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ORIGINAL RESEARCH OR TREATMENT PAPER

Transformative Spaces: Dr. S. Paramasivan and Conservation Science in India in the Early Twentieth Century

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ABSTRACT
The tenure of archaeological chemist Dr. S. Paramasivan (1903–1987) at the Chemical Conservation Laboratory of the Madras Government Museum, India, sheds light on the development of the field of conservation science outside the scholarly centers of Europe and North America. Between 1930 and 1946, Paramasivan defined and broadened the role of a scientist responsible for the care and study of cultural heritage. From building and equipping his own laboratories to serve the museum's many departments, to collaborating with scientists, commercial metallurgists, and even religious practitioners across south India, Paramasivan's work is marked by a sense that the conservation scientist could and should practice beyond a laboratory's typical confines. In fact, working in this way created opportunities not only to physically transform ancient objects through conservation interventions, but also transform the understanding of ancient objects. In tracing his correspondence with Rutherford J. Gettens at the Fogg Art Museum, this paper provides insight into the complexity of defining the work of the conservation scientist even at one of the intellectual centers of the nascent field. Reflecting on Paramasivan's early career provides perspective on enduring challenges in conservation, and offers a way forward for a more expansive, collaborative, and community-engaged practice.

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> … The subject of museum chemistry is still in its infancy in India, so that the work of preserving the exhibits in the Museum requires originality, initiative and scientific observation extending over long periods.[1] – Frederick W. Gravely, Superintendent of the Madras Government Museum, 1936

A 2015 volume of *Studies in Conservation* drew attention to the current, critical juncture in the field of conservation science, and considered how to '[enhance] the integration, relevance and impact of conservation science within the cultural heritage conservation sector, and its capacity to deliver wider societal benefit' (Heritage and Golfomitsou 2015, 1). Of concern was tracing the existing contours of the field, but also looking beyond addressing purely technical questions to foster a more expansive, inclusive, and responsive professional practice. Though focused on the contemporary and future directions of the profession, contributors to the volume recalled conservation science's vaunted origins. Golfomitsou noted that 'science has played a major part of the development of cultural heritage conservation for over a century,' citing laboratories in museums in Berlin, London, and Paris, to which may be added laboratories in Cambridge and New York (Golfomitsou 2015, 39). These sites, associated with important museum collections and universities, continue to loom large not only in the history of conservation science, but also in the field today. However, left out from the history of conservation science is the story of the Chemical Conservation Laboratory (CCL) at the Madras Government Museum (MGM), India, the first museum laboratory in India, where, beginning in 1930, Dr. S. Paramasivan (1903–1987) defined and expanded the possibilities of what a conservation scientist could be. Paying close attention to Paramasivan's early career, particularly his tenure in Madras from 1930 to 1942, offers a rare perspective on the development of conservation science both outside and within the scholarly centers of Europe and North America. Recognizing Paramasivan's story at this moment opens a window into how the fields of conservation and conservation science might be redefined to address the pressing technical as well as the social concerns of our time.

As one of only three 'archaeological chemists' in India in the early twentieth century, Paramasivan's ability to expand the conservation scientist's scope of work far beyond a museum laboratory's confines offers an aspirational vision for conservation that is still relevant today. Drawing on records in the MGM and its CCL and the Tamil Nadu State Archives, Paramasivan's own publications, and oral histories with Paramasivan's colleagues, I begin by considering the

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museum laboratories where he developed methodologies and treatments that were specific to the needs of local South Indian collections. Second, I examine how Paramasivan collaborated across the museum's departments as a means of mobilizing institutional support for a more expansive view of a museum chemist's role. Third, I discuss how the city of Madras (now Chennai) and its environs served as fertile ground for interdisciplinary exchange, making possible joint research projects with scholars and practitioners at local scientific, commercial, and even religious institutions. Finally, I investigate how Paramasivan's interactions with European and North American museum practitioners, particularly Rutherford J. Gettens, provides perspective on an international effort to forge a scientific identity for conservation professionals across the globe.

The development of a new disciplinary field of expertise, in this case conservation and conservation science, had its complications and frustrations, as Paramasivan's experience demonstrates. However, the inherent interdisciplinarity and applied aspects of conservation science also made it a field of tremendous possibility that allowed for the collapse of traditional disciplinary divisions, and even cultural ones, as seen in Paramasivan's early career. Even in a colonial India still under British rule, his work spaces were places of relative intellectual freedom that made transformations of both physical objects and relationships between both Indian and British and other foreign professionals possible. In fact, it was through the lens of conservation science that these changes were possible. Thus as contemporary conservation science seeks to be more collaborative, integrated, and socially embedded in its approach, examining Paramasivan's tenure in Madras from nearly 90 years ago offers perspective on our contemporary concerns, and perhaps even a way forward.

A 'whole time chemist'

On 7 April 1930, Frederick W. Gravely, superintendent of the MGM, informed the Government of Madras (henceforth Government) that he had identified a 'whole time chemist' for the museum.[2] The new hire, S. Paramasivan, was qualified as a chemist and physicist, receiving his training under famed scientist C.V. Raman.[3] Despite having no experience working with museum collections, he was selected because, 'the post of Archaeological Chemist is one requiring technical skill and … Mr. Paramasivan has received special training in electro-chemistry befitting him to discharge the duties of the post efficiently, the work of preservation being an electrolytic process.'[4] At the time of his writing, Gravely, a biologist by training, in fact knew more about the preservation of bronzes than his new museum chemist. Gravely was aware of hundreds of archaeological bronzes in his collection that were 'affected with a "disease" which went on spreading by degrees, destroying all the surface and converting the interior of the bronze into amorphous whitish green powder.'[5] His consultations with specialists over more than a decade had convinced him of the need to chemically intervene on these bronzes to protect the museum's most notable collection, which by 1933 was valued at three million rupees.[6] Paramasivan's scientific credentials were crucial to carrying out this intended intervention.

