

# CŌĻA BRONZES IN THE CONTEXT OF THE HISTORY AND CULTURE OF TAMIL NADU

## I. THE TEMPLE CULT IN SOUTH INDIA IN A RELIGIOUS AND HISTORICAL PERSPECTIVE\*

*(Marzenna Czerniak-Drożdżowicz)*

### RELIGIOUS TRADITIONS OF THE REGION

The region of the South of India and especially Tamil Nadu, or rather, the region dominated by the Tamil culture, has always been very rich in religious developments but in the last centuries of the first millennium AD it was especially prolific, being also an area where the Brahmanical and local cults intermingled.

Brahmanical cults, often identified as orthodox and belonging to the external and sometimes invading Aryan culture, mixed with the rich local religious life connected with many local deities. The issue of Brahmanical culture and the Brahmins of Tamil Nadu, as a subject of research in itself<sup>1)</sup>, does not fit within the scope of our presentation, but it should be noticed that this social group was not so consistent as one could expect and the direction

---

\* The research on South Indian religions and religious art is conducted within the framework of the research grant from the Polish National Centre of Science, decision number UMO-2011/03/B/HS2/02267.

<sup>1)</sup> See for example Subramaniam 1974, Young 2007.

of influences between the local Dravidian culture and the Aryan newcomers went both ways; therefore, not only did the incoming Brahmins influence the life of the Tamils but they also accepted and adopted many local customs and ideas.

The religious traditions which had a decisive impact on the spiritual life of India were the so-called Hindu Tantric rituals and the question to what extent they were orthodox and Brahmanical is yet another domain of research which we have no space here to develop fully. Nevertheless, it should be acknowledged that they, in general, were traditions and ideas introduced by devotees who were mostly Brahmins or claimed a high status; therefore, they should not be perceived as an exclusively local phenomena of low social strata with no connection to the orthodox religion of the Brahmins.<sup>2)</sup> One has to admit, however, that some local ideas were included and adopted to make a consistent whole with the dominating ideology.

#### NEW IDEAS – GOD’S PRESENCE IN THE WORLD; IDOLS AND TEMPLE CULT

The characteristic features of the religious traditions developing in the first millennium AD were, for example: the important role of female potencies and the position of goddesses, the development of particular, elaborate ritual procedures, and a very direct and even intimate relation between a devotee and a god. The god was perceived as an entity which, in his transcendent form, was inaccessible to the devotees, but who, for the sake of his followers, acquired immanent forms enabling direct contact with them.

The issue of god’s presence in his earthly representations is one of the crucial theological and philosophical ideas present in the considerations and discussions of the religious teachers and philosophers of the epoch. It is also one of the crucial topics of the religious texts of Tantric traditions such as Tantras, Āgamas and Saṃhitās.

The general idea shared by Tantric traditions is that in the immanent world the god acquires specific forms that can be self-manifested or created by sages or devotees, symbolic or anthropomorphic. The god, however, can be really and fully present in them only if all the requirements are fulfilled – namely, the representation is created in a prescribed way and then installed and consecrated in an appropriate place. This means a temple in which the

---

<sup>2)</sup> One could refer, for example, to the works of Sanderson (Sanderson 1988), Padoux (Padoux 1998), Young (Young 2007), etc.; see also Czerniak-Drożdżowicz 2008 and 2011.

god would be treated as a king in his palace and worshipped with devotion – *bhakti*. Such an assumption implies the development of a particular knowledge regarding the establishment of holy places and the creation of holy images. This knowledge combines religious elements with practical rules for dealing with material objects; therefore, the construction of a proper representation and temple concerns two fields: art and religion.<sup>3)</sup>

While considering the idea of a god's presence in his representation, we can see that in the South Indian Vaiṣṇava tradition, a god is perceived as active and mobile. This refers to the Tamil understanding of divine presence located 'within the confines of concrete reality'. In the North Indian understanding, as is noticed for example by Nayar, a god is immobile and inactive and located within the temple. The desire and habit of treating god in his representation as a mobile person developed over time in South India.<sup>4)</sup> The doctrine of the five modes of god's existence, of which one is his presence in the representations – *arcāvatāra* – is typical for South Indian Vaiṣṇavism and is connected with the specific forms of worship: *darśana* – seeing the God and being seen by him, and *kainkarya* – being a servant to god.

While analysing the cult of divine representations in the Śaivasiddhānta context, Richard Davis writes about the *āvāhana* (invocation) rite as the one enabling the union of the two aspects of Śiva: *sakala* (having a form, parts) and *niṣkala* (without a form, without components).<sup>5)</sup> In the Śaivasiddhānta, a specific and very popular and important form of Śiva in the Cōla epoch – *liṅga* – becomes a throne of the god and his divine body which is built from *mantras*. Davis, describing the process of invoking Śiva into the *liṅga*, writes: 'Through the imposition of *mantras*, the worshipper invokes the actual energies of Sadāśiva and his agents onto the substratum. According to Śaiva Siddhānta, a *real* metamorphosis of the pedestal and *liṅga* is accomplished through this rite.'<sup>6)</sup>

These developments in religious thoughts were the basis for the development of the god's representations both immobilised in the main temple shrine (mostly made of stone, or, earlier, of wood) as well as mobile to be used in processions etc. (mostly made of metal).

<sup>3)</sup> See for example Czerniak-Drożdżowicz (forthcoming).

<sup>4)</sup> Nayar (Nayar 1992) refers here to Hardy's *Viraha bhakti*, pp. 468–469.

<sup>5)</sup> Davis 1989.

<sup>6)</sup> Davis (1989: 370).

The idea of god's presence in his manifold representations in the Śaiva and Vaiṣṇava traditions is similar<sup>7)</sup> and the rites of installation and consecration of the temples and images are also similar, though they differ in detail. Since there is no time to present all the dimensions of the divine cult in terms of his images, we should remember that the opinion that images were used by less developed devotees has recently been rejected by researchers. They underline the role of images as devices enabling the devotees to use divine powers/potencies for practical appliances. Tarabout, questioning the opinion that the limitations of a human being were the reasons for the cult of images which enabled man to approach a god, refers to the works of, for example, Raghavan, Sanderson and Brunner. These scholars oppose the opinion of, for example, Coomaraswamy, who claimed the 'transcendental nature' of Indian art. Tarabout recalls the opinions of several scholars such as, for example, A. Danielou, who wrote that an image of a god is a form used for the concentration of the mind on an abstraction. Such an idea influenced many scholars, among them Coomaraswamy, who denied any 'naturalism' of Indian art. All these opinions added up to the common idea that the cult of idols is a 'folk cult'. Tarabout, however, points out that images are indispensable for ritual and necessary for all devotees to acquire particular, specific goals despite their religious development, while on the higher level of acquiring emancipation, mental representations of a god are usually preferred. Yet, the material representations are as good as those visualised in the mind's eye.<sup>8)</sup> In the Śrīvaiṣṇava tradition, for example, the term *paripūrṇa* is used to express the 'fullness' of god's incarnations in his representations. In the opinion of Kūreśa, a disciple of Rāmānuja (11<sup>th</sup>/12<sup>th</sup> c. AD), it means that the form in the consecrated image is equal to the form of the Highest Brahman.<sup>9)</sup>

---

<sup>7)</sup> I referred to this issue in my book of 2011, pp. 84–85 when I mentioned some Śaiva texts, explaining also the need for *āvāhana* – the invocation of god into his idols, and also in Czerniak-Drożdżowicz (forthcoming).

<sup>8)</sup> Tarabout (2004, for example p. 71).

<sup>9)</sup> Nayar (1992: 114, 123). On p. 114 she writes about a hymn by Bhaṭṭar, the son of Kūreśa (Rāmānuja's disciple), referring to the doctrine of *vyūha*. It concerns *stotra Śrīraṅgarāja Stava*, in which one can find definitions of the 6 *guṇas*. On p. 123 she refers to the term *paripūrṇa* – which at the end of the 13<sup>th</sup> c. and the beginning of the 14<sup>th</sup> c. was used by Śrīvaiṣṇava theologians to describe „fullness” of the divine incarnation in the god's representations. In the work of Kūreśa it appears probably for the first time and in the *stotra* it clearly expresses the faith that the god's incarnation in the properly consecrated idol is equal to the form of the Highest Brahman.



This development of the religion implies the need for the construction of places designated to be abodes of god's immanent, earthly forms and the need for his representations. These representations, including sculptures, should be installed in the main shrine (*garbhagrha*) and also in other places within the temple's premises.

#### KINGS AND QUEENS AS SPONSORS

The development of places of worship very probably begins with the local shrines not having a particular, solid material structure. They were often places where, according to tradition, the god himself appeared – places connected with particular mythological events, sometimes connected with the local, but not necessarily Brahmanical, cults. They could have been taken over by Brahmins and around them a community of the followers of a cult would arise. In the case of South India, sometimes a local deity was identified with a particular god of the Hindu, pan-Indian pantheon as his local form, and the place of its worship began to grow. Through such a process the local shrine would develop into a regular temple.

One of the first temples in the region were those built by the Pallava rulers (3<sup>rd</sup>–8<sup>th</sup> century AD). This dynasty was represented by several powerful kings who established their capital in Kanchipuram and the main harbour in Mahabalipuram. It is in these two places that we can find spectacular examples of the oldest stone temples in Tamil Nadu. These are cave temples probably introduced by Mahendravarman I (c. 571–630) in Mahabalipuram as well as the Vaikuṅṭha Perumāḷ and Kailāsanātha temples<sup>10</sup> in Kanchi, dated to the period between 600 AD–800 AD. It should also be noted that the dating and affiliation of particular temples to particular rulers is still a subject of discussion among scholars. Nevertheless, the oldest monuments connected with the times of the Pallavas also include the temples and sculptures associated with the name of Mahāmalla Narasiṃha I: Dharmarāja Ratha, Ādi Varāha Maṇḍapa, the Great Penance Relief in Mahabalipuram or the Nageśvara temple in Kumbhakonam. (Fig. 1)

The next powerful dynasty of South India, the Cōlas (850–1279 AD), draw their dynasty line down to the Solar dynasty of the descendants of Manu.<sup>11</sup> Part of this genealogy refers to the connection with the Cōlas of

<sup>10</sup> It was built by Rājasīṃha Narasiṃhavarman II (690/91–728/29).

