

Corundum used extensively in the tip of the borer in the bead-making industry occurs in several places. At Salangipalayam in the Bhavani taluk and at Gobichettipalayam it is found on the surface as scattered crystal, sometimes as big as walnuts. It is also found at Kangayam, Kandiyar Koil, Karatupalayam and Padiyur. Between Karatupalayam and Sivanmalai on the Tiruppur-Kangayam road, it is found as a constituent of syenites, which were exploited regularly until some years ago.



Fig. 4. Megalithic cairn circle placed with quartz blocks as a part of the circle

Mica crystals are found in veins in this region particularly around Bhavani. Feldspar both of the translucent pink and opaque white varieties occurs in abundance, especially in the Erode taluk. Barite occurs in hillocks about half a kilometer west of Kurucci, which is about 16 km north of Bhavani. Asbestos occurs near Perundurairi in Erode district and in Coimbatore. Zircon (a kind of gemstone) is found in the nepheline syenites of Sivanmalai near Kangayam.

Thus, the occurrence of semi-precious stones like beryl, sapphire, quartz, feldspar and corundum in Kongu region helped ideally in nourishing the traditional gemstone cutting industry extensively and continuously through the centuries. The artisans living in this region inherited the skill and technology from their ancestors without any cultural or technological gap.

ARCHAEOLOGICAL SITES RELATED TO GEM STONE INDUSTRY

The Kongu region served as a major resource base for international trade as this region is rich in ivory, spices, aromatic, gems and iron ores. Among them, gemstone played a crucial role, particularly in the trade with the West. The large amount of beads made of semi-precious stones collected both from the ancient habitation cuttings and graves in sites like at Vellalur, Sular,

Kaniyampundi and Kodumanal all located on the banks of river Noyyal, speak about the technological skill that they achieved in the mass production of gemstone beads. Beads of sapphire, beryl, agate, carnelian, amethyst, lapis lazuli, jasper, garnet, soapstone, quartz, onyx, etc. are being collected even today on the surface of the early historic habitation mounds. Beryl, in particular, was highly favoured by the Romans. The sea-green aquamarines were valued more than gold. These finished beads were sent down to ports of Tondi (Tyndis) and Musiri (Muziris) via Palaghat gap on the Kerala coast for final shipment to Roman world (Fig.5)⁴.

Recent studies carried out in the gemstone yielding areas yielded a vast data on the nature on ancient gemstone industry. Even today the gemstone cutting survives as a cottage industry in the nearby towns of Tiruppur and Kangayam situated respectively about 15 km and 25 km east and west of Kodumanal. Still a good number of semi-precious stones are being sent to Gujarat and Rajasthan. The study of potential archaeological sites like Kodumanal, Padiyur, Sivanmalai,



Fig. 5. Trade Centres and Port Towns in Tamil Nadu

Kangayam, Arasampalayam and Vellalur is important at this juncture to understand the full potential of the region.

Kodumanal

The excavations of a megalithic habitation-cum-burial site at Kodumanal (11°62'42" N, 77°30'51" E) in Perundurair taluk of Erode district of Tamil Nadu yielded a comprehensive picture on the nature of settlement, gemstone industry, method of iron and steel production, weaving and shell industry, the burial architecture and practices and the usage of graffiti marks and Brahmi characters⁵.

This tiny village Kodumanal lies in the semi-arid zone on the north bank of the river Noyyal, a tributary of the Kaveri, about 20 km west of Chennimalai. It is actually situated on the ancient trade route connecting Karur, the Chera capital of Saigam Age, with the west coast via the Palghat gap. The Saigam literature, *Patimupattu* has referred to this site as *Koḍumanam*. This habitation-cum-burial site was excavated in four seasons in the years 1985, 1986, 1989 and 1990 by Tamil University, Thanjavur⁶. Forty eight trenches were laid in the habitation area and thirteen megalithic burials were opened in the cemetery area (Fig.6).



Fig. 6. Transepted cist burial with two subsidiary cist at the front found at Kodumanal

On the basis of cultural material, ceramics and palaeography of the Tamil-Brahmi letters, the deposit is divided into two cultural periods namely Megalithic period and Early Historical period datable respectively to 3rd c.BC - 1st c.AD and 1st c.AD - 3rd c.AD. Period I, the megalithic period is further subdivided into subperiod IA and IB⁷.

The people of the first period were mostly artisans working on semi-precious stones and the people of the second period were generally cultivators. In period I, beads made of semi-precious stones and rock crystal, potsherds bearing graffiti marks and Brahmi letters, a crucible furnace, an iron smelting furnace and the russet coated ware were found. In period II terracotta and glass objects, storage pits, red ware etc. dominate the deposit. This may suggest that during the earlier period the emphasis was more on exploiting natural resources such as semi-precious stones and iron ore deposits. The availability of the antiquities, crucible furnaces, semi-precious stone chips, etc., clearly indicate that during the megalithic period the artisans involved in manufacture of steel and semi-precious stone beads were mostly concentrated in the northern zone of the habitation.

The area, as stated earlier, is known for its semi-precious stones. The famous beryl bearing site Padiyur and sapphire bearing hillocks Sivanmalai and Perumalmalai lie about 15 km south and southeast respectively of Kodumanal. A quartz-bearing site Vengamedu (*venka* means quartz and *mēḍu* means mound) and Arasampalayam lies 5 km north and south respectively of Kodumanal. The absence of raw materials, carnelian and lapis lazuli in this region suggests that these were imported from Gujarat and Afghanistan respectively.

