A PILGRIMAGE TO RAMANUJAN'S HOMETOWN

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The district of Tanjore (*Tanjavur* in Tamil) in the state of Tamil Nadu in South India, has been a seat of culture for several centuries. Tanjore has produced some of the greatest composers of *Carnatic* music, the classical music of South India. Tanjore is also very well known for art in various forms; in particular, Tanjore paintings of Hindu gods which have crystal glass pieces imbedded in them, are much appreciated both for their special beauty and art value. The Tanjore district also has the greatest concentration of Hindu temples, and some of them are architectural marvels. It is in the midst of this region steeped in culture, that the Indian mathematical genius Srinivasa Ramanujan lived in the town of *Kumbakonam* in Tanjore district and made some of his path breaking discoveries. In December 2003, my wife Mathura and I had an opportunity to visit Kumbakonam, see Ramanujan's humble home from which a thousand theorems emerged, and visit several temples in that area including the one next to Ramanujan's home where he prayed regularly. In this article I shall describe our memorable visit to Kumbakonam and Tanjore. To prepare a suitable background, I first briefly describe Ramanujan's fascinating life story.

Ramanujan: Srinivasa Ramanujan, one of the greatest mathematicians in history, belonged to an orthodox Hindu brahmin family in the town of Kumbakonam. He was born in Erode in South India on December 22, 1887. Erode was where his mother's family lived. It is the Hindu custom that even though after marriage a woman would live in her husband's home, she will go back to her family home to give birth. Among the brahmins, there are two main subcastes in South India, the *Iyers* who worship Lord Shiva the Destroyer as the primary diety, and the *Iyengars*, who worship Lord Vishnu the Protector as the main diety. Ramanujan was an Iyengar, and from his parents he learnt many verses of the *Vedas*, the Hindu holy scriptures, as well as stories from Hindu folklore and epics. Ramanujan and his family offered prayers regularly at the *Sarangapani temple* for Lord Vishnu in Kumbakonam, which was just down the street from his home.

Ramanujan showed his unsual talent for mathematics very early. Often in the middle of the night he would get up and write down mathematical formulae on a piece of slate lest he should forget them in the morning when he woke up. He would record these marvelous formulae in his now famous notebooks. Ramanujan had a special veneration for the Goddess *Namagiri* of the temple in the neighbouring town of *Namakkal*, and we are told that the Goddess of Namakkal would come in his dreams and give him these formulae! In the town high school in Kumbakonam, Ramanujan's teachers realized that he was unusually talented, but they could not understand or judge the importance of his discoveries. Ramanujan later moved to *Madras* (now called Chennai), the capital and largest city in Tamil Nadu, where he attended College. Although he was successful in high school, his obsessive preoccupation with mathematics led to a neglect of other subjects and so he had to drop out of college. The advantage of being in Madras was that he could come in contact with persons, both Englishmen and Indians, who could appreciate his work. Some of them suggested that he should communicate his findings to leading mathematicians in England - India was a British colony at that time. The rest is history!

The two letters Ramanujan wrote to G. H. Hardy of Cambridge University are considered to be among the most significant in mathematical history. In these letters Ramanujan communicated hundreds of bewildering mathematical formulae he had discovered. Hardy and his peers in Cambridge, were convinced by the letters that Ramanujan was a genius of the class of Euler or Jacobi. Hardy invited Ramanujan to Cambridge to work with him so that the untutored genius could be given a proper sense of direction. Orthodox Hindus believed that it was a sin to cross the oceans, and so Ramanujan declined this invitation; his mother would not give him permission to go. But Hardy persisted. One night, his mother had a dream in which she saw Ramanujan being honored by foreigners in a great assembly. In that same dream the Goddess of Namakkal ordered the mother not to stand in the way of her son's recognition! Thus with his mother's permission, Ramanujan sailed for England in 1914.

Hardy, being an agnostic, dismissed the Goddess of Namakkal stories as mere fables. However, I should point out that it is very natural for Hindus to accept such legends. Hindu belief isthat there is a divine origin to every aspect of knowledge, including music, and that is why much of Hindu classical music is devotional. Hindus believe in the story that Kalidasa, the greatest sanskrit poet, was transformed from an uneducated cowherd to a poet par-excellence overnight because the Goddess Kali wrote her blessings on his tongue. Thus it is very natural for Hindus to accept the Goddess of Namakkal as a divine origin of Ramanujan's great discoveries.

In England, within a short span of five years, Ramanujan wrote several fundamental papers, some with Hardy, that revolutionized various areas of mathematics. But conditions were difficult in England at that time, worsened by the First World War. Ramanujan was a strict vegetarian, and it was not easy to get food to suit his dietary needs. He also did not take care to protect himself from the cold English winters. Thus he had to return to India in 1919, a very sick man. Hardy was concerned that Ramanujan might not live long, and so he worked hard to get him elected as Fellow of the Royal Society (FRS) in 1918. What a recognition for someone who did not even have a college degree! Shortly after Ramanujan returned to India, he died in April 1920 in Madras. In his 32 years Ramanujan had made outstanding contributions and was recognised with the highest honor that any academician in the British Commonwealth could aspire for - the election as Fellow of the Royal Society.