<sup>11</sup> Champakalakshmi 2011.

the Sangam time. The dominant feature of these genealogical stories was devotion – *bhakti* directed to Śiva and the stories of the *itihāsa-purāṇa* type also including eulogies praising rulers belonging to this dynasty. It seems that the Cōlas' predilection towards Śiva was meaningful and was a useful tool for the acculturation of the *liṅga* cult (important in the Sangam time), which was significant and typical of this dynasty. Apart from that, there was also a strong component of the popular Tamil cults such as the Korṛavai=Durgā cult, Mother goddess cult, Murukaṅ cult or the cult of Ālamar Celavan seated under the banyan tree identified with Dakṣiṇamūrti, and finally, that of the dancing god of the cremation ground – Naṭarāja. Female goddesses, often of local origin, became Śiva's consorts. Acculturation has its expression also in taking over old cult places (pillars, trees, etc.) and establishing regular temples around them. It was also the method of inclusion of the local priests into the main, dominating tradition. Significantly, there are no traces of any royal initiative or involvement in the construction of the main temples before the 9<sup>th</sup> century AD. The earliest ones were located on the Kaveri river and most of them were built by the Pallavas and then often renovated by the Cōlas – brick was swapped for stone.

Nilakantha Sastri<sup>12)</sup> was convinced of the very important role of the Cōlas in the process of building temples and the development of the temple cult in the South of India. In his opinion, the Great Temple of Thanjavur, built by Rājarāja I (985–1014 AD), was the example and symbol of the power of this dynasty.<sup>13)</sup> (Fig. 2)

Sastri also mentions the fact that at this time brick temples were rebuilt in stone and one of the queens, Sembiyan Mahādevī, was an important figure as far as the development of the art and architecture is concerned.<sup>14)</sup>

The role of the Cōlas' queens is more thoroughly presented for example in the works by Venkataraman and Kaimal. Venkataraman<sup>15)</sup> writes that women of the Cōla dynasty played a relatively important role in the development

---

<sup>12)</sup> Sastri 1955.

<sup>13)</sup> He writes (p. 654): 'In fact, the place of the Great Temple in the economy of the capital city and of the empire can hardly be exaggerated. Its construction must have extended over many years and furnished employment for the best architects and sculptors of the land during these years, besides a vast number of common labourers.'

<sup>14)</sup> One such important temple was the Vijayālayacōleśvara in Nārttāmalai with its *vimāna* above a round chapel.

<sup>15)</sup> Venkataraman 1976.

of the temple cult due to sponsoring many temples and many sculptures installed inside them. Among these queens were Sembiyan Mahādevī, the wife of Gandarāditya and mother of Uttama Cōla; Kundavai who was the eldest sister of Rājarāja Cōla, the builder of the Great Temple of Thanjavur, and Lokamahādevī who was the wife of Rājarāja.

Sembiyan rebuilt old temples and also established some new ones. Among them were Umāmaheśvara in Konerirajapuram, Cōleśvara in Kuttalam, Kailasanāthasvamin in Sembiyan Mahadevi village, Agastyeśvara in Anangur and others.<sup>16)</sup> Some scholars, therefore, speak even about the ‘Sembiyan Style’, which is characterised, for example, by the growing number of *devakoṣṭha* niches on the outer walls of the *garbhagrha*. In these niches more differentiated sculpted figures began to appear. In general, early Cōla temples did not have *devakoṣṭhas*, or if they had, they were without sculptures. Under Āditya I (c. 871–c. 907 AD) there began to appear figures of: Dakṣiṇamūrti to the South, Viṣṇu to the West or East;<sup>17)</sup> and Brahmā to the North. At that time there began to appear the figures of Ardhanārīnara and in the back *devakoṣṭha* – those of Liṅgodbhava;<sup>18)</sup> there also appeared additional niches for Gaṇeśa to the South and Durgā to the North.<sup>19)</sup>

In the times of Sembiyan (10<sup>th</sup> c. AD), on the walls of the temples were at least 9 *devakoṣṭhas*, as for example in Konerirajapuram, while in Karunttangudi there were even 16. The usual order of the gods established in the *devakoṣṭhas* at that time was: Naṭarāja, Gaṇeśa, Agastya, Dakṣiṇamūrti, Liṅgodbhava, Brahmā, Bhikṣāṭana, Durgā, Ardhanārī. Instead of Liṅgodbhava Viṣṇu or Brahmā could appear. Sometimes there could be some other changes, – for example, in Aduturai Śiva and Pārvatī appear in the Āliṅgamamūrti instead of Ardhanārī.

In the case of the famous temple in Konerirajapuram, due to the fact that it is directed towards the West and follows the rule of connecting the gods

<sup>16)</sup> These were for example: Tirukkurangaduturai in Aduturai; Tirukkoteśvara in Tirukkodikaval; Aśaleśvara in Tiruvarur and Mayuranaṭeśvara in Mayuram; Śivalokam Udaiyar in Tiruvakkarai and Vṛddhagiriśvara in Vriddhachalam; Masilamaniśvara in Vada-Tirumullaivayil in the Chengleput district.

<sup>17)</sup> According to the direction of the temple.

<sup>18)</sup> From the times of Parāntaka I (907–955 AD).

<sup>19)</sup> In the Śaiva temples, if there are 3 *devakoṣṭhas*, on the southern wall Jñāna Dakṣiṇamūrti or Viṇādhāra Dakṣiṇamūrti is situated, to the North – Brahmā, and at the back Liṅgodbhava could appear. If there are 5 niches, in addition, to the South there is Gaṇeśa and to the North – Durgā. There appears also the figure of Agastya.

with particular directions, the order is reverted,<sup>20)</sup> but here we can probably see one of the first stone sculptures of Naṭarāja (Fig. 3). One of the first reliefs representing Naṭarāja in the *ānanda-tāṇḍava* dance pose, as for example Charlotte Schmid supposes,<sup>21)</sup> could be found in the yet another temple of the region, established between the Kaveri and Kollidam rivers. In the Caṭaiyar temple in Tirucennampunti, featuring traces of both dynasties, the Pallava and the Cōḷa, the relief appears above the *devakoṣṭha* with the Vinadhāra's sculpture. (Fig. 4)

As for the two other queens which we have already mentioned, Kundavai<sup>22)</sup> was adding to the glory of the Thanjavur temple and founded 4 bronze sculptures there, among them the two which represented her parents. Lokamahādevī,<sup>23)</sup> apart from founding Śaiva temples, also sponsored Vaiṣṇava and Jain temples.

Among the sculptures appearing on the walls of the temples of this time, sometimes one can see the representations of the rulers themselves – for example, Gandarāditya worshipping Śiva in *liṅga* can be seen on the southern panel of the main chapel in Konerirajapuram between Naṭarāja and Dakṣiṇamūrti (Fig. 5). There is also a portrait of Sembiyan in the Kailasanātha temple in the Sembiyan Mahadevi village. Rājarāja, the builder of the Great Temple (Bṛhadīśvara) in Thanjavur, is represented on the wall painting of the *garbhagr̥ha* in the Thanjavur temple. He is accompanied by his 3 queens, among them Lokamahādevī.

The reign of the Cōḷa dynasty was therefore, apart from being a period of great development of temple architecture, the time of the development of the stone and metal-cast sculptures and the formulation 'Early Cōḷa bronzes' applying mostly to Sembiyan's time.<sup>24)</sup>

There is, however, a discussion among scholars about the actual role of the Cōḷa dynasty in the construction of the temples. One of the important voices

<sup>20)</sup> These are: Ardhanārī, Durgā, Bikṣāṭana, Brahmā, Liṅgodbhava, Dakṣiṇamūrti, Naṭarāja (Naṭarāja is near Dakṣiṇamūrti and not at the end of *pradakṣiṇa*), Gaṇeśa, Agastya (if we follow *pradakṣiṇa*). I am grateful to my colleague Dr. Anna Ślącza, for drawing my attention to this atypical order of the figures in Konerirajapuram.

<sup>21)</sup> Schmid (2014: 168–171).

<sup>22)</sup> Venkataraman (1976: 65–84).

<sup>23)</sup> Venkataraman (1976: 85–103).

<sup>24)</sup> As Venkataraman says: "Reared in a milieu where life centered around the temples, the Chola queens have made a significant contribution to Indian Art and Culture." Venkataraman (1976: 125).

belongs to Padma Kaimal, who in fact proposes to speak about the 'Kaveri style' instead of the 'Cōla style'. She speaks<sup>25)</sup> about over one hundred small Hindu temples of granite in the Tamil Nadu's Kaveri river delta constructed during the 9<sup>th</sup> and 10<sup>th</sup> centuries AD. Many researches of Indian art and history attributed the patronage of their construction to the first nine kings of the Cōla dynasty. Although Kaimal acknowledges a link between kings and art, she points to the fact that the monuments of the 'early Cōla style' were not necessarily sponsored by Cōla rulers themselves.<sup>26)</sup> She claims that the inscriptions in these temples name non-Cōla patrons much more frequently than the Cōlas and, therefore, her work challenges one of the important ideas concerning Indian art history, namely the one stating that art patronage has been primarily the work of kings. Kaimal's meticulous research should make us cautious about attributing all the monuments directly to the Cōlas.

Nevertheless, acknowledging the role of this dynasty, Kaimal<sup>27)</sup> analyses, for example, the appearance of the figure of Naṭarāja as well as the development of its iconography with reference to the Cōlas. It was this particular dynasty that appropriated this figure as the royal emblem, and it had become visible by the reign of Rājarāja I (985–1014 AD). Kaimal also agrees about the important role of Queen Sembiyan and writes:

'I propose that the Chola queen Sembiyan Mahadevi was Rājarāja's predecessor in deploying the Naṭarāja image as a Chola emblem. The dozen temples she had built between 970 and the early eleventh century were the first to feature Naṭarāja in full-scale wall niches. Their geographic distribution across the deltaic region the Cholas aspired to dominate suggests that one important function of her temples was to expand the fame of the Chola dynasty in the localities. I see the prominent Naṭarāja sculptures on their walls as playing a role in that expansion and in the innovative iconographic programs her temples introduce.'<sup>28)</sup>

---

<sup>25)</sup> Kaimal 1996.

<sup>26)</sup> She mentions the fact that the inscriptions from these temples refer to other people, not belonging to the Cōla family, sometimes even not rulers but landowners, as primarily responsible for constructing these temples

<sup>27)</sup> Kaimal (1999: 19).