Beads of sapphire, beryl, agate (Fig.7), carnelian (Fig.8), amethyst (Fig.9), lapis-lazuli (Fig.10 and 11), jasper, garnet, soapstone and quartz were unearthed from the habitation whereas beads of carnelian particularly the etched variety and agate were restricted to burials. The high watermark of their workmanship could be seen from the fine example of a tiger figurine inlaid alternatively with carnelian and lapis lazuli. Carnelian beads, mostly of etched variety were found in large number in megaliths. For instance, a cist burial with menhir (Meg.II) yielded 80 carnelian beads, another (Meg.V) about 2220 and a

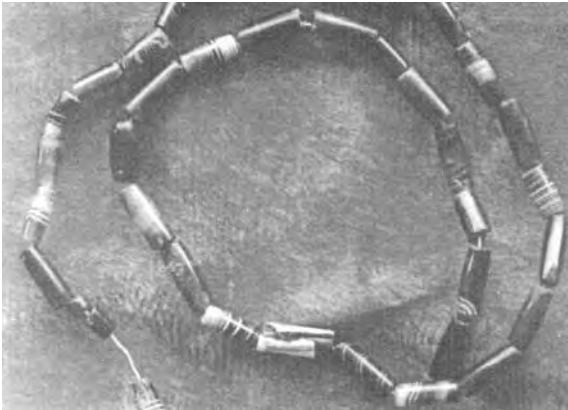


Fig. 7. Agate bead collected from the megalithic burial at Kodumanal



Fig. 8. Carnelian bead collected from the megalithic burial at Kodumanal



Fig. 9. Amethyst and quartz beads collected from the megalithic burial at Kodumanal

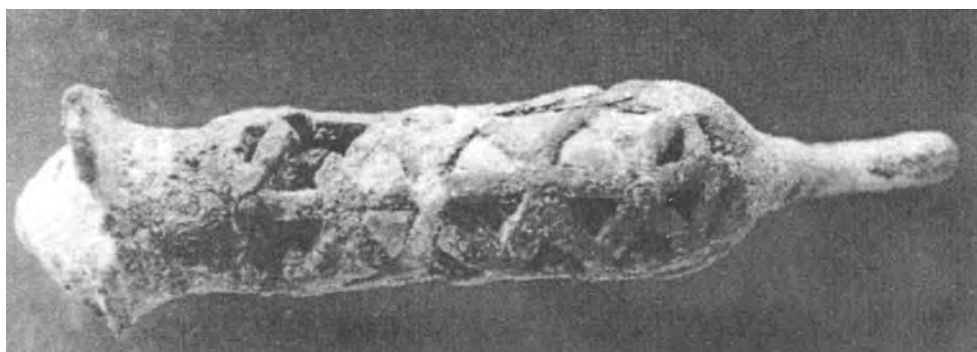


Fig. 10. Tiger figurine inlaid with carnelian and lapis lazuli collected from the megalithic burial at Kodumanal

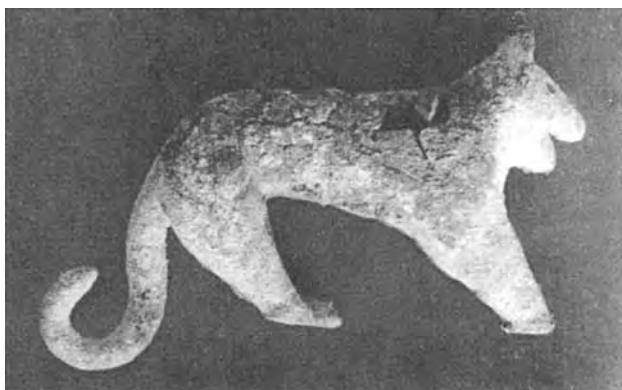


Fig. 11. Tiger figurine inlaid with carnelian and lapis lazuli collected from the megalithic burial at Kodumanal

third one (Meg.X) about 1000. The occurrence of 2220 carnelian beads in a single burial may be the first instance of its kind in India⁸.

The beads in different manufacturing stages, finished and semi-finished, drilled and undrilled, polished and unpolished were unearthed along with the raw material. The discarded chips, grooved stone slab and an interesting stone slab with few grooved beads intact clearly demonstrate that these were manufactured locally at Kodumanal. The skills involved in manufacturing stone beads at this site during early historic times and the technology applied today in the places like at Kangayam and Tiruppur are quite interestingly the same. This suggests that the tradition has continued over a long period of time without much change.

Broken pieces of rock crystal occurred in the habitation trenches. Quite a variety of quartz objects has been noticed. Finished as well as semi-finished beads, roughly shaped balls, cylindrical discs, rings, truncated cones, blades, etc., unearthed in the habitation area clearly indicate that they were manufactured at this site.

Even to this day, the rock crystal beads are bored by using simple instruments like steel needle fixed with diamond or corundum (*kuruntam* in tamil) point (borer) and bow drill. The bead to be drilled is fixed on the wax, and, while boring, water kept in a coconut shell is made to drip on the bead to keep it cool. The Kodumanal beads were bored from either side to make a single hole of hour-glass section. The same technique is still followed in the bead-making centres of Tiruppur, Kangayam and Tiruchirapalli.

Vellalur

The village Vellalur lies on the left bank of the river Noyyal about 16 km southeast of Coimbatore. It once served as a trade centre. The importance of this site can be confirmed by the occurrence of large number of Roman coins and objects found in three hoards in the village. The first hoard found in 1842 yielded 522 dinari, second one contained 547 and the third one 121 dinari. Recently two hoards seem to have been found one near the Bus stand and another one near the mound called *uppiliyar mēdu* lying adjacent to the village. In association with Roman hoards, a few Roman objects were also recovered. Among them, two carnelian objects representing a grazing horse and a fish are noteworthy⁹.

Arasampalayam

The village Arasampalayam is located one km north of the Kangayam-Chavadipalayam road at a distance of 10 km west of Kangayam in Erode district. This is also one of the Sangam age sites as attested by the megalithic burial site which lies at the juncture of the Arasampalayam road and the Kangayam-Chavadipalayam road. There are more than 100 cairn circles noticed on an elevated field of the cultivated land. Most of them are in good condition. As already noted the most interesting part of the site is the huge quartz deposit covering an area of a sq.km exposed at this place (Fig.12)¹⁰.



