



ZEALOUSLY GUARDED SECRET: Artisans even today use traditional 'low-tech' methods to produce a sophisticated metallurgical end product

Nadu to make artifacts for the Parthasarathy temple. In an interesting twist, it was a widow, Parvati Ammal, who came to their rescue as she dreamt that Lord Parthasarathy or Krishna had revealed the secret of making an unusual reflecting metal. Not only was the Raja placated by a crown made of this material, but he also exhorted the artisans to make, from this alloy dreamt up by the widow, the *valkannadi* or mirrors for the auspicious *ashtamangalyam* wedding sets of brides-to-be. A large old metal mirror is also installed in a subsidiary shrine in a Bhagavati temple complex in Ernakulam where it is worshipped as a form of the goddess.

What is marvellous about the Aranmula mirror is that merely by using traditional 'low-tech' methods and materials a rather sophisticated 'high-tech' metallurgical end product is achieved. The metallurgical investigations that I had made of various fragments of the mirror alloys established that these were uniquely made of a binary alloy of copper with 33 per cent tin. It is this composition which yields properties ideally suited for a mirror, since it is a hard, stable and silvery compound which can therefore be polished to a mirror finish.

The entire mirror manufacturing process seems to be geared at skilfully optimising the presence of this alloy mix at non-equilibrium room temperatures. While this silvery metallic alloy shatters quite easily like glass, this brittleness is offset by casting a very thin blank, no more than 3 mm thick, which is re-inforced by mounting it with resin on a wooden mount for the polishing process.

For the casting process, a cleverly made jug-shaped crucible-cum-mould of clay is used: the lower portion consists of a two-piece clay mould which is connected to the neck consisting of a hollow cup wherein the metal pieces to be cast are placed. This sealed clay crucible-cum-mould is heated neck down on a hearth, whereby the metal melts in the neck, and then the jug-

Mirror marvel

Kerala's traditional Aranmula mirror gets patent protection with a Geographical Indication tag

By DR SHARADA SRINIVASAN



THE little village of Aranmula is one place which lives up to the hype of Kerala tourism's sales pitch of 'God's Own Country'. Located on the

banks of the languid river Pampa, Aranmula comes alive in a frenzy of spectacular snake-boat races and water carnivals during Onam religious festivities. Aranmula is also home to a waning handicraft tradition which is a technological marvel in its own right.

The Aranmula *kannadi* is an extraordinary metal mirror which was one of the eight auspicious articles or *ashtamangalyam* set that made up a bride's wedding trousseau. The manufacture of the Aranmula *kannadi* has been a zealously guarded secret of all but a handful of surviving artisans known as *acharis*.

The Centre has patented the Aranmula mirror with the Geographical Indication tag. The tag identifies goods that have originated or are manufactured in a particular region, and the quality of which is attributable



to their geographical origin. Darjeeling tea, Pochampalli saris, Basmati rice and Mysore silks are some of the other products that have earned the tag.

Local legends link the history of Aranmula mirror to the Parthasarathy temple of Lord Krishna at Aranmula. One lively story about the origins of the Aranmula metal mirror is that the Raja of Aranmula had threatened to evict some bronze craftsmen, who are said to have migrated from Tamil

Sands of time

By FARWA IMAM ALI

At the end of a dusty track, 24 km from Tirunelveli in Tamil Nadu, men dig trenches under a blistering sun. What resembles a construction site is actually an archaeological excavation site of an urn burial ground, which dates to 1000 BC. Archaeologists have already found 40 urns at the 114-acre Adichanallur site. "It is the most exciting find in recent archaeological history," said T. Satyamurthy, superintending archaeologist and director of the site.

Urn burial is typical of megalithic culture. As per custom, after cremation, the bones were placed in an urn and its mouth was sealed with another urn. The 'twin-pots' retrieved at Adichanallur correspond to descriptions of the ritual found in Tamil Sangam literature. Some urns have been unearthed with small pots strung around them. "These could have contained the personal belongings of the dead person," said Satyamurthy. He and his 15-member team are presently

shaped crucible-cum-mould is tipped over so that the molten metal flows into the narrow gap between the oval two-piece mould so that it solidifies into thin oval metal blank. The cast blank, which is retrieved by breaking the mould, is mounted onto a wooden handle and polished over several days with hessian and velvet cloth to get a mirror finish. The hard, powdered mirror alloy is itself used to give the mirror a final polish.

There are several Indian sculptural depictions such as the mediaeval Hoysala dancing girls from Karnataka holding mirrors. Such mirrors resemble the thick wooden polishing board with a rear handle from Aranmula onto which the mirror blank is affixed with resin for polishing. This could have itself been used as a finished mirror as an alternative to the current traditional practice of mounting the mirror blank into a brass frame.

There is other evidence of the technological distinctiveness of the Aranmula mirrors. Whereas bronze mirrors with a high tin content were

documenting the finds which include black and red ware and painted pot shards.

The archaeologists are more excited by the prospect of discovering habitation sites close by. "If a burial ground is present, it is logical that a habitation site is not too far away," said Satyamurthy. The focus of the current excavations is to arrive at the cultural sequence of the civilisation.

"The date of Adichanallur may even be earlier than that of Mangadu [a civilisation discovered near the Ashtamudi Lake in Kollam district, Kerala], that is, prior to 1000 BC," says Satyamurthy. This could make it the missing link in the jigsaw detailing the rise and decline of one of the earliest Tamil civilisations.

The site was first excavated in 1900 by British archaeologist Alexander Rea, who said it was "the most extensive pre-historic site as yet discovered in southern India". Rea recorded thousands of objects found there including finely-made pottery, iron implements, weapons and ornaments of gold diadems, bronze, stone beads and bones. "If his aim was to record that an ancient Tamil civilisation existed," said Satyamurthy, "ours is to establish the sequence of events that typified that civilisation and fix a date for the same."



V. RAMESH

EXCITING FIND: ASI's T. Satyamurthy (left) examines a burial urn at the Adichanallur site

used widely in China and also in the Roman world, these were generally cast with around 25 per cent tin with up to 10 per cent lead. Although the addition of lead would have served to reduce the brittleness of cast bronzes with over 20 per cent tin, lead being an opaque material that does not dissolve in copper, such mirrors probably were not as reflective as the unleaded alloy used for the Aranmula mirrors.

Rather, the Aranmula high-tin delta metal mirror seems to draw from long standing Indian familiarity with making artifacts of unleaded binary high-tin bronze which has been hitherto little known. I have undertaken metallurgical investigations on vessels from Iron Age burials and megaliths such as from the Nilgiris and Adichanallur in Tamil Nadu datable to the early to mid 1st millennium BC and

I found these to be of wrought and quenched high-tin beta bronze with around 23 per cent tin, which rank among the earliest such alloys known in the world. These specialised alloys can be hot forged and when quenched or cooled in water they have improved properties of golden lustre, musical properties, toughness and corrosion resistance. Such vessels and cymbals are still made in Kerala.

After all these years the burial complex at Adichanallur now being excavated has yielded pottery and finds which are dated to 1000 BC (box). It is interesting that one excavation report on Mohenjodaro (2500 BC) listed two unleaded bronze samples of 22 per cent and 26 per cent tin, although without metallography one can't tell if these were accidentally or intentionally alloyed. Thus it is possible that the Aranmula mirror making process evolved out of longstanding indigenous metallurgical traditions.

(Dr Sharada Srinivasan has won an award from the Indian Foundation for Arts (IFA) for her work in documenting Indian metal crafts.)