<sup>28)</sup> Kaimal (1999: 19).

## II. THE MAKING OF CŌĻA BRONZES AND THE RIJKSMUSEUM BRONZE RESEARCH

(Anna A. Ślącza)

**T**he rise in power of the Cōḷa dynasty dealt with in Part I coincided with the introduction of new religious ideas. These, in turn, had an impact on the temple cults. As we can ascertain from textual sources, the late-Cōḷa period is the time when festival images (*utsavamūrti*) began to play an important role in South India. Part II of the present article discusses the techniques of bronze casting in the Cōḷa period and now, with special attention being given to the monumental Naṭarāja-bronze from the collection of the Rijksmuseum, Amsterdam.

### INTRODUCTION: CAST-METAL ICONS IN SOUTHERN INDIA

In the Deccan, the production of cast-metal icons goes back to the first centuries of our era. Among them, best known are the small-size Buddha figures in the 'Amaravati style' (5<sup>th</sup>–6<sup>th</sup> centuries CE). The earliest surviving *Hindu* images are a few centuries later, dated, on the basis of stylistic analysis, to the end of the Pallava period (8<sup>th</sup>–9<sup>th</sup> centuries CE).<sup>29)</sup> The first *securely dated* Hindu icon from the Tamil region is the famous Umā from Karaiviram (Karaveeram), inscribed with a date equivalent to 917 CE.<sup>30)</sup> Images, such as the Umā, are nowadays primarily used when worship requires the presence of the main deity outside the *sanctum*, for example during temple festivals, when they are carried during processions. For this reason, they are popularly called 'festival images' (*utsavamūrti* or *utsavabera*).

The surviving Pallava-period cast-metal icons tend to be small in size.<sup>31)</sup> The growing size, and number, of metal images that can be observed in the

<sup>29)</sup> The dates given to these images vary, and there is no consensus among authors over which images should be considered 'late Pallava', to be distinguished from 'early Cōḷa'; see, for example, Nagaswamy (1983: 4–5).

<sup>30)</sup> This is one of the very few inscribed bronze images from South India. Dating South Indian metal images is problematic because almost none bear inscriptions. Dating, therefore, has to be executed purely on stylistic grounds, through comparison with stone sculptures, or by association with the inscriptions in the temple where they are preserved; such dating, necessarily, is far from certain.

<sup>31)</sup> According to some authors they were intended for private worship, being too

mid to later Cōla periods (i.e. from the 11<sup>th</sup> century onwards) presumably reflect new devotional and ritual practices. Indeed, they coincide with the introduction of new theological and ritual treatises, such as the South Indian Śaivāgamas: the *Kāraṇa*, *Kāmika* and the *Ajita*, to name just a few. These 11<sup>th</sup> and 12<sup>th</sup> century texts<sup>32)</sup> that provide the basis for liturgy in Tamil temples even today, contain elaborate descriptions of religious festivals, involving the use of portable metal images.<sup>33)</sup> Another important alteration of the ritual practice, especially concerning the form of temple festivals, must have taken place in the post-Cōla period, under the rule of the Vijayanagara (1336–1565 CE) and Nayaka kings (16<sup>th</sup>–early 18<sup>th</sup> century), when the *utsavamūrtis* reached an unprecedented size, with the bronze Naṭarāja from the Umāmaheśvara Temple in Konerirajapuram being a prime example (Fig. 6).<sup>34)</sup> These changes are reflected in the Sanskrit and Tamil inscriptions engraved on temple walls, and in the modifications of temple plans, such as the introduction of large corridors and additional *maṇḍapas*.<sup>35)</sup> However, it is more typically the earlier icons, produced between the 9<sup>th</sup> and 12<sup>th</sup> centuries CE, that are praised for their very high aesthetic and technological qualities. These icons are often labeled ‘the best bronzes on the Indian subcontinent’.

#### PRODUCTION TECHNOLOGY OF METAL IMAGES IN TAMIL NADU

There are numerous publications dealing with the subject of the Cōla ‘bronzes’.<sup>36)</sup> Considering the amount of literature on this topic, one might have the impression that everything that needs to be said has already been said.

---

small for temple worship, see: Srinivasan (1994: 39), but this conclusion seems a little too far-fetched. Relatively small images are used in temples even nowadays, for instance in ‘daily festivals’, such as *śrībali*.

<sup>32)</sup> As proved by recent research by Goodall (2004).

<sup>33)</sup> Religious festivals and accompanying processions did already take place under the Pallavas, but we do not know how were they organised and what was the function of metal images. For the performance of temple festivals in different periods, see Orr (2004).

<sup>34)</sup> Because the Naṭarāja is under worship, I was not allowed to take measurements, but it appears to be over 2m. in height, including the square pedestal.

<sup>35)</sup> See, for instance, Orr (2004), Branfoot (2001), Branfoot (2002).

<sup>36)</sup> Actually, these are not bronzes in the true meaning of the word, but are made of almost pure copper with very little (if any) tin, and for this reason they are sometimes referred to as ‘copper alloy images’. I will, however, use ‘bronze’ for the sake of convenience.



But nothing can be further from the truth. The majority of the publications discuss the iconography and style in detail, leaving out the technological aspects, which are of less interest to art historians. Information about production technology, if included at all, is rarely based on scientific research. The same is true for the instructions allegedly found in the ancient Sanskrit and Tamil treatises on art, which are often misquoted. The results are incorrect, or at best imprecise, with statements often repeated by several authors.

It is of course not possible to trace, in all its details, the production process used for making metal icons in the Cōla period – there are several methods of direct casting. But we can assume with a high degree of probability that the Cōla images were made through the lost wax (*cire perdue*) method, for this is mentioned in the *śilpaśāstras*: technical manuals in Sanskrit that deal with iconography, temple architecture and the making of images.<sup>37)</sup> *Cire perdue* is also used nowadays by the hereditary bronze casters of Tamil Nadu.

Currently, images meant for worship are solid cast: they consist entirely of metal and there is no clay core inside.<sup>38)</sup> To produce a solid-cast metal sculpture by means of the lost wax method, a wax model has to be made first. This should be identical to the intended metal sculpture and the more detailed the model, the better the cast image will be. It is impossible to determine what materials were used during the Cōla period, but nowadays the traditional bronze casters of Swamimalai in Thanjavur district of Tamil

---

<sup>37)</sup> The lost wax method (*madhūcchiṣṭavidhāna*) is explained in a number of texts, for example *Mānasāra* 68, by many authors incorrectly ascribed to the Gupta period; see, for instance, Reeves (1962: 29), and Chakrabarti and Lahiri (1996: 144), but most probably dating from around the 11<sup>th</sup>–12<sup>th</sup> century CE; and *Mānasollāsa* (12<sup>th</sup> century CE). It is also mentioned, albeit in a single sentence, in the treatises on ritual, such as *Viṣṇusamhitā* 14.65 and *Aṃśumadkāśyapa* 56.2.

<sup>38)</sup> The information below is based on interviews with Mr. D. Srikanda Sthapathy, a hereditary bronze caster and owner of the Sri Jayam Industries ('S. Devasenaspathy Sthapathy Sons') in Swamimalai, Tamil Nadu, conducted in February 2011 and 2014. For a more detailed description of contemporary bronze casting process in Swamimalai, see Krishnan (1976), Raj et al (2000) and, especially, Levy et al (2008). For other bronze casting centres in India, see Krishnan (1976). It should be mentioned here that the long fragments presented by Levy et al (2008: 51–52, 60, etc.) as the translation of the *Mānasāra* are, in fact, the verses of the *Mānasollāsa* as translated by Sarasvati (1936; Levy mentions Acharya's translation of the *Mānasāra* as his only reference and one wonders what was the source of the confusion: do the bronze casters use Sarasvati's translation, or a compilation of various texts, under the name of the *Mānasāra*?).

Nadu use a mixture of 50% beeswax and 50% resin powder.<sup>39)</sup> The wax model is enveloped in layers of clay and left to dry in the sun, which may take three to four weeks (Fig. 7). For the innermost layer, the clay from the shore of the river Kaveri, which flows through Swamimalai village, is used. The Kaveri clay is believed to be especially suited for this purpose and according to the casters it has been in use since antiquity. The second layer consists of coarse clay taken from paddy fields. Finally, the clay mould is tied with metal wire to prevent breakage during the wax removal. When the clay is completely dry, the model is heated so that the wax melts and flows out through purposely constructed channels (sprues), hence 'lost wax' technology. Smaller channels, the vents, provide a passage for air to escape the mould. The molten wax exits via cavities into which, subsequently, liquid metal is poured. Their exact location may depend on the size of the image, but at least in one case in antiquity the channels were attached to the back (sprues) and bottom (vents) of the icon as shown by a South Indian, 11<sup>th</sup> century miscast bronze, now at the Victoria and Albert museum in London.<sup>40)</sup> Smaller channels connect protruding parts, such as arms, to facilitate the flow of metal. During casting, the red hot mould is buried in the sand to prevent cracking, with its sprues and vents uncovered and pointing upward.

Once the metal has cooled, the clay mould is broken off with a hammer to reveal the cast image, which still has to be chiseled to sharpen the details, and subsequently polished. There seems to be disagreement among the authors about how much chiseling was used in antiquity; as for contemporary practice, chiseling plays an important role in finishing the face,

---

<sup>39)</sup> Details, such as the composition of the wax or clay used depend on the region and perhaps even on the workshop as shown by Krishnan (1976: 11 and 13–14).

<sup>40)</sup> Johnson (1972: 48). Contrary to the title of the publication, the image in question is presumably Sambandar, not Kṛṣṇa, these two representations being very similar. See also: Srinivasan (2006: 52), referring to an image from the British Museum (acc. no. 1958.7.15.1): 'As revealed by the rear of the Chandrashekhara image, the casting technique was one where the mould was placed at a horizontal incline; and the main sprue at the base of the spine was then cut off, leaving behind a protrusion. The back of the arms bears traces of runners which were once attached to the main image to aid the flow of molten metal and then sawn off.' In contemporary practice, the main sprue and vent seem to be attached to the feet of the image (or to the pedestal, in case of smaller sculptures), see Krishnan (1976: 13, 23–24 and 74).

hair and ornaments (Fig. 8).<sup>41</sup> The sprues are sawn off, although in a few cases the small connecting ones have been left (Fig. 9). Because every new image requires a new wax model and clay mould, all bronzes made by this method are unique pieces. As a result, there are no two identical Cōḷa bronzes, even though sometimes they may look very similar to an untrained eye. The production process is therefore long and can take up to a few months for very large sculptures.