Fig. 12. Quartz mine at Arasampalayam



Fig. 13. Quarried quartz material placed at Arasampalayam

Kangayam

Kangayam, the taluk headquarters, is the hub of the stone industry of the region. There are nearly 250 families working on this industry when authors visited the place in the year 1990. But today it has drastically come down to the level of 50 families. This is due to the gradual introduction of the lathe and electrical components in this industry. Presently the bead-making industry is restricted to Muslims.

The survival of this site since San gam age is well observed with the avail-ability of the three groups of burials, mainly cairn circles. The first group

is noticed behind the Higher Secondary School on the Dharapuram road, second group near the Carmel convent on the Tiruchirapalli road and the third group around Agilandapuram¹¹.

Sivanmalai

Sivanmalai, a small hillock, lies 4 km west of Kangayam on the Kangayam-Tiruppur road (Fig. 14). Megalithic monuments are noticed on the southern slopes of the hill covering an area of more than 75 acres¹². This site also falls under the zone of Padiyur. According to the local people on some occasions beads of beryl are being collected from the disturbed megalithic monuments. Besides beryl, the Geological Survey of India collected sapphire in the hillocks.



Fig. 14. The view of the Sivanmalai yielding sapphire



Fig. 15. Various beads and artifacts collected from the habitation-cum-burial site at Sulur

Sulur

Earlier excavations at Sulur by W.H.Tucker yielded a large quantity of beads kept in a pot below the bench of a cist burial. C.Horace Beck who examined the beads of Sulur recorded that both the habitation and burial yielded identical beads¹³ like beads of red steatite (40), carnelian (39), shell (21), green steatite (11), glass (8), agate or onyx (3), bone (2), quartz (1), pink limestone (1), stalagmite? (10) and shale ? (1). The authors also collected beads made of carnelian, agate and quartz from the extensive habitation mound locally called *kōttai mēḍu* on the left bank of the river Noyyal near Muthukavundanpudur (Fig.15)¹⁴.

GEM AND GEM-CUTTING IN SAṄGAM LITERATURE

Besides the above material evidence, the contemporary literature gives a graphic picture on the gemstone industry. A close study on the literature provides valuable data to understand the contemporary technology.

The earliest Tamil literary works popularly known as Saṅgam literature (c. 100 BC - 200 AD) give useful information on the existence of gemstone industry in Tamil Nadu. The Saṅgam folk inherited the knowledge of identifying various minerals, technique of cutting, quarrying and lifting huge boulders and slabs from the megalithic people. The latter had the knowledge of building large sized cist/dolmens and erecting huge monolithic pillars as at Kodumanal, Mallachandram, Kilseppuli and Tirumulavadi and also had the advanced techniques of preparing minute stone beads as small as mustard out of hard minerals. They made beads by boring and polishing minerals like carnelian, quartz, garnet, sapphire, beryl, agate, etc. The inheritance of this technology is well reflected though indirectly in the literature.

The anthology *Paṭiṟṟupattu* speaks exclusively of the Cera kings who ruled dry but mineral yielding zone of Kongu region of Tamil Nadu. The collection of various semi -precious stones and the places of occurrence are documented. The cowherds (*kōvalar*) used to collect semi-precious stones in the hillock called *Ceruppumalai* belonging to the Cera king Pooliyar Ko (Palyanai Celkelu Kuttuvan). This can be identified, contextually, with the Sivanmalai and Perumalmalai located west of Kangayam in Erode district (*Paṭiṟṟupattu* 21:20-23). Stones were also collected while tilling the lands

(*Patirrupattu* 58:12-19; 76:11-15). In one occasion, even the nature of occurrence of the gem is noticed. The gems were found in the midst of milk-white quartz and feldspar (*Patirrupattu* 66:16-20). The exposed gem stones reflected the evening sunlight fell on the western slopes of the Kolli hills (near Namakkal of Salem district., *Akanānūr* 213:11-15). *Kāṇavas* also collected precious stones while they dug for roots (*Kuṟuntokai* 379:1-3). The precious stones also appeared in the pits dug by the wild boars (*Narṛinai* 399:2-4) and also in the pits dug by the *kāṇavas* (hillock people) with help of elephant tusk (*Akanānūr* 282:1-10). The gems also appeared on the surface due to the thrust of the toe of galloping deer (*Puraṇānūru* 202:1-8). The hills, hill slopes and lands were spread with the stones (*Maduraikāñci* 273-285; *Narṛinai* 234:3) and they were found exposed during rainy time and these were sometimes brought down by the streams (*Aiṅkuṟuṇūru* 233:2-4). These precious stones collected by the local people were sold out in the markets (*Maduraikāñci* 504-506). Quite interestingly there is reference to a specialist artisan called *tirumaṇi kuyiṇar*, Gem borer, (*Maduraikāñci* 511; *Cilappatikāram* 5:46) and *maṇi viṇaiṇar* (*Maṇimēkalai* 28:45) exclusively working on the gemstones. The brahmi inscription of 2nd c. AD, found at Arachchalur in Erode district, mentions about a gem stone trader called *vaṇṅkkaṇ*. The famous anklet story of *Cilappatikāram* (ca.4-5th cent. AD) says that Kannaki's anklet was studded with gems whereas that of the Pandiyan queen anklet had only pearls. The Whetstone/lap stone (*cāṇaikal*) specialist *ciṟukarōtaṇ* prepares the wheel by mixing *payin* (wax) and *kal* (probably corundum powder) (*Akanānūr* 1:5-6; 359:9-10). The gems to be faceted or polished are fixed on wax placed on the tip of the rod (*Kuṟuntokai* 155:3-4). These references clearly indicate the existence of the gemstone industry in Tamil Nadu during the Saṅgam age (for further details see Appendix I).

