

Dr Sharada Srinivasan on past Indian metallurgical techniques: Best not always linked to grandness

indianexpress.com/article/technology/science/sharada-srinivasan-past-indian-metallurgical-techniques-7424369/

July 27, 2021

Written by [Adrija Roychowdhury](#) | Kolkata |
July 27, 2021 11:55:29 am



As a practising Bharatnatyam dancer Dr Sharada Srinivasan was fascinated by figures like the Nataraja icon. (Sharada Srinivasan)

As an engineering student in the Indian Institute of Technology (IIT) Bombay, Dr. Sharada Srinivasan was drawn towards Quantum Physics. But as a practising Bharatnatyam dancer she was fascinated by figures like the Nataraja icon. Marrying her two passions, she has been closely studying the metallurgical compositions of historical artistic productions.

But what can the study of metals of archaeological artifacts lead to? “One is to understand the history of technology and the progression of metals in civilisation; the other is that for the conservation of artefacts, one needs to understand their corrosion behaviour, composition and so on. Thirdly, it helps us to get better insight in archaeology and in art history,” says the 55-year-old archaeometallurgist who is Professor at the National Institute of Advanced Studies (NIAS), Bengaluru.

Earlier this year, Srinivasan was elected as the only Indian among 240 worldwide to the American Academy of Arts and Sciences in the category of Social and Behavioral Sciences: Anthropology and Archaeology. Her work has been honoured earlier as well when in 2019 she won the Padma Shri in Archaeology and in 2011 when she won the Kalpana Chawla Woman Scientist Award.

<https://images.indianexpress.com/2020/08/1x1.png>

In an interview with [Indianexpress.com](https://www.indianexpress.com), Srinivasan spoke at length about how she brings science, history, and art together in her work as an archaeometallurgist, and what the study of metals tells us about the history of India.

Excerpts from the interview:

Why were you drawn towards archaeometallurgy?

Dr. Sharada Srinivasan: My first degree was in engineering in IIT and yes at one time I wanted to study Quantum Physics. But I was also a practising Bharatnatyam dancer for a long time and I had a fascination towards figures like the Nataraja icon. It draws together in three dimensions the connections between the geometric, the anthropomorphic and elements of devotional poetry, dance and Bhakti era philosophy. So when I would perform the shloka of the Ashtamurti of Shiva, the Panchabhuta, I would of course delve into the metaphorical realm of the 'five elements', but then I also got interested in exploring what the actual scientific analysis of the elemental composition can tell us about the metallurgical characterisation of objects.



Chola Nataraja from Kankoduvanithavam, Tanjavur District (Sharada Srinivasan)

How does the study of metals help us in better historical understanding?

Dr. Sharada Srinivasan: One problem with historical icons and particularly in the South Indian context is that many are solid bronzes, cast using the same conventions over a long period of time. Quite often they do not have very clear inscriptions so it is not easy to make attributions of style and dates through visual means alone. So what I tried to do is to look at how we can actually find some characteristic metallurgical profiles for different styles of bronzes in different dynastic periods like Pallava, Chola, Vijayanagara, which we can then use to make better attributions.

For example, among the many Nataraja images I analysed were a few that fit into the metallurgical profile of the Pallava bronzes. There were a large number of them from the Chola period and there were none from the Vijayanagara period. It makes sense because in the Vijayanagara period there was a different kind of religious or cultic worship. The Vijayanagara rulers were staunch Vaishnavas whereas the Cholas were Shaivas.

I think another example would be of the Rama iconography of the Vijayanagara and the Chola periods. What I found was that the Vijayanagara Rama had an iconometric proportion closer to the Dashatala of the major deities like Vishnu, Shiva etc. The Chola Rama on the other hand followed the modelling proportions of Ashatala, associated with an ideal man. This reflects an actual cultic shift whereby Rama worship became more prominent in the Vijayanagara period. The distinct metallurgical profiles of the Rama icons of these two periods was due to different sources of metals being used in the Chola and the Vijayanagara periods as mentioned before.

What would you say is the connection between the kind of metals being used in a particular period and the religious or political profile of the dynasty ruling at the time?