As noted, images made in this way are called ‘solid-cast’ bronzes, because they consist entirely of metal. In the production of ‘hollow-cast’ images, however, a clay core is used which is then covered with a layer of wax, finished with the desired degree of detail. Pins may be inserted through the wax to hold the core in place; subsequently, the clay mould is built up around the wax in layers. After heating, the wax flows out, leaving a narrow space for the molten metal. But contrary to the solid-cast technique, here the clay core of the image remains under the layer of metal (so such images are not truly ‘hollow’, but they are not made of solid metal either). This method is cheaper, because less bronze is required.

#### CŌḶA IMAGES IN SECONDARY LITERATURE: SOLID *VERSUS* HOLLOW CAST

Although almost all Cōḷa *utsavamūrtis* seem to be *cire perdue*, solid-cast bronzes, some authors maintain that they are hollow-cast.<sup>42</sup> Others claim

<sup>41</sup> See, for example, Dehejia (2002: 12): ‘In Chola times, only the barest minimum of finishing work, like removing the channels of bronze connecting hands to torso... remained to be executed; the product of a well-encased wax model needed only be polished’. And Srinivasan (2006: 52): ‘The best Chola bronzes did not need much finishing as suggested by the details that stand proud of the surface.’ Nagaswamy (1983: 5), however, proposes that chiseling was more and more applied from the late-Cōḷa period onwards: ‘An examination of Pallava bronzes also makes it clear that the artist paid greater attention to even minute details in the wax stage itself so that there was little chiseling to do after casting the image. By contrast from about the 12<sup>th</sup> century, the wax model was fairly rough made and extensive chiseling had to be resorted to after final casting.’ A similar statement is found in Ramaswamy (1994: 471). The research by Johnson (1972: 46), on a bronze group attributed to ca. 1100 CE (as dated by Pal 1972: 33), proves that towards the later-Chola period the amount of chiseling and filing required was indeed substantial. It is of course to be expected that, the same as nowadays, better craftsmen produced more ‘complete’ images, requiring less finishing after casting.

<sup>42</sup> See, for example, Craddock and Hook (2007), Ward (2008: 70) and Pal (1972: 7: ‘For economical reasons larger bronzes were usually hollow casts’).

that although the bodies of the deities are cast solid, their animal mounts (*vāhana*) are hollow, the latter statement being given by such important scholars as P.R. Srinivasan<sup>43)</sup> and R. Nagaswamy.<sup>44)</sup> Furthermore, at least one author claims that the halo surrounding the deity is also cast hollow.<sup>45)</sup> These statements are usually not supported by references to technological research.<sup>46)</sup> It would perhaps be imprudent to reject these claims altogether, and yet very few hollow-cast images remain, *vāhana* or otherwise, from the period under discussion. One of them is the famous bull of Śiva from Tandantottam in Thanjavur district, already mentioned by Barrett just because it is unusual.<sup>47)</sup> Lesser known is the horse in a composition showing Śiva

<sup>43)</sup> Srinivasan (1994: 140), about the bull from the Vṛṣabhavāhana-group from Tandantottam, Thanjavur District: 'Interestingly the bull is cast hollow while the other figures are cast solid. In fact, animal figures are generally cast hollow', see also (1994: 355) about the bull from Tiruvanmiyur, Chingleput District: 'Just as in the case of other Nandis [a popular term for Śiva's bulls] this is also *probably* [my Italics] made according to the hollow-cast process.' It has to be stressed that very few metal icons of Śiva's bull found their way to museums, in any case far less than the Vṛṣabhavāhana or Ardhanariśvara images, which were originally accompanied by a bull-figure. Metal-cast bull images can still be seen under worship in temples in the area of Thanjavur, see Nagaswamy (1983: 132).

<sup>44)</sup> Nagaswamy (1983: 8): 'The metal images meant for worship in temples are cast solid including the large size Naṭarāja images, except the mounts like bulls, which are cast hollow.' Yet, the only example of a (partly) hollow image included in Nagaswamy's book is that of Śiva as a horse merchant (see below), while the only bull described in his catalogue (originally from Korukkai and now in Thiruthuraippundi, Thanjavur District; see p. 132) is not mentioned as being hollow-cast.

<sup>45)</sup> Ramaswamy (1994: 465): 'Solid casting has been preferred... and it is only the pedestal (*piṭham*), the halo (*tiruvāśal*) and the animal mount (*vāhana*) which are made through hollow casting' (the same is repeated on p. 470). Regrettably, he gives no examples.

<sup>46)</sup> The difference between solid and hollow-cast bronzes is easy to establish by checking the weight of the image: hollow-cast images should be lighter than the solid ones. But this might not be a precise enough method to examine small, not always easily detachable, elements (such as the halo). In such a case, other methods should be applied, for example X-ray radiography of the image. Although it should be noted that if core material is present, exposure to radiation can render Thermoluminescence dating useless.

<sup>47)</sup> Barrett (1965: 25; the bull is dated by him to the last quarter of the 10<sup>th</sup> century). It is also mentioned by Nagaswamy (1983: 134) and Srinivasan (1994: 140; see note 45). It is nowhere reported how the bull was examined, but it is plausible that it was done by simple weighing. Thanjavur Art Gallery images, for example, seem to have been weighed, as their weight is given in the Gallery's catalogue (see Rathnasabapathy 1982).

as a horse merchant (Kudiraichokkar), from the Jambukeśvara Temple in Thiruvanaikka, Trichy District.<sup>48)</sup> A third rather interesting example is a small seated figure, of which only the lower part of the body, including the legs, is hollow cast.<sup>49)</sup> Several authors mention inscriptions from the period, in which images donated to temples are described either as *ghana* (thick, solid) or *susira* (hollow).<sup>50)</sup> Because the provided references are often incomplete, the present research has thus far traced only one such inscription, originating from the famous Bṛhadiśvara temple in Thanjavur and quoted by several scholars, which speaks of Śiva's bull that is (partially) solid and (partially) hollow.<sup>51)</sup> As far as all the remaining 'mounts' and haloes of the Cōla-period figures are concerned, they were either never examined, or the results have not been published.

At least some of the statements quoted above may reflect contemporary practice. The much respected master-craftsman Ganapati Sthapati of Mahabalipuram in his recent book on image making prescribes that '... vehicles (or *vahanam*) should not be solid'.<sup>52)</sup> Moreover, it appears that at least some authors witnessed the bronze casting process in one of the traditional pro-

<sup>48)</sup> Nagaswamy (1983: 134): 'The figure of Siva is solid cast, while the horse is hollow with a burnt clay core.' He dates the sculpture to ca. 1250 C.E. There is one more Kudiraichokkar described in the same publication, but here Nagaswamy does not say anything about the casting technique (see p. 133).

<sup>49)</sup> Raj et al (2000: 84 and figs. 88a-b). It apparently is a 'small size icon', but it is further not identified by the authors and no information concerning date, provenance and present location are given.

<sup>50)</sup> See, for instance, Ramaswamy (1994: 470) and Nagaswamy (1988: 146).

<sup>51)</sup> The inscription is in Tamil and published by Hultzsch (1916, Part 2, no. 46). See especially lines 26–27 (text on p. 178, translation on p. 187): *kaṇapoḷḷalākac ceyta ṛṣabha[m] oṇru*, 'One bull (*ṛṣabha*), (partially) solid (and partially) hollow'. Literally: one (*oṇru*) *ṛṣabha* made (*ceyta*) solidly and hollowly (*kaṇam+poḷḷal+āka*). The inscription is mentioned by Rao (1985: 51), Balasubrahmanyam (1975: 45), Kuppuram (1989: 118), Sivaramamurti (1992: 3) and, presumably, Nagaswamy (1983: 134), with the authors (except Balasubrahmanyam who only gives the translation) re-Sanskritizing the Tamil *kaṇam* into *ghanam*. I would like to thank Emmanuel Francis for his help in tracing and interpreting this inscription.

Interestingly, the haloes surrounding the deities are described as 'solid'. A few more inscriptions, also from the Bṛhadiśvara, speak of *kaṇam* images, but I did not find any other inscription mentioning a 'hollow' one. A thorough study of all edited Tamil and Sanskrit inscriptions would certainly be desirable.

<sup>52)</sup> Sthapati (2002: 220).

duction centres that still thrive in South India, such as the aforementioned Swamimalai. The hereditary bronze casters consider themselves the descendants of the Cōla-period craftsmen and claim to use exactly the same methods as did their predecessors one thousand years ago. Still, they frequently use the hollow-cast method (even for entire images), which is not only cheaper – as noted earlier – but also easier in the case of very large bronzes. The only exceptions are bronzes meant for worship, commissioned by temples, which are always cast solid. Therefore, one should be cautious applying information provided by these hereditary craftsmen to interpret Pallava and Cōla images.<sup>53)</sup>

It is also plausible that the idea that vehicles (and haloes) should be cast hollow derives from some (relatively late) treatise on image making, or from a modern interpretation of an ancient text nowadays used by the casters. It should be noted that the *Mānasāra*, the text most frequently referred to by the contemporary bronze casters and scholars writing about Cōla bronzes alike,<sup>54)</sup> does not provide any such information.<sup>55)</sup> The 12<sup>th</sup>-century *Mānasollāsa* contains more detail than the extremely corrupt *Mānasāra*, but explains only the technique of solid casting;<sup>56)</sup> the 16<sup>th</sup>-century *Śilparatna* mentions both tech-

<sup>53)</sup> Unfortunately, the casting methods practiced in Swamimalai are often presented as the ‘original Chola’ ones, sometimes including details which would be impossible to verify even by examination using the best of technologies. Exceptions are publications by Raj et al (2000) and Levy et al (2008) whose authors do mention changes in the casting process. Ramaswamy (1994: 465) ascribes these changes to the expanding tourist industry and subsequent growing demand for bronze images.

<sup>54)</sup> See, for instance, Ramaswamy (1994: 473), Srinivasan (1999: 99), and Guy (2006: 21).