TECHNOLOGY

Every artistic product is a blend of manual and mechanical operations performed upon any sort of material. The artistic product possesses a value which varies from time to time and depends upon the social dimension. The present study analyses the relationship between such art and techniques employed in the gem stone industry.

The artisans of the Kangayam region mostly work on the crystal material which is a homogeneous body in the form of a polyhedron, bounded by spontaneously formed faces, whose character is determined by the nature of the constituent substance.

Gems

Crystals display certain degree of symmetry, depending on the ordered arrangement of their atomic particles. Gems are usually bright, colourful or transparent materials that are relatively rare and are durable enough to be used in Jewelry. Each Gem or mineral has a characteristic crystal structure and chemical composition.

The present day artisans predominantly use the minerals that are generally available in Tamil Nadu. However during early historic times a few gemstones like carnelian, lapis lazuli and agate were brought respectively as far as from Gujarat, Afghanistan and Maharastra as raw material and they were worked on here to make an object of bead¹⁵. Majority of semi-precious stones used in the Kangayam region is mainly of corundum (*kuruntam*), sapphire (*nīlakkal*), beryl (*paccaikkal*), quartz (*paḷiṅkukkal*) and moonstone (*eṇṇaikkal*). They collect these stones either directly from the field or from the local weekly market where the village folk bring them for sale.

Gem cutting

Gem cutting is an operation whereby a rough stone is made to assume a certain shape in line with their crystal structure to enhance its luster so that it can be in an item of jewellery. These were rounded and polished into a convex shape known as a *cabocho*n (from *caboche*, an old Norman French word for head). This type of cut is now only used for stones of limited transparency.

The methods used in gemstone industry have not changed over the centuries, although the use of certain instruments and materials has been greatly improved. The cutting of hard gems is almost similar to that of ancient times. In faceting a hard gem crystal, the bottom portion called *mastam* is faceted first, and then the top portion called *kucai*.



Fig. 16. Raw material placed in the house of an artisan at Kangayam

Process

Once the raw material reached the workshop (*pattarai*) it enters the process that gradually transforms the smooth patinated stones into beads and other objects (Fig.16). The first step in the process is to separate the valuable material from the impurities. The observation made on the material collected from the Kodumanal excavations reveals the method of separation from the cortex and subsequent chipping (Fig.17). A small portion of the surface of the mass was polished and an incision was made at the dividing line between gem and the parent rock using micro blade. Then the gem is removed without much damage by striking the block indirectly at the point of incision.

The second step is to heat some of the material like carnelian in small pots filled with smoldering sawdust. This causes a physical change in the stone which makes the next step, clipping, an easier one. The knapping of the stones is done in two stages, the first of which roughs out the shape of the bead. This is smoothed by finer chipping. In both the cases, hammer technique is applied. An anvil or spike driven into the ground is used as support base. In a few cases, small chisels are used. The chisels are applied directly on the rough surface by



Fig. 17. Impurities being removed from the raw material by the artisan

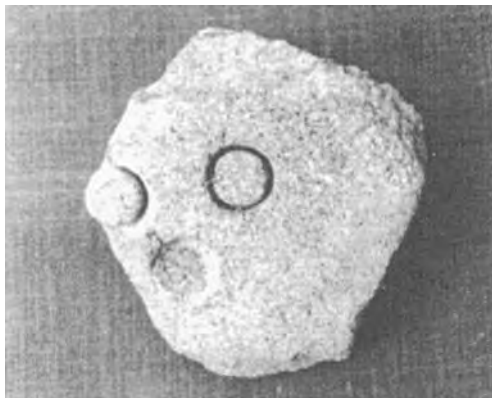


Fig. 18. A beautiful drilled piece collected from the excavation at Kodumanal demonstrating the early method of gem cutting

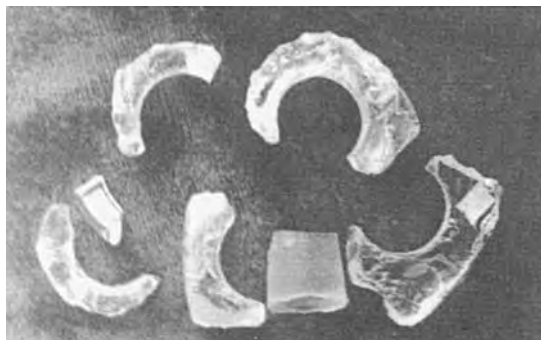


Fig. 19. Conical and ring pieces of quartz material collected from Kodumanal excavation

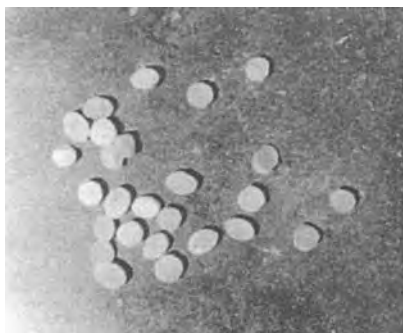


Fig. 20. The quartz pieces fashioned at Kangayam Gemstone Industry



Fig. 21. The close view of the quartz pieces fashioned at Kangayam Gemstone Industry

