

WATER SUPPLY SYSTEMS OF THE SENJI (GINGEE) FORT IN SOUTH INDIA (16-18th CENTURY)

JEAN DELOCHE*

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In the fort of Senji, two water systems of hydraulic works corresponding to two periods are identified. The Nayaka technology of water supply in the inner fort used the principle of gravity flow and the siphon to convey water by pipeline from a rain water collection tank (*Chakrakulam*) to the Royal centre which reflects a local and indigenous tradition as found in other sites of South India during the Vijayanagara period. On the other hand, the Nawab technology in the outer fort has a distinguished feature of the drainage linking the large *Chettikulam* to the centres of settlement, punctuated, at intervals, with square brick-built hollow water towers. The latter is a new concept in water engineering and is typical of the Medieval Islamic water supply system (drawings and photographs, courtesy: Ecole Française d'Extrême-Orient, Pondicherry).

Key words: Hydraulic works, Pipeline, Water supply, Water towers

INTRODUCTION

The domestic water supply systems of the fort of Senji in the Tamil country employed rain water storage ponds and catchment tanks for the supply of the urban settlement, thus exploiting the hydrological environment to the maximum advantage by using the available technologies. In the fort, two water systems (Fig. 1) which correspond to two periods of great hydraulic works were constructed (Deloche 2005, pp. 189-200).

* Ecole Française d'Extrême-Orient P.O. Box No. 151, 16&19, Dumas Street, Pondicherry-605 001; Email: jeandeloche@gmail.com

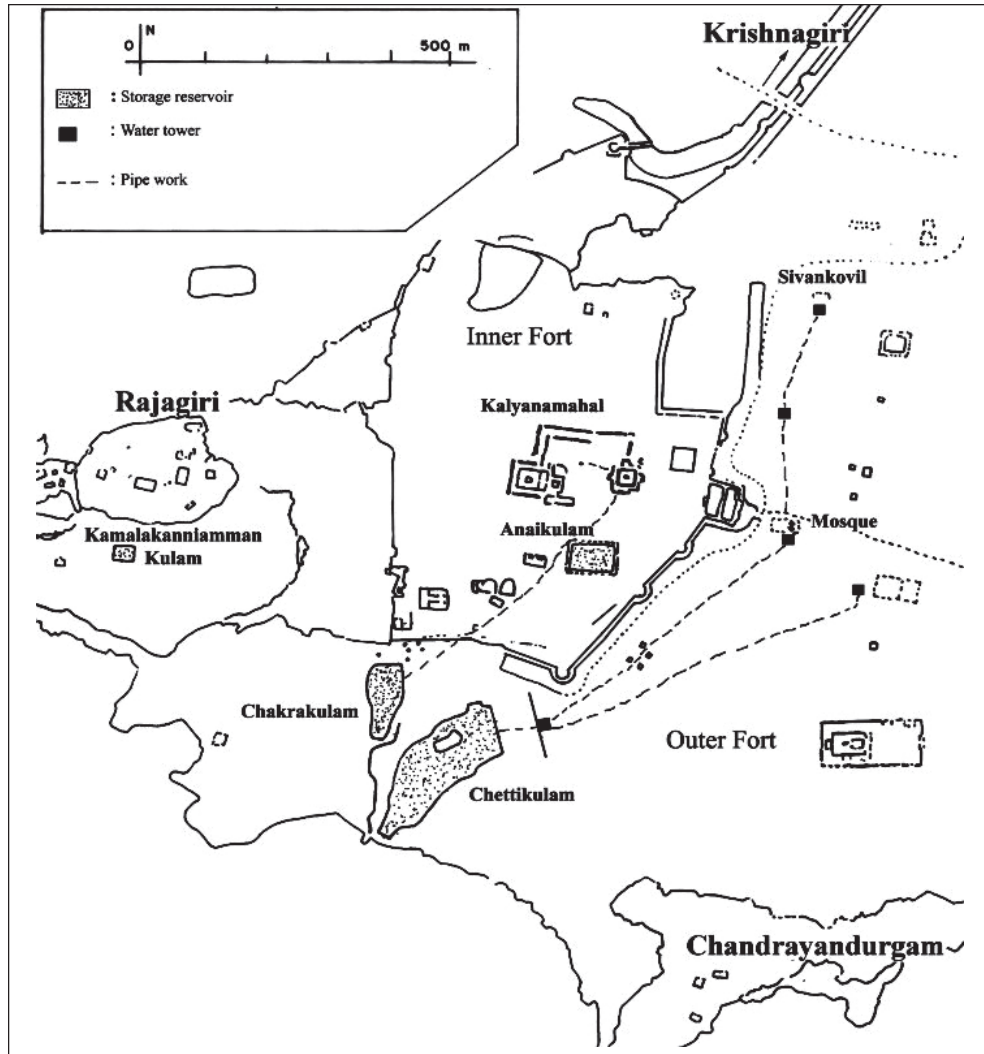


Fig. 1. Senji: Hydraulic Works

NĀYAKA WATER-WORKS (16TH CENTURY)