<sup>55)</sup> The text of chapter 68 dedicated to bronze casting is corrupt and cannot be used for any practical purpose, while its translation by Acharya (1934: 633–636) is not very good either. It would be interesting to know which text (if any) is being taught at the Poompohar Art Metal Training Centre in Swamimalai, established in the 1950s by the Department of Industries and Commerce in order to train mainly non-hereditary bronze casters. In India, ancient, well-known, and respected texts are often given as sources to lend prestige to whatever activity one is involved in, be it temple building or image making. During my research on the *garbhanyāsa*, a temple consecration ritual of South India (Ślāczka 2007), the priests of Kerala claimed to use the Sanskrit *Tantrasamuccaya* as a source, but in practice a more recent Malayalam translation, which at some places differed considerably from the original text, was used.

<sup>56)</sup> The full text of the *Mānasollāsa* was not available to me. Instead, I used the transcription of the chapter on bronze casting given in Sarasvati (1936: 141–142), Raj et al (2000: 23–24) and the study by Krishnan (1976: 1–8).



nologies, but does not say to which images, or parts of images, they should be applied.<sup>57)</sup> Finally, the *Sakalādhikāra*, also given as a source sometimes, does not seem to speak about the production of metal images at all.<sup>58)</sup>

#### THE MYSTERY OF THE *PAÑCALOHA*

One often reads that ancient South Indian images are made of the so-called *pañcaloha*, an alloy of five metals. The lists found in secondary sources vary: copper, silver and gold are always included, but there is no agreement about the remaining two metals. We either have brass (itself containing both copper and zinc) and lead or white lead;<sup>59)</sup> or we have brass and zinc;<sup>60)</sup> and sometimes even brass and iron.<sup>61)</sup> Interestingly, tin as an ingredient of the *pañcaloha* is rarely mentioned,<sup>62)</sup> although several authors speak of Tamil ‘high-tin bronzes.’<sup>63)</sup> As for the contemporary practice, the hereditary casters

<sup>57)</sup> See Part II, chapter 2.32–53 (as given by Sastri 1929). It is interesting to note that the *Śilparatna* appears to be the only early Sanskrit text to describe hollow casting in detail (it only mentions solid casting very briefly at the end of the chapter). The text is believed to originate from Kerala where, contrary to the Tamil country, hollow casting was applied on a much larger scale (Nagaswamy 1988: 174–175). It is plausible then that the text describes the existing local tradition of bronze casting.

<sup>58)</sup> Ramaswamy (1994: 465): ‘Icon casting in Tamil Nādu by the traditional Kammāla craftsmen was done strictly in accordance with the scriptural injunctions laid down in texts like *Sakalādhikāra*. *Sakalādhikāra* (see Iyengar 1973), however, deals mainly with making brightly painted clay images, such as those seen nowadays in village temples of Tamil Nadu (although the deities described in the first part of the text are orthodox Brahmanical ones, including some typically South Indian forms, such as Somāskanda and Liṅgodbhava). The only verse mentioning metal images (26.13) prescribes gold, brass (*kāmsya*), silver or copper or a mixture of these as suitable for (patrons coming from) all castes.

<sup>59)</sup> Ramaswamy (1994: 469), Reeves (1962: 107–108), and Chakrabarti and Lahiri (1996: 183); Guy (2006: 21) and Gangoly (1978: 33) substitute white lead for lead.

<sup>60)</sup> Nagaswamy (1983: 8): ‘Mainly copper was used for making these images; the epigraphs of the Cholas refer to them as copper images (*Śeppu thirumeni*), though at a later period, the use of five metals (copper, silver, gold, brass and zinc), called the *pañcaloha* came into vogue.’

<sup>61)</sup> Assayag (1999): gold, silver, copper, brass, iron; Levy et al (2008: 98–99): copper, silver, gold, zinc and tin or iron.

<sup>62)</sup> A few exceptions are: Ramachandran (1965: X) and Dehejia (2002: 12): copper, tin, lead, silver and gold; and Dehejia (1999: 65): brass, copper, tin, gold, silver.

<sup>63)</sup> Ramaswamy (1994: 469) speaks of over 20% tin, but no examples or references



of Swamimalai use copper (82%), brass (15%), lead (3%) and small additions of gold and silver, the last two exclusively for temple images. So what really is the *pañcaloha* and where is it explained? The term is said to have its origin in the *śilpaśāstras*,<sup>64</sup> the Sanskrit treatises on architecture, iconography and image making. Yet, neither the *Mānasāra* nor the *Mānasollāsa* mention it.<sup>65</sup> The *pañcaloha* is also absent from other frequently-quoted treatises, the *Viṣṇusamhitā* and the *Śilparatna*.<sup>66</sup>

Again, I do suspect the term to occur in some later-date work, or a Tamil rendering of some ancient Sanskrit treatise, used by contemporary craftsmen.<sup>67</sup> It should be added that the few examinations whose results were

---

to specific studies are given, so it is possible that he refers here to prehistoric bronzes from Tamil Nadu which, indeed, had a high tin content. Compare also Srinivasan (2006: 52): ‘Of the 28 Chola images analysed by the author, most were leaded bronzes with an average of 7 per cent tin and 7 per cent lead and only two had up to 2 per cent zinc... In later periods, the tin content falls as in the Vijayanagara-style Varaha image ... with 3 per cent lead and 2.5 per cent tin.’ The highest tin content in a Chola bronze detected by Srinivasan (1999: 104) was 15wt% in a Bhūdevī image, originally from Coimbatore District and now at the Victoria and Albert Museum (IM.137–1927), dated by Srinivasan between 850–1070 CE. The percentage of tin in the Srīdevī from the same group (IM.149–1927) is, unfortunately, not given. The fall of tin content from the 13<sup>th</sup> century onwards is also noted by Kuppuram (1989: 110), but it seems to increase again in the 17<sup>th</sup> century.

<sup>64</sup> Ramaswamy (1994: 469): ‘According to the *śilpaśāstras* Indian ‘bronze’ consists of five metals (*pañcaloha*); and Guy 2006: 21: ‘In south India these [*śilpaśāstras*] dictate that the alloy known as ‘pancha laucha’ (‘five metals’), should consist of an amalgam of copper, the principal element, with gold, silver, brass and white lead.’ See also Gangoly (1978: 33) and Dehejia (1999: 65). Nagaswamy (1988: 146) is probably the only scholar who, in one of his articles, proposes that the *pañcaloha* is mentioned neither in inscriptions, nor in any of the early texts.

<sup>65</sup> *Mānasollāsa* (see Sarasvati 1936) mentions only four metals as suited for image making: gold, silver, copper and brass/bell-metal (*ṛiti*, probably a mistake for *ṛti*). Admittedly, brass is already an alloy of two metals, but we do not know what exactly was meant by *ṛti* by the authors of the text: translation of technical terms from Sanskrit is another problem that has to be dealt with.

On the other hand, the expression *pañcaloha* is found in some *āgama* texts in passages dealing with temple consecration rituals (see Ślaczka 2007), but it is used in the meaning of ‘[any, or these] five metals’ rather than as a specific technical term. Cf. *Suprabhedāgama* 28.24ab, transcript T360: *suvarṇaṃ rajataṃ tāmraṃ āyasaṃ trapuṣaṃ tathā //23cd//madhyame ca caturdikṣu vinyastvā pañcalohakam*.

<sup>66</sup> See Sastri (1990: chapter xiv) and Sastri (1929: chapter 2.32–53).

<sup>67</sup> In fact, Raj et al (2000: 23) mention that ‘The Tamil and Malayalam versions of

published show considerable differences in the metal composition of Cōla images, including those of similar date and provenance (the copper content is always very high, but the percentage of other metals varies). This indicates that the approved metal composition was not static, but varied according to workshop and availability.<sup>68)</sup>

The contradictory statements found in secondary literature and the difficulty in accessing the often unpublished results of technological studies on Cōla bronzes were the main reasons to begin the bronze project in the Rijksmuseum in Amsterdam.

#### THE RIJKSMUSEUM BRONZE RESEARCH

(*Joosje van Bennekom and Sara Creange*)

The scientific research was carried out by a team from the Rijksmuseum, the Cultural Heritage Agency (RCE) and the Free University of Amsterdam (VUA). The research is still ongoing, and will be presented elsewhere, so the results presented here are preliminary.

The Rijksmuseum possesses a small but interesting collection of Asian bronzes. The technological research was meant as an attempt to trace the production process and understand how the images, at least those in the collection, were made. The first object examined was a monumental Naṭarāja bronze that dates from about 1100 CE, and has been in the Netherlands since the 1930s (Fig. 10–11). It is a very large icon, with a height of 153 cm, which makes it one of the largest bronzes from the period.<sup>69)</sup> It is an interesting piece to study because the large size implies technical proficiency: to produce such a large and complicated image is very difficult even now, so it was certainly no easy task in the 12<sup>th</sup> century.

The first objective was to remove any doubts as to the method of casting. It was previously assumed that the body was cast solid because of the weight

---

the translation of this chapter [chapter 68] of *Manasara* is presently being used as the guidebook for lost wax metal casting’.

<sup>68)</sup> The aforementioned Bhūdevī image (see note 65), analysed by Srinivasan (1999: 104), has a very high tin content of 15%. This high tin content was not confirmed in other images coming from the same treasure trove and being similar in date, although they all shared the lead isotope and trace element ratios. The group analysed by Johnson (1972: 56) also showed differences in alloy composition.