SASTRA University and Ramanujan's Home: The Shanmugha Arts, Science, Technology and Research Academy (SASTRA), is a private (deemed) university whose main campus is located in the town of Tanjore, after which the district is named. SASTRA University was created about 15 years ago as a private educational institution. Unlike public colleges and universities in India, where most admission is based on a quota system for certain underdeveloped segments of society, admission to private educational institutions like SASTRA is based on merit. Thus in a short span of time, SASTRA attracted some of the brightest students and the best teachers, and therefore grew both in size and quality to attain the status of a deemed university. Owing to this successful growth, SASTRA recently opened a second campus at Ramanujan's hometown, Kumbakonam.

In 2003 SASTRA purchased the home of Ramanujan in order to maintain it as a museum. Ramanujan is an idol and inspiration to all students in India, and hence the preservation of his home was essential to the spirit and hope of Indian intellectuals. SAS-

TRA also created a Srinivasa Ramanujan Centre which has a library containing Ramanujan memorablia, as well as books, papers, and journals relating to his work. Since a university has now purchased Ramanujan's home, we now have the active involvement of administrators, academicians, and students, in the preservation of Ramanujan's legacy for posterity.

To mark the occasion of the purchase of Ramanujan's home, the Srinivasa Ramanujan Centre of SASTRA University conducted an International Conference on Number Theory and Secure Communications during December 19-22, 2003, where I was invited to lecture on my work. Other plenary speakers at this conference included George Andrews from The Pennsylvania State University, Noam Elkies of Harvard University, Samuel Wagstaff of Purdue University, and Antol Balog of The Hungarian Academy of Sciences. George Andrews gave the Opening Lecture of the conference as well as the concluding Ramanujan Memorial Lecture on December 22, Ramanujan's birthday. The conference was supported by the Indo-US Forum, the Number Theory Foundation, and several funding agencies in India. The President of India, Dr. Abdul Kalam, inaugurated the conference and declared open Ramanujan's home as a museum and national treasure. My wife Mathura, who is a Bharathanatyam dancer and teacher, and I, were happy to have an opportunity to visit this home and the wonderful temples of the Tanjore district.

Accommodation and sightseeing: All the delegates with their families who came from overseas were accommodated at Sterling Resorts in the *Swami Malai* near Kumbakonam. Swami Malai derives its name from a temple there for Lord Subramanya, who as a child explained the deep meaning of the sacred Hindu syllable *Om* to his father Lord Shiva. The significance of this story is that knowledge has no age barriers. *Swami*, which means God, refers here to Lord Subramanya, and *Malai* which means mountain in Tamil, refers to a little hill on top of which the temple is located.

Sterling Resorts is an amazing place. It is a set of cottages with tiled roofs, in a farm or plantation setting. There are plenty of banana trees all around and several cows on the premises of the resort. Thus milk and all milk products required for guests are obtained fresh from the resort itself. Also, delicious Indian food is served Indian style on banana leaves. On the resort grounds there is a magnificent white statue of Lord Shiva with his young son Lord Subramanya on his lap whispering the meaning of *Om* into his father's ear. When all guests arrived at the resort, we were given a very warm traditional welcome, namely, we were not only greeted with garlands and flowers, but trained staff at the resort in traditional Indian dress, washed and massaged our feet with fragrant water. I suppose the tradition came about because in the past travellers used to arrive by foot, and so this foot massage was a welcome relief. We arrived by a van from Madras, yet we immensely enjoyed and appreciated this traditional welcome!

Although Sterling Resorts has an old fashioned setting, the rooms have all amenities, such as a TV, telephone, and water heater. There are no note pads near the telephone to take down messages. Instead, you are provided a slate and a piece of chalk. When I went to bed I hoped that like Ramanujan, I too would get a formula in my dream so that in the middle of the night I could get up and write it down on the slate with the piece of chalk!

Seeing Ramanujan's home was itself a dream come true. What an inspiration to see this small humble home from where so many significant mathematical discoveries poured forth. The home has only three rooms surrounding a small courtyard - a bedroom, a

kitchen, and a dining area. In the back there is a well and a bathroom. This was a typical village home where a family of four to eight lived. Not every one could sleep in the bedroom, and so members of Ramanujan's family slept in the courtyard as well. The home is located on Sarangapani Sannidhi Street, so named, because Sarangapani Temple is located at the end of the street. There is a window in the bedroom overlooking the street. As a boy Ramanujan used to sit on the bedroom cot doing mathematics and watching the passers by on the street through this window. Mathura and I had the pleasure of seeing Ramanujan's home along with Professor George Andrews of The Pennsylvania State University, one of the world's greatest authorities on Ramanujan's work.