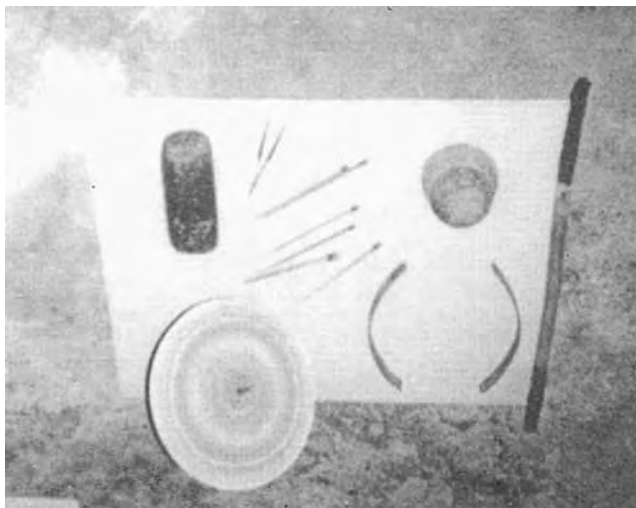


Fig. 22. Various tools used in the gem stone industry at Kangayam



Fig 23. A view of the traditional gemstone industry workshop at Kangayam the artisan. They hardly use any metal hammer on the chisel head. Instead they use a hammer made of buffalo horn on a thin flexible bamboo handle. The work at the chipping stations proceeds briskly and a final roughed-out bead can be produced in a very short time. Beads requiring further chipping are moved to another worker who handles this task. The chipped blanks are then sorted and sent to another separate work area where it is grounded to their final shape (Figs.18, 19,20 and 21). This process requires tools like wheel, stone daber, semi-circular rings, dop sticks etc. which are discussed below (Fig.22 and 23).

Wheel

The artisans prepare the wheel used in the gem cutting themselves. To prepare a wheel, wax is heated to a molt condition and is poured inside a ring formed out of two semi-circular rings, placed on a flat stone surface. Once the wax reached its leather condition, the semi-circular rings are rotated around the edges of the wax. A stone dabber is used to rub the upper surface of the wheel to get an even surface. The wheel is fused with the corundum powder called *kurundam potī* or sand. The sand used for fusion is numbered according to its size. The abrasive wheels, against which the beads are grounded, are commercially made today. This wheel is rotated rapidly by using a bow and string fitted to the axle. However most of the industries have recently started using the wheel powered by electric motors. The thickness of the wheel is from a quarter to one third inch. The gem to be grounded is cemented to one end of a small rod (generally in a mushroom shape stick called *dop stick*). The fixation of bead on the rod-top involves a minor process. First, the rod is pasted with a thick coat of wax. Then the wax is slightly heated in a furnace and the bead to be fashioned is fixed. The fixed bead is applied to the lapidary having the means of giving a very rapid rotatory motion to the mill-plate (wheel). It grinds away

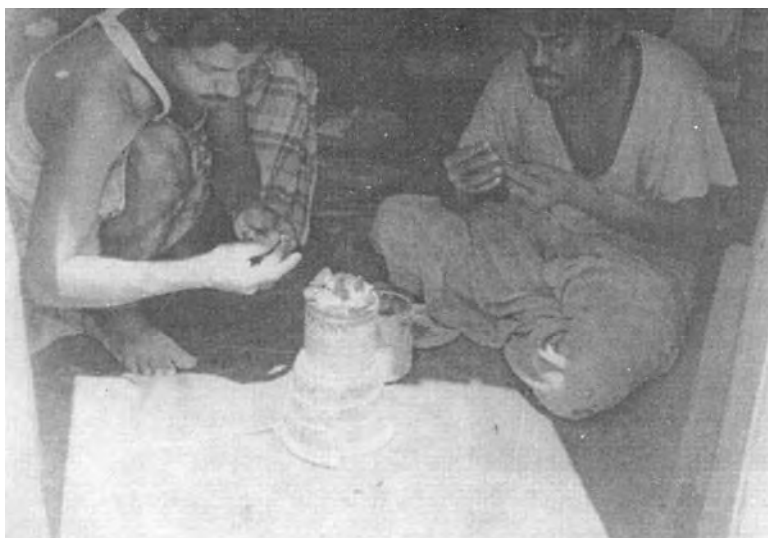


Fig. 24. Artisan fixing the object to be polished on the stick fixed with wax.



Fig. 25. Artisan fixing the object to be polished on the stick fixed with wax.

the substance of the gem according to the kind of effect required to be produced. The worker holds the gem in one hand, turns the wheel with the other, and grinds the gem applying it to the rough surface of the wheel. When the stone is sufficiently worn away, it is polished by being applied to the surface of a smoother wheel than the first, but managed in a similar way. Several individuals generally work at a single machine. The grinding of a single bead never takes more than a minute. Spherical beads are shaped on a specially formed “corrugated” grinding wheel. This wheel is used in

conjunction with a simple but specially prepared wooden implement which holds the rough chipped stones in place while they are pressed against the rapidly spinning wheel. It takes only a matter of seconds for rough chipped blanks to be transformed into nearly perfect tiny spheres.

For grinding, the mill-plate is touched with a little diamond-powder and oil, to give the requisite abrading power; for emeralds, beryls, topazes, garnets and all other softer gems, corundum and water are applied to the plate. The present day Kangayam artisans follow only the latter method. The grinding wears away the surface of the gem in various parts. But the new surface thus produced looks dull or without much lustre. To get enough lustre, the gem is again polished on a softer mill-plate with leather and water.

Each side of the gem has to be faceted quite separately because one side of the gem is stuck to a nail with wax (*arakku*) while the other side is being faceted. The gem has to be held very steadily against the spinning lap so that the friction facets the portion of the gem that is being carefully held in a wooden clamp called a *kai-cā vi* (hand key). This instrument is primitive ancestor of the modern faceter used in work on the semi-automatic modern machines (Figs.24, 25 and 26) .



Fig. 26. The stick fixed with object to be polished.