The Nāyaka water system, the first of the two, supplied perennial water to the inner fort or Royal Centre from the *Chakrakulam*, a pond which was fed by surface drainage to the west of the second enclosure. It utilised the principles of gravity flow and the siphon to convey water by a network of pipelines made of sealed earthenware pipes to the palaces, tanks and fountains.

Fragments of these pipes consisting of spigot-pointed sections, fitted together and sealed with *chunam*, of roughly the same form and dimensions, have not only been found on the bank of the *Chakrakulam* but in the *Kalyanamahal* as well. These sections clearly appear to be part of the same pipework which supplied the *Kalyanamahal* with water. To the west of this tower, on the vast royal platform which has been recently excavated, is found the extremity of a pipe which also seems to be a part of the same system; likewise, at the bottom of the platform, through holes made in the ground, conduits of the same type appear.

Thus, water was evidently distributed into the heart of the stronghold by the same network of pipelines originating in the *Chakrakulam*. It has been suggested that the primary source of this water-supply could have been the *Kamalakanniamman* situated in the middle of the plateau leading to the top of Rajagiri. But this seems to be unlikely since no traces of any pipelines have been found in the heaps of boulders along the southern slopes of the hill.

Indications of these water works in the Royal Centre can also be found reported in certain literary sources. Father Pimenta, at the time of his visit in 1597, saw, near the palace, a “perpetual fountain”, and the Dutch merchant Kindt says that, in 1615, this area was full of “natural fountains”.

These remarks acquire now a special significance, because they are confirmed by the recent renovation works carried out in the *Kalyanamahal* by the Archaeological Survey of India (ASI). In the square court of the building, under the cornice of the arcaded gallery, jutting out over by half a centimetre there are 36 openings (today filled up) obviously connected inside the ceiling with a bigger conduit, and having the dimensions of those found on the steps of the tank. These openings are probably a part of the system described above.

In December 2000, a great discovery was made while plastering the steps of the rectangular tank. In the first stair (from the top), encased in heavy brickwork, an earthenware pipe going all round the four sides of the tank, was found. On this main pipe, every 36 or 42 centimetres, there are holes provided with a small vertical pipe, topped by an earthen ring (Figs 2, 3, 4). Obviously these pipes have been designed for discharging jets of water.



Fig. 2. *Kalyanamahal*: Earthenware pipe (north side), heavy brickwork, hole for vertical pipe



Fig. 3. *Kalyanamahal*: Earthenware pipe (west side), small vertical pipe



Fig. 4. *Kalyanamahal*: Earthenware pipe (south side), opening

The fountains on the stairs of the tank and below the cornices of the gallery, cooling the air, or serving as ornaments, must have been a fantastic sight for visitors!

WATER TOWER SYSTEM OF THE NAWAB (18TH CENTURY)

The second water supply system is found in the outer fort; it is fed with perennial water by inlet pipes taking off from the *Chettikulam*, to the south-east of the *Chakrakulam*, through an extremely elaborate supply system with control towers at regular intervals along the length of the pipeline.

Four water towers or brick reservoirs, in which earthenware pipes fitted together with lime mortar terminate, have been found. Three of them are built on a square plan. The first one is situated to the south-east angle of the Śiva temple; the second, in the fields, to the north of the gate of the second enclosure and the third, to the south of the Sa'adat-ullah-Khan's mosque.

Inside these reservoirs, there are several vertical alignments of circular openings, between 9 and 11 centimetres in diameter, which correspond to

several vertical conduits encased in the wall, as well as several vertical rows of steps consisting of granite blocks embedded in the wall, designed to give access to the bottom (Figs.5-8).