<sup>69)</sup> By which I mean ‘the Cōla period’. As noted earlier, Vijayanagara-period bronzes might be even larger.

of the image, which is about 300 kg. But there was still doubt about the halo and the dwarf mount. Furthermore, it was interesting to know if the metal showed any cracks or casting defects and if there were any remains of armature or pins.<sup>70)</sup> Some 20 years ago film x-radiographs were made, but the equipment was not strong enough to examine the body of the sculpture. Therefore, in December 2011 the image was examined by radiography in the strongest x-ray tunnel in the Netherlands, normally used for scanning sea cargo containers in the Rotterdam harbour, which has a power of 9,3 MeV (Fig. 12).<sup>71)</sup> The examination did not reveal armature, core material, core pins or alignment studs in the main parts of the icon, thus confirming that the body, the halo and the dwarf were cast solid. It remains possible that copper pins were used to hold sections of the original wax model together: these would have remained in place after melting out the wax but would not necessarily be visible in the x-ray, because of a similar density to the main alloy. The only hollow-cast part is the detachable rectangular pedestal (which

<sup>70)</sup> Armatures were employed in other regions of South and Southeast Asia, but usually in hollow cast images, and they are very rare in Tamil Nadu. Krishnan (1976: 24) only mentions 'core pins' used in contemporary hollow casting (to keep the core and the mould in position after removing the wax). However, Guy (2006: 21) writes: 'In both techniques [solid and hollow-cast], larger images generally require the insertion of copper or iron-rod armatures to give strength to the wax model'. And he adds: 'Protruding sections are later sawn away, but iron armatures ... are often detectable, in the crown of the head, for example, marked by a small area of iron corrosion.' Armatures in the halo were perhaps most common as remarked by Raj et al (2000: 63): 'It is to be noted that in large Nataraja icons and other icons, the *prabhavalli* [halo] is further reinforced with an iron rod bent in a semi-circular fashion. Instances of this iron rod being exposed to atmosphere and getting corroded, damaging the *prabhavalli* have been often observed.' Unfortunately, the only documented example that has thus far been found in the literature is a 12<sup>th</sup>-century Naṭarāja from the collection of the Victoria and Albert Museum (IM.71-1935; 85.2 cm) whose "... aureole is reinforced with an inner hoop of iron which has swollen in process of oxidisation and split the bronze in parts" (see the Victoria and Albert Museum website: <http://collections.vam.ac.uk/item/O25011/shiva-nataraja-lord-of-the-figure-unknown/>). Another one might be the large Naṭarāja still under worship in the Bṛhadiśvara Temple in Thanjavur whose foot and aureole were restored in the 19<sup>th</sup> century, the signs of it still visible (Fig. 14) and a Naṭarāja at the Norton Simon Museum, Pasadena (M.1974.01.1.S).

<sup>71)</sup> A previous attempt to X-ray the Naṭarāja, in 1999, generated some information about porosity and joins between the metal parts. However because the equipment used (280KeV) was not powerful enough to penetrate the thickest parts of the body, a stronger X-ray source was needed.

is always the case, and in larger sculptures it is cast separately). Aside from the pedestal, parts of the sculpture which might be separately cast are the flying locks of hair, which are attached with pins to the halo (their means of attachment to the back of the head could not be clearly seen: a mechanical (pin) attachment is most likely, or possibly they were cast as one unit with the body). One of the forward hands shows some variations in porosity and a possible join, which may be evidence that it was cast-on as a repair (see alloy discussion below). This requires further examination; it should be noted that the other forward facing hand does not show up clearly in the x-ray images. Contrary to some, usually smaller, Cōḷa-period images, the halo is not detachable; the halo and dwarf appear to be one unit. However, further x-ray investigation of the joins is needed to determine whether the body and halo/dwarf were welded together (or perhaps joined by cast-in pieces) or whether they were cast as one unit.<sup>72)</sup> While there are several bands of porosity/shrinkage cavities in the lower area of the halo, the Naṭarāja figure appears to have only a slight porosity in one (fore-)hand, and no large casting flaws. If the body proves to have been separately cast from the halo, and then attached by hot forging, it would be consistent with the observations made by Raj et al. that the body usually shows fewer defects than the halo and the pedestal; the halo and pedestal were perhaps cast by assistants, not by the master craftsman.

Whether or not the halo and body were cast together, one thing is clear: the extraordinary expertise of the Cōḷa casters, who were able to mitigate shrinkage and cracking in the substantial mass of metal which makes up the body of the icon.

To ascertain what metal the Naṭarāja is made of, a number of surface analyses of the alloy were made using the non-destructive X-ray fluorescence

---

<sup>72)</sup> The bronze casters of Swamimalai maintain that the large Naṭarāja icons were cast in one go (D. Srikanda Sthapathy, personal communication, February 2014). However, according to Raj et al (2000: 84): 'In practically all the bigger icons, it has been observed by radiography that the main body of the deity, the pedestal and associated features like *Prabhavalli* etc. were cast independently and were subsequently forge welded. Joints between the body and the pedestal were revealed in the radiographs. It was observed that reference studs were used to facilitate the alignment of the red hot individual parts of the icon during forge welding.' Features observed on two icons at LACMA research suggest the use of piece moulds (Johnson 1972: 46–47), although it appears that no other evidence of piece moulds has been documented on South Indian bronze idols. Piece moulds would indicate an entirely different casting method: indirect casting from a model.

(XRF) method.<sup>73)</sup> For a more in-depth check, including examination of the trace elements and lead isotope ratios, inductively coupled plasma mass spectrometry (ICP-MS) was performed on two metal samples.<sup>74)</sup>

Table 1<sup>75)</sup>

	XRF (wt%)			ICP-MS (% per million parts)	
	Halo (n=4)	Figure (n=15)	Protruding hands (n=5)	Body	Hand
Cu	95.7	94.8	77	90.3	88.5
Pb	0.1	0.7	0.8	6.3	2.3
Ag	0	0	0.1	0	0
Fe	2	2.4	5	0	0
Sn	0.5	0.6	0.5	1.4	0.3
Sb	0.1	0.1	0	0.3	0.02
Ni	0.2	0.1	1.2	0.09	0.1
Zn	1.1	1.1	15.4	0.17	0.24

The outcome<sup>76)</sup> is that the alloy of the body and halo is almost pure copper, with the average for the body amounting to 94.8% and 95.7% for the halo.

<sup>73)</sup> The XRF data were collected by Joosje van Bennekom/Arie Pappot, with the ARTAX Spectra from Bruker. Fifteen measurements were averaged for the body and four were averaged for the halo. Tungsten tube, 500mA, no filter, 60 seconds measuring time, 1mm collimator.

<sup>74)</sup> The ICP-MS examination was done at the Deep Earth and Planetary Science Cluster, Faculty of Earth and Life Sciences of the Free University of Amsterdam, under the guidance of Prof. Gareth Davies. Two samples were removed by drilling to a depth of approximately 1 cm. Surface drillings were discarded so that the bulk alloy was measured.

<sup>75)</sup> By Joosje van Bennekom.

<sup>76)</sup> The noted differences in the XRF and ICP-MS measurements can be explained by differences in the two technologies. With the use of the XRF, a large number of surface measurements can be made, but the X-rays penetrate only into the uppermost layers of the image: in places covered by a thick layer of corrosion, the results would show the values for that layer along with the pure metal below. Therefore areas of bare metal or at least minimal corrosion are chosen, and results are averaged for various parts of the sculpture. ICP-MS is performed on samples removed from the metal with a drill, after the corrosion has been removed. Therefore it is possible to measure pure metal. However,

Other important elements are iron (2.4% body; 2% halo) and zinc (1.1% for both). The amount of tin is very low (ca. 0.5% XRF; slightly higher in the ICP-MS measurement, body sample, ca. 1.4%); the same is valid for lead: 2–3%. The high content of copper is consistent with results of other research.<sup>77)</sup> The separately cast base has a slightly different alloy, with a higher amount of tin and lead, ca. 8–9% for both elements.

As mentioned earlier, because of the lack of inscriptions, the dating of Cōla bronzes is problematic. A large and fundamental study of one hundred and thirty South Indian (including 28 Cōla) bronzes was undertaken in 1999 by Sharada Srinivasan; bronzes from several different periods were found to have distinct trace element and lead isotope ratio patterns. By examining the trace elements and the lead isotope ratios in the alloy we hoped to add an additional factor to aid in dating our Naṭarāja, and possibly discover links with data from sculptures and ore sources examined by Srinivasan.<sup>78)</sup> Because the published data of Srinivasan's research are not detailed enough to serve as comparative material, and her unpublished 1996-PhD thesis, which contains more data, was unavailable,<sup>79)</sup> the investigation is ongoing.

In addition to the two metal samples mentioned above, five soil and accretion samples from the surface of the Naṭarāja were analysed by ICP-MS. It is often the case with archaeological objects that remnants of the burial crust can still be found on the surface of the metal. Also common is the well-known 'restoration' practice of applying soil or other materials to camouflage repairs or to create an impression of age and patina. On the basis of neodymium (Nd), strontium (Sr) and lead (Pb) isotopes it can be concluded that the soil (including soil on the forward hands, see discussion below) originates from India and so is consistent with a burial crust rather than a restoration. Previous analyses of corrosion samples from the surface (X-ray diffraction and SEM, performed at the Netherlands Centre for

---

segregation of metals within the alloy (globules of lead, for example) can mean that the samples are not truly representative of the whole image.

<sup>77)</sup> See, for instance, Nagaswamy (1988: 144): 'Most of the early bronzes were made of copper ... the copper content being more than 90%. The quality and quantity of copper content gradually decrease from about the 14<sup>th</sup> century...'

<sup>78)</sup> A difficult factor in dating images through this method is the re-use of metal, which is very common in India.

<sup>79)</sup> See Srinivasan (1999 and 2006). Repeated attempts at procuring a copy of this unpublished and thus far not digitalised PhD (University of London) have not been successful.

Cultural Heritage) also indicate elements consistent with burial, for example copper phosphates and oxalates. South India was invaded by the armies of the Delhi Sultanate at the beginning of the 14<sup>th</sup> century, who penetrated as far as Madurai. During that period, and perhaps also during the turbulent times in later centuries, bronze images were buried on or near the temple premises with the hope to be re-consecrated for worship after the danger had passed. Yet, for whatever reason, many of them were never recovered, and as a result, ancient icons are unearthed in Tamil Nadu almost every month, for instance during temple renovation or digging water tanks (see Fig. 13).<sup>80)</sup>

#### THE PROBLEM OF THE FORE-HANDS

(Joosje van Bennekom and Sara Creange)

A difference in porosity and a possible join line were observed in the X-rays of one of the front hands. Interestingly, the alloy of the foremost pair of hands differs considerably from that of the rest of the figure. The hands contain much less copper (ca. 77%, according to XRF results) and more zinc (ca. 8–10%) and lead (ca. 5–6%). Oddly, the measured difference in alloy was not confirmed by ICP-MS analysis of metal samples from the proper left front hand compared with the sample taken from the body (see table 1). A likely explanation is that the small specimen taken from the hands was from a location where less zinc was present – perhaps corroded – because all XRF results indicate a similar high amount of zinc on the hands.

The difference in alloy of the protruding hands and the main body raises the question whether the hands were cast on during fabrication, or were they perhaps a later cast-on repair? The isotope data on the metal samples indicate that both the hand and the body probably originate from India, but are encrusted with soils which may have more than one (Indian) source.