After seeing Ramanujan's home, we went to the Sarangapani Temple to offer *Archana* to the Lord. Archana is a special form of prayer in which the priest mentions the family background (*sankalpa*) of the devotee on whose behalf he is offering the prayer. It was a very pleasant surprise that the high priest not only asked Professor Andrews to join us in the sanctum sanctorum of the temple but included his name in the sankalpa as well. In many Hindu temples of South India, even today, only Hindus are allowed into the inner sanctum. This recent practice of allowing others into the sanctum was a very pleasant development we saw in the Tanjore district at all temples we visited.

Tanjore town, which is about half an hour from Kumbakonam by car, has one of the most impressive temples in all of South India, the *Brihadeeswara temple* for Lord Shiva. When you enter its grounds you see a massive *Nandi*, or bull, which is the guardian diety in all Shiva temples. As we entered the Brihadeeswara temple, we saw an *abhisheka* (daily purification bath) being performed for the Nandi. When an abhisheka is performed, the diety is washed with milk, yoghurt, honey, and in this case also *veeboothi* (holy ash of Lord Shiva), and finally with water. All through the abhisheka, the appropriate verses from the *vedas* (Hindu holy scriptures) are chanted. Imagine the amount of milk, yoghurt and honey used in the abhisheka of a massive Nandi!

After offering prayers at the Brihadeeswara temple, our hosts at SASTRA took us to a few shops in Tanjore town containing a wonderful collection of local art. Mathura wanted to purchase a Tanjore painting during a visit there. So we actually went to the home of a local artisan and bought a lovely painting of Lord Krishna. This now adorns the wall of the *puja* (worship) room in our home in Gainesville, to remind us every day of the rich cultural experience we had in Tanjore district. The visit was also truly memorable because it provided us an opportunity to see the home of Ramanujan, thereby making it an unforgettable mathematical pilgrimage.

About the Author: *Krishnaswami Alladi is Professor and Chairman of the Department of Mathematics at the University of Florida. His research is in Number Theory, an area where Ramanujan has made spectacular contributions. He is also the Editor-in-Chief of The Ramanujan Journal, an international publication devoted to all areas of mathematics influenced by Ramanujan. A shorter version of this article will appear in the newsletter of LOTUS (The Lord of the Universe Society), in Honolulu, Hawaii. Krishna's wife Mathura has given a Bharathanatyam (Indian classical dance) program at the East West Center, coorganized by the LOTUS Society in August 1993. They return to India every year but this was the first time they visited Kumbakonam to see Ramanujan's home and enjoy the rich cultural heritage of the Tanjore district.*

ADDENDUM

I had an opportunity to return to Kumbakonam and SASTRA University in December 2004, this time with my second daughter Amritha. The visit was in connection with an International Conference on Number Theory and Fourier Analysis at SASTRA's Kumbakonam campus during December 20-22. I was asked to inaugurate the conference on December 20 and to deliver the concluding Ramanujan Commemmoration Lecture on December 22. My colleague Frank Garvan who accompanied me on the trip gave the opening lecture of the conference. He gave a second lecture on his joint work with my other colleague Alexander Berkovich who was invited to the conference, but could not attend. Two other speakers from outside India were Moti Yung from Columbia University and Michael Unser from the Swiss Federal Institute of Technology in Lausanne. Also George Andrews' daughter Amy, and her husband Mark Alznauer, were with us. Amy was in South India in connection with her project to write the story of the discovery of Ramanujan's Lost Notebook.

The speakers and guests from overseas were once again housed at Sterling Resorts, and shown all the wonderful sights mentioned above. In addition, we were taken to the Town High School in Kumbakonam where Ramanujan studied. It was a moving experience to see the humble shed in the school which was Ramanujan's sixth grade class, and the old library from where Ramanujan borrowed mathematics books that kindled his curiosity.

There were two very significant developments during this visit which are highlighted below.

SASTRA Mathematics Olympiad: SASTRA University has decided to conduct an Annual Mathematics Olympiad for 11-th and 12-th grade high school students. I had the pleasure of setting the question paper for the First SASTRA Olympiad which took place on December 26, 2004, and in which more than 3,500 students all over India participated. SASTRA announced that the First Prize Winner will get an all expense paid trip for one month to the University of Florida to receive training from our group here. The Olympiad winner's stay at the University of Florida in 2005 will be supported by a grant from the Number Theory Foundation. SASTRA will provide the international airfare. India is a great reservoir of talent especially in mathematics and by conducting this Olympiad, I am pleased to be part of an effort to identify mathematically gifted students.

SASTRA Ramanujan Prize: During the inauguration of the conference, the Vice-Chancellor Mr. Sethuraman announced that starting in December 2005, SASTRA will award an annual Ramanujan Prize of $10,000 to be given to a mathematician under the age 32 for outstanding contributions to an area of mathematics influenced by Ramanujan. The age limit of 32 is to encourage young mathematicians and also because Ramanujan achieved so much in his brief life of 32 years. The SASTRA Ramanujan Prize is open to young mathematicians all over the world. I am working with SASTRA to set up an international expert committee to select the winner. The very mention of Ramanujan's name reminds us of the thrill of mathematical discovery, and I am honored to be associated with this effort to reward pathbreaking contributions by young mathematicians.