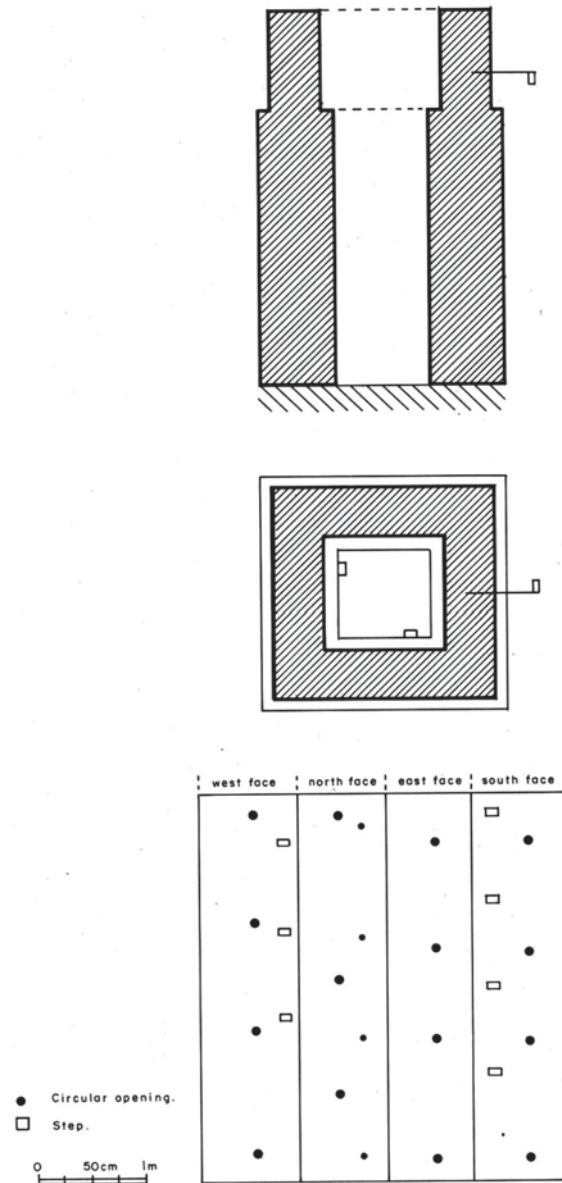


Fig. 5. Outer fort: Water tower, section, plan and elevation



Fig. 6. Outer fort: Water tower, near the Śiva temple, outside

The fourth reservoir, situated to the west of the ruins of the French barracks, is built on a rectangular plan but is damaged in its upper part.

These water towers were meant to distribute water under pressure to the surrounding reservoirs or fountains, Their function was to relieve the pressure in the pipes, to act as a siphon for use in drawing water from one container to another on a lower level, and finally, to intercept silt and prevent the pipes being choked. Another advantage was that, due to the multiple openings which could be closed by plugs, it was possible to control strictly the distribution of water according to the changing requirements.

Manifestly, this hydraulic technology was influenced by that of the Muslim cities of the Deccan kingdoms, since reservoirs of this type are found at Daulatabad, Aurangabad, Ahmadnagar and particularly at Bijapur

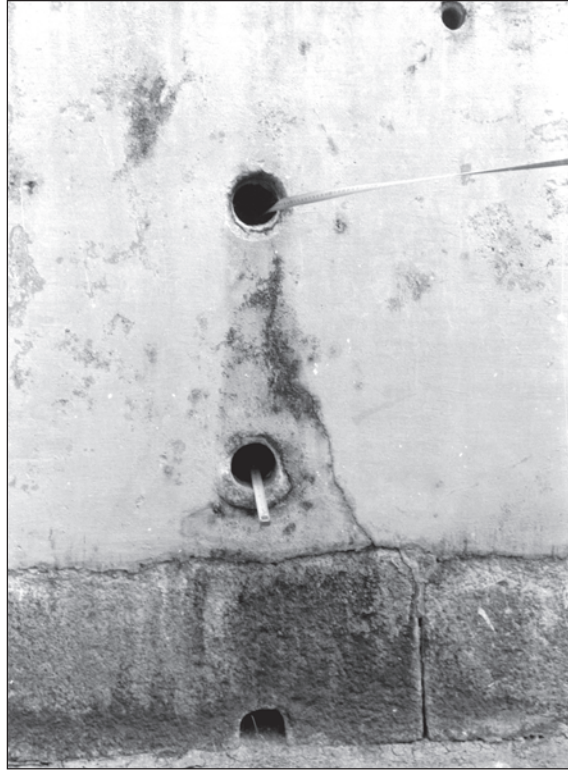


Fig. 7. Outer fort: Water tower, near the mosque, inner openings (vertical alignment)