Furthermore the trace element data shows that certain trace elements are present in the body, but not in the hand. There are a number of possible explanations for this: the ore mixture that was used for making the hands

---

<sup>80)</sup> The most famous being probably the ‘Esalam bronzes’, see Nagaswamy (1987). Such discoveries could be a true treasure trove of data for archaeologists and art historians but, unfortunately, the bronzes have almost never been unearthed by specialists. In the few cases when the Archaeological Survey of India could arrive to the finding location on time, the reports remain unpublished, perhaps for fear of treasure-seekers.



could be missing one ingredient that contained these trace elements. Another (more daring) conclusion could be that the metal mixture used for making the hands was less contaminated, and therefore more refined, indicating a possible later date of origin than that of the body.

In any case it is clear that the front hands were cast separately, either at the same time with the rest of the image, as a result of a failed cast or perhaps even intentionally,<sup>81)</sup> or at a later point to repair damage. Sanskrit treatises allow replacing damaged minor body parts (such as limbs and attributes, but not the head or the torso) after which the image can be re-consecrated and returned to worship (*Mayamata* 35: 39–40; *Mānasāra* 68: 26). Proof that such prescriptions were followed is found in the aforementioned Naṭarāja at the Bṛhadīśvara Temple in Thanjavur, still under worship after the repair of one of the feet of the god, and the lower part of the halo (Fig. 14).

#### CONCLUDING REMARKS

The often contradictory statements found in publications demonstrate that there is a need for a thorough technological examination of Cōḷa bronzes. Unfortunately, with the exception of a few isolated examples, very little research has been made in the past. The results of investigations that did take place frequently remain unpublished, rendering any evaluation and comparison of the (old and new) data difficult or impossible. The paucity of technological research is surprising: while we can only guess how exactly metal icons were used in ancient India – we only have prescriptive, textual sources to guide us and a small number of inscriptions on temple walls – we do possess concrete evidence that can help us understand how the icons were made, and in this way we can enhance our knowledge of the past societies that created them. And yet, there are at this point not only unanswered questions, but questions that have never been asked. Therefore, we have decided to address these gaps in our understanding by sharing the preliminary results of our research project at the Rijksmuseum. We are planning to publish the final results in the future.

---

<sup>81)</sup> One wonders if it was more often the case with large Naṭarāja sculptures as the front hands are the most protruding and therefore difficult parts to make.

## BIBLIOGRAPHY:

- Acharya 1934 = Prasanna Kumar Acharya, *Architecture of Mānasāra: Translated from Original Sanskrit*, Oxford University Press, London 1934.
- Aṃsumadkāśyapa (Kāśyapaśilpa)*, Institut Français de Pondichéry T1, paper transcript of the Keelvelur palm-leaf manuscript (by Neelakanta Sarma), completed 24.05.1958.
- Assayag 1999 = Jackie Assayag, *The Resources of History: Tradition, Narration and Nation in South Asia*, École française d'Extrême-Orient, Paris – Pondicherry 1999.
- Balasubrahmanyam 1975 = *Middle Chola Temples. Rajaraja I to Kulottunga I (A.D. 985–1070)*, Thomson Press, Faridabad 1975.
- Barrett 1965 = Douglas Barrett, *Early Cola Bronzes*. Bhulabhai Memorial Institute, Bombay 1965.
- Branfoot 2001 = Crispin Branfoot, “Tirumala Nayaka’s ‘New Hall’ and the European Study of the South Indian Temple,” *Journal of the Royal Asiatic Society, Third Series* 11/2 (July 2001): 191–212.
- Branfoot 2002 = Crispin Branfoot, “‘Expanding Form’: the Architectural Sculpture of the South Indian Temple, ca. 1500–1700,” *Artibus Asiae* 62/2 (2002): 189–245.
- Chakrabarti and Lahiri 1996 = Dilip K. Chakrabarti, Nayanjot Lahiri, *Copper and its Alloys in Ancient India*, Munshiram Manoharlal, New Delhi 1996.
- Champakalakshmi 2011= R. Champakalakshmi: *Religion, Tradition and Ideology. Pre-colonial South India*. Oxford University Press, New Delhi 2011.
- Craddock and Hook 2007 = Paul Craddock and Duncan Hook, “The Bronzes of the South of India: A Continuing Tradition?,” in: Douglas, Janet G.; Jett, Paul; and Winter, John (eds.), *Scientific Research on the Sculptural Arts of Asia. Proceedings of the Third Forbes Symposium at the Freer Gallery of Art*, Archetype, London, 2007: 75–89.
- Czerniak-Drożdżowicz 2008 = Marzenna Czerniak-Drożdżowicz: *Studia nad pañcaratṛą. Tradycja i współczesność*. Wydawnictwo Uniwersytetu Jagiellońskiego, Kraków 2008.
- Czerniak-Drożdżowicz 2011 = Marzenna Czerniak-Drożdżowicz: *Studia nad pañcaratṛą. Część II. W poszukiwaniu tożsamości*. Wydawnictwo Uniwersytetu Jagiellońskiego, Kraków 2011.
- Czerniak-Drożdżowicz (forthcoming) = Marzenna Czerniak-Drożdżowicz: “At the Crossroads of Art and Religion – Image Consecration in the Pāñcarātrika Sources”, (forthcoming) [paper presented at the international seminar *Consecration Rituals In South Asia*, Department of Archeology and Religious Studies, Norwegian University of Science and Technology, Trondheim].
- Dallapiccola (ed.) 1989 = Anna Libera Dallapiccola ed. in col. with Christine Walter-Mendy, Stephanie Zingel-Ave Lallemand: *Shastric Traditions in Indian Arts*. Vol. 1. Texts, vol. 2. References and documentation. Franz Steiner Verlag Wiesbaden, Stuttgart 1989.
- Davis 1989 = Richard H. Davis: “Enlivening Images. The Śaiva Rite of Invocation”, in: Dallapiccola (ed.) 1989: 351–359.
- Davis 1999 = Richard H. Davis, *Lives of Indian Images*. Princeton University Press 1999.

- Dehejia 1990 = Vidya Dehejia, *Art of Imperial Cholas*, Columbia University Press, New York 1990.
- Dehejia 1999 = Harsha V. Dehejia, *Parvati, Goddess of Love*, Mapin, Ahmedabad 1999.
- Dehejia 2002 = Vidya Dehejia, "Chola Bronzes: How, When and Why", in: Dehejia (ed.), *The Sensuous and the Sacred. Chola Bronzes from South India*. Americal Federation of Arts, New York 2002: 11–27.
- Gangoly 1978 = Ordhendra Coomar Gangoly, *South Indian Bronzes: A Historical Survey of South Indian Sculpture with Iconographical Notes Based on Original Sources*, Indian Society of Oriental Art, Calcutta 1978 [orig. pub. 1915].
- Goodall 2004 = Dominic Goodall, *Parākhyatantram: the Parākhyatantra, a scripture of the Śaiva Siddhānta*, Ecole française d'Extreme-Orient/Institut Français de Pondichery, Pondicherry, 2004.
- Granoff/Shinohara eds 2004 = Phyllis Granoff and Koichi Shinohara eds: *Images in Asian Religions: Texts and Contexts*, UBC Press, Vancouver 2004.
- Guy 2006 = John Guy, "Parading the Gods: Bronze Devotional Images of Chola South India," in: Vidya Dehejia, John Eskenazi and John Guy, *Chola: Sacred Bronzes of Southern India*, Royal Academy of Arts, London 2006: 12–25.
- Hultzsch 1916 = E. Hultzsch, V. Venkayya, H. Krishna Sastri, *South Indian Inscription. Vol. 2*, Superintendent Government Press, Madras, 1916.
- Iyengar 1973 = V. Gopala Iyengar, *Sakalādhikāra of Sage Agastya. Critically Edited with Translation, Introduction and Appendices in English*, Sarasvati Mahal Library, Thanjavur 1973.
- Johnson 1972 = Ben B. Johnson, "Krishna Rājamannār Bronzes: an Examination and Treatment Report", in: *Krishna: The Cowherd King*, Pratapaditya Pal (ed.), Los Angeles County Museum of Art, Los Angeles 1972: 45–58.
- Kaimal 1996 = Padma Kaimal, "Early Cola Kings and "Early Cola Temples": Art and the Evolution of Kingship", *Artibus Asiae*, Vol. 56, No. 1/2 (1996): 33–66.
- Kaimal 1999 = Padma Kaimal, "Shiva Nataraja: Shifting Meanings of an Icon", *The Art Bulletin*, Vol. 81, No. 3 (Sep., 1999): 390–419.
- Kaimal 2000 = Padma Kaimal, "The Problem of Portraiture in South India, Circa 970–1000 AD", *Artibus Asiae*, Vol. 60, No. 1 (2000): 139–179
- Khandalavala 1988 = Karl J. Khandalavala, "Introduction," in Karl J. Khandalavala and Asha Rani Mathur (eds.), *Indian Bronze Masterpieces: The Great Tradition*, Brijbasi Printers, Delhi 1988: 8–11.
- Kuppuram 1989 = G. Kuppuram, *Ancient Indian Minin, Metallurgy and Metal Industries*, Vol. 1, Sundeep Prakashan, Delhi 1989.
- Krishnan 1976 = M.V. Krishnan, *Cire Perdue Casting in India*, Kanak Publications, New Delhi 1976.
- Mahalingam 1970 = T.V. Mahalingam, *Studies in the South Indian Temple Complex*, Kananda Research Institute Dharwar 1970.
- Nagaswamy 1983 = R. Nagaswamy, *Masterpieces of Early South Indian Bronzes*, National Museum, New Delhi 1983.
- Nagaswamy 1987 = R. Nagaswamy, "Archaeological Finds in South India: Esālam Bronzes and Copper Plates," *Bulletin de l'Ecole Française d'Extrême-Orient* 76 (1987): 1–68.