Perforation

Drilling is the most delicate of the whole process and in which the probability of wasting pure and extensively processed material is highest. Therefore, highly specialised and experienced artisan does this job. The numerous partially perforated beads broken during drilling found along with the waste in the excavations attest to these losses. This may be due to the erroneous drilling angles and flaws in the crystalline structure. From the discarded material, it appears that polishing preceded drilling. Even to this day, simple instruments like steel needle fixed with diamond or corundum (*kuruntam*) point (borer) and bow drill are used to bore the rock crystal beads. The corundum stone is available in the region between Tiruppur on the west and Karur on the east. These corundum chips are placed on the drill tip by using an awl to form a cup-like thing at the drill point. The bead to be drilled is fixed on the wax, and, while boring, water kept in a coconut shell is made to drip on the bead to reduce the heat (Fig.27). The position of the artisan is worth observing. He sits on a small wooden plank with right leg in folded posture and the left leg sometimes placed over the bead to be drilled. He holds the drill in his left hand and bow in his right hand. Sometimes, he places a stone dabber below the knee portion of the folded right leg (Fig.28). According to the artisan, the stone dabber helps to keep the body position perfectly while giving thrust. The speed at which the beads are drilled is determined by the hardness of the material. The beads were bored from either side to make a single hole of hourglass section.

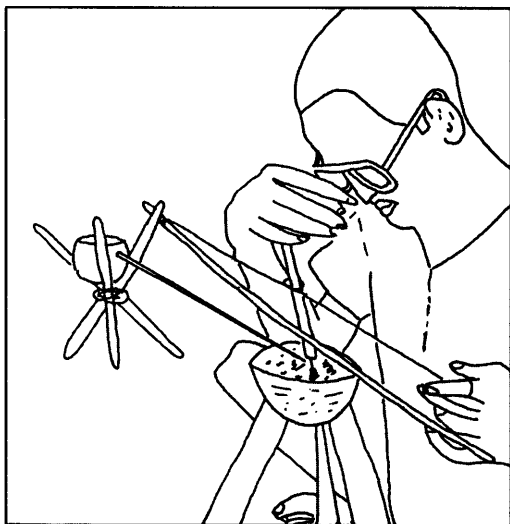


Fig. 27. An artisan boring the object with help of corundum tipped borer at Tiruppur

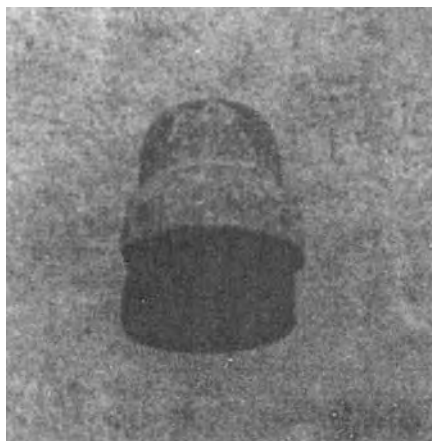


Fig. 28. A stone dabber used to rest the folded leg on it while working on gems

Final polishing

The final step in this process of bead manufacture is the final polishing. The final polishing is usually done on a leather or fabric covered on revolving horizontal lap (Figs.29 and 30). For this very fine, abrasive powder is sprinkled on the leather.

Engraving

The engraving of seals is an operation allied to that of cutting and polishing gems. In hard material, the engraving requires the action of a rotating edge to cut it. Generally speaking, it is the softer kinds of the gems, such as carnelian, chalcedony, quartz, amethyst and onyx, which are considered best for engraving. The diamond, sapphire and ruby are too hard for this operation. The beryl, topaz and emerald are sometimes engraved. Whatever be the kind of gem employed, it is first ground to the proper form by the lapidary, and then engraved by the aid of a small and delicately constructed lathe. A small steel cylinder or bar is made to rotate very rapidly on a horizontal axis, and on the one end of this cylinder is fixed a very minute disc or wheel, which forms the cutter or engraving tool. In Tamil Nadu, engravings are not in vogue nowadays. However, on request an artisan from Tiruppur demonstrated the process involved in engraving. The engraver fixes the gem by cement to the end of a stick. He draws the face of the gem to the outline of the little wheel or disc with diamond-powder and oil and sets the wheel in rapid rotation, and then applies the gem to it. By altering the size and shape of the wheels employed, one could make desired engraving on the gem. The engraved portion generally ends with a rough surface. This rough surface is again polished as stated earlier.



Fig. 29. The beads produced at Kangayam gemstone industry

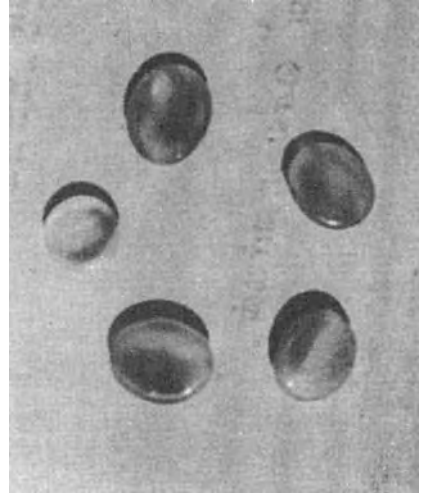


Fig. 30. The beads produced at Kangayam gemstone industry

Decoration

The enquiries made in the local gem industry divulged the fact that no one knows about the technology involved in the preparation of etching. However, the observation made by Mackey along with N.G.Majumdar in 1930 is worth recalling here¹⁶. Mackey is fortunate enough to learn the process from an old man of Sehwan in middle Sindh, named Sahebmino. According to him, the artisan carefully macerated the tips of young shoots of a bush (*capparis aphylla* Sindhi: *Kirar*) in a glazed pottery bowl with the aid of a wooden stick with a rounded end. This maceration was done without the aid of water until a thick pasty mass of an olive-green colour was produced. Then he took fine powder of ordinary washing soda and mixed it with water. This small solution is poured on the *kirar* and rubbed the whole carefully together to a semi-fluid mass. This is again strained through a piece of linen into a large empty mussel-shell and the paste is ready.