Dr. Sharada Srinivasan: One could take the example of the Delhi iron pillar, which has the Sanskrit and Brahmi inscriptions giving attributions to Chandragupta of 400CE. But it has the same kind of commemorative value as that of the stone Ashokan pillars in front of monasteries. The iron pillar is the earliest surviving large forged iron artefact in the world. It is as if the artistic motif that had been developed through the stone Mauryan pillar of the second century BCE was now being used in metal in the Gupta period: to also proclaim something about their kings. The Mauryan pillar too drew from the Hellenistic and Persian world where inscribed pillars with commemorative value were installed.



I want to point to some interesting examples in the Megalithic and Iron Age in South India which is not considered a very sophisticated material culture, says Dr Sharada Srinivasan (Sharada Srinivasan)

Another example is found in the inscriptional record when Mahendravarman I of the Pallava dynasty started making free standing rock excavations (such as at Mamallapuram), whereby there is an inscription in Mangadapattu which mentions that neither brick, nor mortar, nor wood were used (in rock cut excavation). This proclamation is reflective of such technological transitions in the Pallava period when there was a shift from wood to stone, as well as from wooden processional icons to metal processional icons. It is as if the rulers of the period were consciously experimenting with new technologies and methods to also make political statements of their prowess.

In the Indian historical trajectory, under which ruling dynasty would you say that metallurgical techniques were most sophisticated?

Dr. Sharada Srinivasan: I do not have a blanket answer to this question. If you look at the Incas, they had the most sophisticated gold-silver alloys which you do not find anywhere else in the world. Yet, they never progressed beyond iron technology. What I am trying to say is that different kinds of technologies developed in different ways and in different places. This could have also been related to the access to resources. So I will not say that there is any one period where we get the best of everything.

To that extent, I want to point to some interesting examples in the Megalithic and Iron Age in South India which is not considered a very sophisticated material culture. But we have analysed vessels which are of an extraordinary sophisticated technology of what is called high-tin beta bronze.

Bronze is an alloy of copper and tin, and at a particular composition of 23 per cent tin at very high temperatures, it acquires certain properties so that it can be forged very extensively. Then once it's rapidly cooled in water so that the plastic beta phase is retained, it acquires some unusual properties like golden lustre, musicality and lower brittleness. We find such vessels from the Nilgiris, Adichinallur, Kodumanal which are extraordinarily thin, about 0.2 millimeters, forged with perforations and decorations.

So this is a very sophisticated skill in the Megalithic period which we often think of as a not-so-elite culture. Metalworking is a physically laborious task and even today we see that the most skilled traditional metal workers such the Agharias, the Asurs or the Kotas come from the so-called tribal or indigenous communities. They are mostly marginalised. So this idea that the best is often associated with grandness may not always apply. We can see very skilled techniques in contexts that outwardly do not appear very complex. Similar alloys are still in use and known by various names such as Ottupatram in Tamil and Malayalam and Kansa in Eastern India.

What are some of the foreign influences on metal technology in India?

Dr. Sharada Srinivasan: Look at the largest bronze from the subcontinent which is the Sultanganj Buddha from Eastern India of the 6th century in the Birmingham Museum today. It is a life-size image that is made by a hollow casting technique. First, a clay core was made and then the wax was applied on top of that, so that the final cast image is not of solid metal unlike most south Indian images but consists of a thin layer of metal on top

of the intact clay core: which is described as a hollow casting. That is very much a Hellenistic technique which seems to have permeated from Northwestern India and carried over into this Gupta period.

Another good example is that of zinc metallurgy. It is in the Indian subcontinent that zinc as a metal was first isolated and so you have the most extensive remains of early zinc extraction in the Zawar region in the 11th and 12th centuries. The earliest use of high zinc alloy is the Bidriware which has about 90 per cent zinc and some copper. Zinc metal was already known in pre-Islamic Indian context, but it was with the Deccan Sultanate's Persian influence that this technique of inlaying with silver and patination was introduced, which makes it less corrosive. It was a coming together of different traditions in interesting ways.

© IE Online Media Services Pvt Ltd