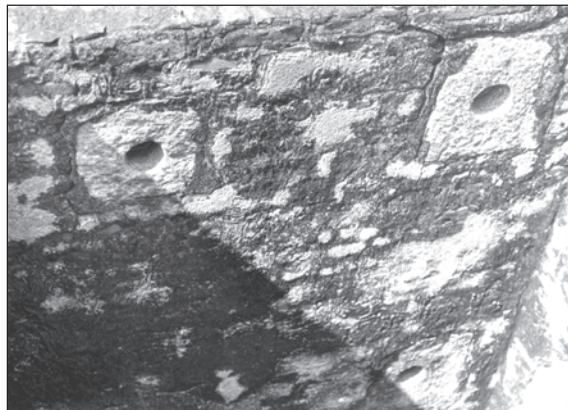


Fig. 8. Outer fort: Water tower, near the Shiva temple, inside

(Mate & Pathy 1992, pp. 45-49, Bavaadam L. 1993, pp. 69-71, Rötzer 1984, pp. 125-19) and, in all likelihood, the masters who built the water-towers of Senji came from this part of South India.

But when and by whom were these water-towers built? A Persian inscription, embedded into the northern face of the third water-tower situated near Sa'adat-ullah Khan's mosque, gives the answer. This commemorative slab specifies that, in 1723, the governor of the fort, Sa'id [i.e. Sa'adat-ullah Khan], "*increased the water-supply of the city of Senji by [the construction] of a canal.*" (Annual Report 1938-39, p. 45)

This fact was further confirmed recently by the publication of extracts from a Persian chronicle preserved in the British Library, London, *The Said Nāma*, written by Jaswant Rai 'Munshi' (and translated in Narayana Rao V & al. 2006, p. 207):

"It was the desire of the nawab [Sa'adat-ullah Khan] that... he should spend a few days of the rainy season in the fort of Nusratgadh [Senji] in order...to look to the progress of the mosque that he had ordered built near the gate of the fort of Kala Kot [the second enclosure] and the garden-end-palace that he also desired to be built. During his stay in the fort he wished to look into the digging of a lake at Chettigunta [Chettikulam], the water from which was to have passed through the cistern of the mosque to the bath and courtyard of his palace and then to the living quarters of his household".

Thus, Sa'adat-ullah Khan planned a new complex system meant to distribute water to a variety of domestic features of the outer fort.

This urban project, however, was not fully implemented. Apparently the palace with bath and courtyard was not erected, since there are no vestiges of such a structure; the living quarters of his household may have been constructed since rectangular blocks of houses and lanes in the outer fort are shown in a French plan dating 1759; the garden also may have been built since Narayanan Pillai at the beginning of the 19th century says that, after Desing's death, a garden called *Brindāvan* was laid out, and a French plan of 1750 shows, below the *Chettikulam*, an area covered with trees (Deloche 2005, Figs. 26, 23, p. 199).

Besides the water towers, the beautiful Sa'adat-ullah Khan's mosque is the only existing evidence to this project; on the eastern face of its pool,

there is still a vertical earthenware pipe with 3 openings of the same type as those mentioned above.

Thus, it becomes essential and important to undertake detailed examination of these two water-supply systems. Let us hope that the ASI will consider carrying out excavations to study these fascinating water-works, particularly the water towers which deserve a thorough investigation: a simple digging, 6 feet deep, all around these structures would already give us the alignments of the earthen pipes and permit us to make a preliminary drawing of the main lines of these water supply systems!

CONCLUSION

Though, in the Senji Fort, the entire course of the water works has not been fully exposed through excavations, the range of material found in the inner and outer forts is sufficient to allow a reconstruction of the supply system.

- Much of the Nāyaka technology of water supply in the inner fort, i.e. using the principle of gravity flow and the siphon to convey water by pipeline from a rain water collection tank (*Chakrakulam*) to the Royal centre, reflects a local and indigenous tradition as found in other sites of South India during the Vijayanagara period (Davison-Jenkins 1997, pp. 72, 78).
- On the other hand, in the works of the Nawab in the outer fort, the main feature of the drainage linking the large *Chettikulam* to the centres of settlement, punctuated, at intervals, with square brick-built hollow water towers, is a new concept in water engineering and is typical of the Medieval Islamic water supply system.

Future excavations within the lower fort will surely reveal further traces of the water works.

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