The carnelian bead to be painted is fixed in a setting made of clay mixed with cotton wool. This cotton wool prevents the clay from cracking in the process

of drying. This setting is evidently intended to protect the bead as much as possible from flame contact. When the setting is dry, a design is made upon the exposed surface of the carnelian bead with a reed pen filled with the paint. It is very difficult to see the painting at the time of execution but when the paint is dried it appears very distinctively. These painted pieces still in its painting is placed on a piece of iron-sheet and laid on the embers of a charcoal fire until the design is perfectly dry. The beads are then buried in the embers and fire is slowly fanned for about five minutes. The stone removed from the fire is taken from its clay setting and placed under a small cup to cool down gradually. After the cooling, the bead is rubbed briskly with a rag. At the end of this process, the object became a fine example.

SOCIO-ECONOMIC CONDITION

The study on the traditional gem-cutting in Tamil Nadu had yielded substantial evidences on the continuance of the tradition since the early historic period. The traditional bead making is an extremely skilled and difficult craft, which generally takes six to eight years to learn. This long period of learning also gives an expertise to judge the gem. The artisan is capable of evaluating, by eye, the minute measurements of the gem on which all facets have to be cut. The artisan also must have metal calibre to do the minute details and physically fit as it is necessary to pedal the wooden beam at sufficient speed all the day in order to spin the lay for faceting. This tradition is now under the extreme pressure due to the invasion of the synthetic and the semi-automatic machines. The semi-automatic gem-cutting machines, popularly called "Gem park", are used in Tiruchirappalli and Pudukottai area whereas in Kangayam still they rely on the traditional method. The Kangayam artisans are not engaging with any synthetic material and they mainly rely on the locally available precious stones. This way, the Kangayam artisans still preserve the better part of the tradition. In contrast to this, the workshops in Tiruchirappalli and Pudukottai are switched over to synthetic gems and hardly few people work on the natural stones. The long hours of work for a meager output and less profit due to the middle man made them to move fast out of this work. A few artisans still lingering with this job may be due to the lack of job-mobility.

The social conditions of this people are not an happy affair. This rural based industry almost runs in a small huts with few worn-out wooden machinery but remarkably make beautiful gems. They use to purchase the raw material from local weekly market brought by the villagers who collected it from the field in the semi-precious zone area. Today, the traders personally make a frequent visits to villages located in the 25 km radius in and around Kangayam. It is quite interesting to observe that the village-folk of this region is aware of the basic things about gems. They knew various gems and their quality. They call the pure gem as *nirôṭṭakkal*.

In Kangayam region, the men-folk are only involved in the gem stone cutting whereas in Tiruchirappalli and Pudukottai area woman and children are

also involved. This may be due to the social status of the womanhood. In Kangayam, the industry is now under the control of the Muslims. In this community, generally women are not allowed to take such jobs. But in Tiruchirappalli, this industry comes under the control of Soliya Vellalar, a Hindu caste, where the women moving out of home for work is not prohibited.

During the first visit in 1987 to Kangayam, the author could see more than 200 families working on gems and they eked out their livelihood comfortably as the finished gems were in good demand. During that time, it offered an excellent return on their investment. There are permanent traders from Gujarat and Rajasthan called *seth* or *marvādī*. In contrast to this, when investigators visited the same area in July 1998 there is hardly 50 families working on it and that too in a waned spirit. Again in 1999, there is hardly any change in the social environment. This is partially due to the introduction of the synthetic gems and semi-automatic machines.

This traditional art is being given up due to the cut-throat competition with the introduction of artificial gems. In the first visit in 1987, the authors could ask an artisan of 70 years old to demonstrate the perforation process. But in the second visit in 1998, he could not find a single artisan knowing this process. When asked for the reason, almost all answered that their grandfathers knew the art and today they hardly learned as this work is taken over by the lathe and machines. It is afraid that the present limited amount of skill also will be given up in the years to come as the machines are fast encroaching in the field of faceting and polishing too. The attempt of present study to record this valuable traditional art is worth pursuing as this small-scale industry is undergoing rapid change due to new technology and expanding markets. The traditional sector continue to work in the old ways, the only major change being the motorization of foot-pedal machines. Thus, the present study delineated so far is an attempt to document the art of gem-cutting through field observations. The long survival of this tradition sustained through the transformation of technical expertise from generation to generation is explained with help of archaeological, literary and field data. The onslaught of technological innovations in recent days in gemstone-cutting placed the artisans under tremendous economic stress, which indirectly effects its social fabric too.