- Nagaswamy 1988 = R. Nagaswamy, "South Indian Bronzes," in Karl J. Khandalavala and Asha Rani Mathur (eds.), *Indian Bronze Masterpieces: The Great Tradition*, Brijbasi Printers, Delhi 1988: 142–179.
- Nayar 1992 = Nancy Anna Nayar, *Poetry as Theology. The Śrīvaiṣṇava Stotra in the Age of Rāmānuja*, Otto Harrassowitz, Wiesbaden 1992.
- Orr 2004 = Leslie Orr, 'Processions in the Medieval South Indian Temple: Sociology, Sovereignty and Soteriology', in: Jean-Luc Chevillard, Eva Wilden (eds.), *South Indian Horizons* (F. Gros Felicitation Volume), Institut Française de Pondichéry / Ecole française d'Extrême-Orient, Pondicherry 2004: 437–470.
- Padoux 1998 = André Padoux, "Concerning Tantric Traditions", in: *Studies in Hinduism II. Miscellanea to the Phenomenon of Tantras*, ed. Gerhard Oberhammer, Österreichischen Akademie der Wissenschaften Wien 1998: 9–20.
- Pal 1972 = Pratapaditya Pal, *Krishna: The Cowherd King*, Los Angeles County Museum of Art, Los Angeles 1972.
- Rabe 1987 = Rabe Michael, *The Monolithic Temples of Pallava Dynasty: A Chronology*. (Volumes I-III). Phd dissertation (University of Minnesota 1987).
- Raj et al 2000 = Baldev Raj, C. Rajagopalan, C.V. Sundaram, *Where Gods Come Alive*, Vigyan Prasar, New Delhi, 2000.
- Ramachandran 1965 = T.N. Ramachandran, *The Nāgapaṭṭiṇam and Other Buddhist Bronzes in the Madras Museum*, Government Press, Madras 1965 [orig. pub. 1953].
- Raman 2006 = K.V. Raman: *Temple Art, Icons and Culture of India and South-East Asia*. Sharada Publishing House, Delhi 2006.
- Ramaswamy 1994 = Vijaya Ramaswamy, "Metallurgy and Traditional Metal Crafts in Tamil Nadu (With Special Reference to Bronze)", *Indian Journal of History of Science* 29(3), 1994: 465–476.
- Rao 1985 = T.A. Gopinatha Rao, *Elements of Hindu Iconography*, Motilal Banarsidass, Delhi, 1985 [orig. pub. 1914].
- Rathnasabapathy 1982 = S. Rathnasabapathy, *The Thanjavur Art Gallery Bronze Sculptures: A Descriptive Catalogue with Illustrations in Colour*, Thanjavur Art Gallery Administration, Thanjavur 1982.
- Reeves 1962 = Ruth Reeves, *Cire Perdue Casting in India*, Crafts Museum, New Delhi 1962.
- Saraswati 1936 = Sarasi K. Saraswati, "An Ancient Text on the Casting of Metal Images," *Journal of the Indian Society of Oriental Art* 4/2 (Dec. 1936): 139–144.
- Sastri 1929 = K. Sambasiva Sastri (ed.), *The Silparatna of Sri Kumara*, Superintendent, Government Press, Trivandrum 1929.
- Sastri 1990 = M.M.T. Ganapati Sastri (ed.), *Viṣṇusamhitā*, Sri Satguru Publications, Delhi 1990 [orig. pub. 1925].
- Sastri 1955 = Nilakanta Sastri: *The Colas*, second edition, University of Madras 1955.
- Sivaramamurti 1992 = Calambur Sivaramamurti, "South Indian Bronzes," in: M. Raman (ed.), *A Souvenir Released on the Occasion of the Exhibition on South Indian Bronzes*, Government Museum, Madras 1992: 1–7.
- Schmid 2014 = Charlotte Schmid: *La Bhakti d'une reine. Śiva à Tiruceṇṇampūṅṅi*. Institute français de Pondichéry, École française d'Extrême-Orient, Pondicherry 2014.

- Sanderson 1988 = Alexis Sanderson: Śaivism and the Tantric Traditions. W: *The World's Religions*. Ed. by Stewart Sutherland et al. London 1988: 660–704.
- Shulman 1985 = David Dean Shulman: *The King and the Clown in South Indian Myth and Poetry*, Princeton University Press 1985.
- Ślącza 2007 = Anna Aleksandra Ślącza, *Temple Consecration Rituals in Ancient India: Text and Archaeology*, Brill, Leiden 2007.
- Srinivasan 1994 = Pullur Ramasubrahmanya Srinivasan, *Bronzes of South India*, India Press, Madras 1994 [orig. pub. 1963].
- Srinivasan 1999 = Sharada Srinivasan, "Lead Isotope and Trace Element Analysis in the Study of Over a Hundred South Indian Metal Icons," *Archaeometry* 41/1 (1999): 91–116.
- Srinivasan 2006 = Sharada Srinivasan, "The Art and Science of Chola Bronzes", *Orientalions* 37(8): 46–54.
- Stein (ed.) 1975 = Burton Stein (ed.), *Essays on South India*. Asian Studies at Hawaii no 15, University Press of Hawaii 1975.
- Sthapati 2002 = V. Ganapati Sthapati, *Indian Sculpture and Iconography: Forms and Measurements*. Sri Aurobindo Society, Pondicherry, 2002.
- Subramaniam 1974 = Kuppup Subramaniam *Brahmin Priests of Tamil Nadu*, New Delhi 1974.
- Tarabout 2004 = Gilles Tarabout, "Theology as History: Divine Images, Imagination, and Rituals in India". In: *Images in Asian Religions: Texts and Contexts*. Eds Phyllis Granoff and Koichi Shinohara, UBC Press Vancouver 2004: 56–84.
- Venkataraman 1976 = Balasubrahmanyam Venkataraman, *Temple Art under the Chola Queens*. Thomason Press (India) Limited. Faridabad, Haryana, 1976.
- Young 2007 = Katherine K. Young, "Brāhmaṇas, Pāñcarātrins, and the Formation of Śrīvaiṣṇavism", In: *Studies in Hinduism IV. On the Mutual Influences and Relationship of Viśiṣṭādvaita Vadānta and Pāñcarātra*. Ed. Gerhard Oberhammer, Marion Rastelli. Österreichischen Akademie der Wissenschaften Wien 2007:179–261.
- Ward 2008 = Gerald W. R. Ward (ed.), *The Grove Encyclopedia of Materials and Techniques in Art*, Oxford University Press, Oxford 2008: 70.



PART I: THE TEMPLE CULT IN SOUTH INDIA IN A RELIGIOUS  
AND HISTORICAL PERSPECTIVE

*(Marzenna Czerniak-Drożdżowicz)*

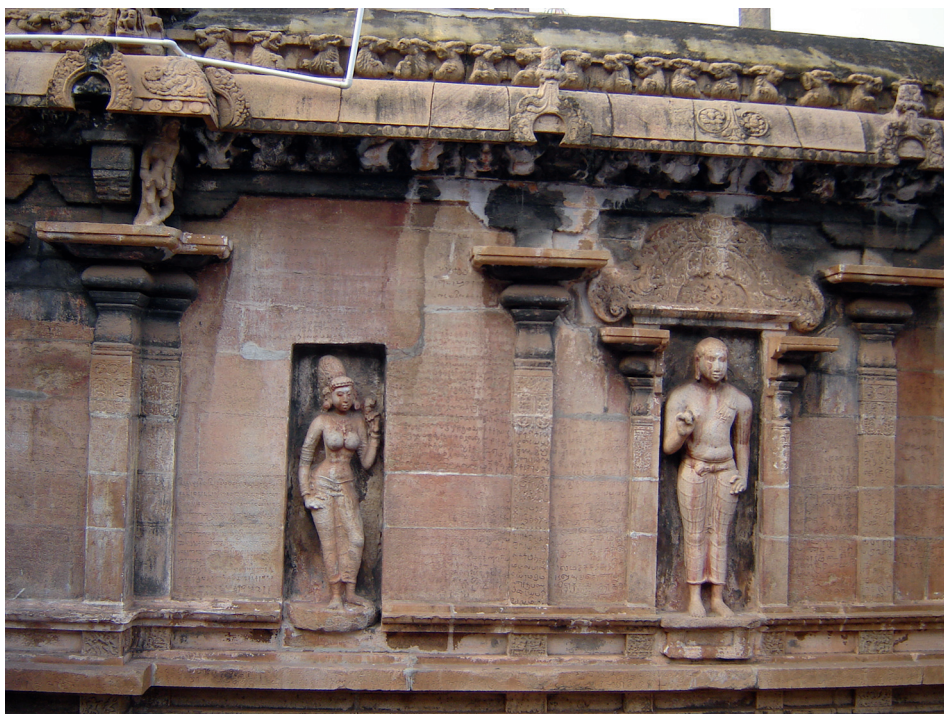


Fig. 1. Nageswara temple, Kumbhakonam. Photo: Lucyna Drożdżowicz



Fig. 2. Bṛhadīśvara temple, Thanjavur. Photo: Marzenna Czerniak-Drożdżowicz



Fig. 3. Naṭarāja, Umāmaheśvara temple, Konerirajapuram. Photo: Marzenna Czerniak-Drożdżowicz





Fig. 4. Natarāja on the relief, Tiruĉennampuntī temple. Photo: Marzenna Czerniak-Drożdżowicz



Fig. 5. Gandarāditya panel, Umāmaheśvara temple, Konerirajapuram. Photo: Marzenna Czerniak-Drożdżowicz

PART II: THE MAKING OF CŌLA BRONZES AND  
THE RIJKSMUSEUM BRONZE RESEARCH

(Anna A. Ślaczka)



Fig. 6. Naṭarāja, Umāmaheśvara Temple, Konerirajapuram, Thanjavur District, Tamil Nadu, Vijayanagara period. Photo: Arvind Venkatraman





Fig. 7. Clay moulds, Swamimalai bronze casting workshop, February 2014. Photo: Anna A. Ślącza



Fig. 8. Swamimalai bronze casting workshop, February 2014. Photo: Anna A. Ślącza



Fig. 9. Viṣṇu, Art Gallery,  
Thanjavur, acc. no. 186,  
16<sup>th</sup>–17<sup>th</sup> century CE.  
Photo: Anna A. Ślączka



Fig. 10. Natarāja (front),  
Rijksmuseum Amsterdam,  
acc. no. AK-MAK-187,  
ca. 1100 CE



Fig. 11. Naṭarāja (back),  
Rijksmuseum Amsterdam,  
acc. no. AK-MAK-187,  
ca. 1100 CE



Fig. 12. Naṭarāja, Rijksmuseum Amsterdam, at the Rotterdam customs X-ray tunnel





Fig. 13. Excavated bronzes, Parameswara Mangalam, Kanchipuram district, Tamil Nadu, 14 August 2011. Photo: Chandrasekaram Jayaraman, REACH Foundation



Fig. 14. Natarāja, Bṛhadiśvara Temple, Thanjavur, ca. 12<sup>th</sup> century. Photo: Arvind Venkatraman