Appendix I: References on Gems in Sangam Literature

Poem No. (verse no.)	Verse	Meaning
<i>Puranānūru</i> (21:20-23)	<i>vecik kānāṭṭu vēṭṭuvar atta katc kā ṇ ak kaṭamā nal eru kataru maṇi kilar a citaru paṇ miḷira kaṭiya kaṭ alum netu varaip paṭ appai ven ri nilaiya vilup pukaḷ oṇ ri irupal peyariya uru keḷu mutur koṭi pala atukkiya poruḷ numakku utaviya nitu nilai araiya ttuk kēṭum kēḷ</i>	Sparkling (<i>miḷira</i>) gems (<i>maṇi</i>) appears on the gound due to the trust of toe of the running deer (<i>kaṭamā</i>)
<i>Paṭir ṛuppattu</i> (21:20-23)	<i>mullai kaṇ ṇ ip palāṇ kōvalar pullutai viyan pulam palā parappi kal uyar kaṭattita i katir maṇi perūum miti al cerppin pūḷiyar kōvē</i>	The <i>kōvalar</i> (cattle keepers) collects sparkling precious stones (<i>katir maṇi</i>) while going for cattle grazing in the <i>mullai</i> region (pastoral zone) of Ceruppumalai (<i>hillock</i>) belongs to Chera king.
<i>Paṭir ṛuppattu</i> (58:13-19)	<i>kaṇāṅku ica ic citati pori araiap poruntiya ciritilāi vēlam periya tōṇṇ um puṇpulam vittum vaṇ kai viṇaiṇ ar cīrutaip pal pakaṭu olippap pūṭṭi nāṇ cil āṭiya koḷuvaḷi maruṇ kiṇ alaṅku katirt tirumaṇi perūum akan kaṇ vaippin nāṭu kiḷavōṇē</i>	Gems (<i>tirumaṇi</i>) were collected from the plough marks (<i>nāṇ cil āṭiya koḷuvaḷi</i>) while tilling the land.
<i>Paṭir ṛuppattu</i> (66:18-20)	<i>vaṇ palīṅku virai ya cem paral murampin iḷiṅku katirttiru maṇi perūum akan kaṇ vaippin nāṭu kiḷavōṇē</i>	Gems were found in the midst of quartz (<i>van palīṅku</i> and red gravel (<i>cem paral</i>).
<i>Paṭir ṛuppattu</i> (76:11-15)	<i>pal vitai uḷaviṅcil erā lar paṇit turaip pakaṇraip pāṇ kutait teriyal kaiḷuvuru kaḷiṇ kam katuppa cūti iḷiṅku katirt tiru maṇi perūum akan kaṇ vaippin nāṭu kiḷavōṇē</i>	The tillers (<i>eralar</i>) of the land use to get precious stones
<i>Maduraikāṇ ci</i> (273)	<i>āḷnta kuḷampil tiru maṇi kiḷara</i>	Gems appears when the toe (<i>kuḷampu</i>) of an animal digs while walking or running.
<i>Maduraikāṇ ci</i> (504-506)	<i>malaiyavum nilattavum niravum piravum palvēru tiru maṇi muttamotu poṇ koṇṭu cr ir anta tē ettup paṇṇiyam pakarnarum</i>	Gems (<i>tirumaṇi</i>) came from hill, land and water.

<i>Maduraikān ci</i> (511)	<i>koṭu po l katainarum tirumaṇi kuyinarum</i>	Gem-cutter particularly borers (<i>tirumaṇi kuyinarum</i>)
<i>Akanānūru</i> (213:11-15)	<i>akaral ā yintanar ayiṅ um pakal celap pal katir vān kiya paṭu cutar peru maram kaṅṅa kā l puku viyaṅ puṅattu eri maruḷ katira tiru maṇi imaikkum</i>	Gems emit lights (<i>imaikum</i>)
<i>Akanānūru</i> (282:1-10)	<i>perumalai cilampiṅ vēttam pōkiya ceṛi maṭai ampin val vil kāṅ avaṅ porutu tolai yāṅ ai veṅ kōṭu koṅṭu kōṭu nir tikaḷ cilampiṅ naṅ poṅ akaḷvon kaṅ porutu imaikkum tiṅ maṇi kiḷarppa vain nūti vāl maruppu otiya ukka teṅ nir ali kaṭukkum mūttamoṭu mūvēeru tāramum oruṅ kutan koṅṭu cantam paraimaram ā ka narai nār venkaik kaṅṅiyaṅ iḷitaru naṭarṅku</i>	The <i>kānavar</i> (hillock people) dig the land with help of tusk (<i>veṅ porutu tolai yāṅ ai veṅ kōṭu koṅṭu kōṭu</i>) of the elephant (<i>yāṅ ai</i>) to <i>nir tikaḷ cilampiṅ naṅ poṅ akaḷvon</i> collect gems
<i>Akanānūru</i> (1:5-6)	<i>cirrkaroṭaṅ payiṅoṭu cērttiya kalpōl piriyalam.....</i>	The whetstone/lap stone maker (<i>cirukarotan</i>) mixed was (<i>payiṅ</i>) and stone (<i>kal</i> probably of corundum <i>kuruntam</i>).
<i>Akanānūru</i> (356:9-10)	<i>cirrkaroṭaṅ payiṅoṭu cērttiya kalpōl piriyalam.....</i>	The whetstone/lap stone maker (<i>cirukarotan</i>) mixed was (<i>payiṅ</i>) and stone (<i>kal</i> probably of corundum <i>kuruntam</i>)
<i>Narriṅai</i> (234:3)	<i>tirumaṇi varanrum kunram koṅṭu</i>	The hillock (<i>kunram</i>) yielding semi-precious stones (<i>tirumaṇi</i>)
<i>Narriṅai</i> (399:4-5)	<i>nilavarai nivanta pala uru tiru maṇi</i>	Gem stone (<i>tirumaṇi</i>) with various shapes (<i>pala uru</i>) emerged from below the ground (<i>nilavarai</i>)
<i>Ainkurnūru</i> (233:2-4)	<i>aru varai marunkiṅ ai maṇi varnri ollena ilitarum aruvi nin kalluṭai nā ṭṭuc cellal - teyyō</i>	Gems available in the midst of the gravel. <i>Kuruntokai</i>
<i>Kuruntokai</i> (379:1-3)	<i>palankuli akalnta kanavan kilankinotu kan akan tūmaṇi perum nāṭan</i>	The <i>kanavas</i> (mountain people) collects precious stones (<i>tumaṇi</i>) along with roots (<i>kilanku</i>) while digging in the hills (<i>kunram</i>)
<i>Kuruntokai</i> (155:3-4)	<i>utulai peita pakuvait tenmaṇi</i>	The good precious stone (<i>tenmani</i>) fixed with wax (<i>meluku</i>) made in the furnace (<i>udulai</i>)
<i>Paṭṭinapālai</i> (187)	<i>vaṭamalai piṅanta maṅiyum</i>	The precious stone that came from the north

ACKNOWLEDGEMENT

This paper is the result of fieldwork undertaken as part of the project *Traditional Bead Making and Chank Diving in Tamil Nadu* funded by the Indian National Science Academy. We are grateful to INSA for the financial support extended to us.

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