In 1930, Madras was an administrative center of British India, a locus for numerous academic and commercial institutions, and the main urban cultural center of the southern part of the country. By the late 1890s, the museum was described as 'the official show-place of Madras city.'[7] Founded in 1851 through the East India Company as a collection exemplifying Southern Indian natural resources and commodities for a British colonial audience, by the early twentieth century, the museum was a civic institution of scientific and cultural import. Known within national and international circles for its scholarly publications in history, biology, and anthropology, and visited by hundreds of thousands of Indian visitors annually, the MGM had an impressive intellectual and popular reach (Aiyappan 1951). It also had an ambitious mission: to ensure that the 'priceless art treasures with a unique cultural and archaeological interest for South India … [were held] in trust for future generations as well as for the present.'[8]

The curt advertisement for Paramasivan's position read: 'Archaeological Chemist, temporary … at cost of Rs. 1500 for the year 1929–30 … required for work connected with the treatment of bronze images in the Museum.'[9] Undisclosed were the museum's unsatisfactory efforts at bronze conservation. In 1923, the museum had attempted to hire a traditional Indian craftsman specializing in bronze casting to stabilize the bronzes with this advertisement:[10]

> Applications are invited from competent Sthapathis or Silpis who have a special knowledge of the preservation of bronze images and who are willing to undertake the preservation of the collection of bronzes in the Museum, mostly discovered as treasure trove buried underground and acquired from time to time. Many of them are deteriorating for want of proper treatment, and some of them are badly corroded, the surface affected being converted to a light green amorphous powder. We have 81 big and 71 small idols badly affected which should be effectively treated, and 35 big and 34 small images not badly affected, whose green patina should be preserved.

At that time, the Government had insisted on hiring cheaper Indian artisan labor rather than retaining the more expensive services of British chemist Erlam Smith, then professor at Presidency College in

Madras, who had some knowledge of conservation practices in Europe and the U.S.A. When no suitable artisans were identified for the bronze conservation work, Ram Singh Ahuja, a chemist trained at the Archaeological Survey of India's laboratory in northern India was hired to work at the museum for a period of six months. His electrochemical, rather than electrolytic reduction treatments (discussed below) had been a disappointment, with more than a third of the objects he conserved developing new corrosion within a year of treatment. Paramasivan thus arrived to some skepticism about his likely efficacy, but Gravely's support was unwavering. Paramasivan later acknowledged this by thanking his superintendent 'for giving [me] the necessary facilities for carrying out the work' (Paramasivan 1941a, 63).

A first laboratory

Gravely had written to the Government as early as 1928 'that a laboratory is badly needed for the chemical treatment of bronzes and … it will be convenient to utilize the [vacant former Muslim restaurant] building … for the purpose.'[11] With the guidance of Erlam Smith, Gravely had outfitted the space – consisting of three rooms covered with a tin roof – with a thousand rupees worth of apparatus and chemicals 'required in connection with the treatment of bronzes' as well as furniture including 'two glass almirahs, 1 writing table … 1 office chair and two wooden tubs.'[12] This space was in fact the first laboratory outfitted to care for museum collections in India (Thangavelu 1972; Agrawal 1989).[13] No drawings or photographs exist of the space, but a request from Gravely to the Government seven months after Paramasivan's arrival offers a glimpse into this working environment:[14]

> My Chemist requests permission for the use of the fan in the Museum laboratory … for the following reasons:-
>
> (1) In certain chemical reactions, there are irritating vapors evolved and there should be a draft of wind to drive them off.
> (2) When the room is hot and when the chemist is cleaning the bronzes, he has to keep the room cool with the fan running, as perspiration damages them.
> (3) The bronzes, after washing, are quickly dried up in a current of air due to the fan.
>
> Under these circumstances and especially as the room has very small windows, I consider that the further continuance of the use of fan on and after 1st Nov 1930 is necessary in this case.

Given Madras' tropical climate, the heat, lack of circulation and fumes must have made for a stifling and noxious laboratory. The 'chemical reactions' listed in Gravely's letter likely refer to Paramasivan's continued use of Ram Singh Ahuja's chemical treatments including soaking encrusted bronzes in a 5% solution of sulfuric acid, followed by washing in water and then sealing with paraffin wax.[15] Ahuja also used the 'Krefting's' method of electrochemical reduction; objects were soaked in a warmed 10% solution of sodium hydroxide to which zinc granules were added, producing hydrogen gas that reduced the corrosion products on the surface. Though Paramasivan likely continued Ahuja's treatments at the beginning of his tenure because he had no training in conserving museum collections, he was already strategizing about alternative, long-term treatments.[16]

'In the early stages of his work, when he was new to it, Mr. Paramasivan found it necessary to consult..[chemist Erlam Smith] at frequent intervals for help and advice which [Smith] freely gave.'[17] Smith knew of chemists working with museum collections in Europe and North America, and Paramasivan later '[expressed] his thanks to Prof. Erlam Smith who suggested the problem [of electrolytic reduction] to him' (Paramasivan 1941a, 63). Smith also likely alerted the new chemist to scholarly publications on bronze conservation. Within three months of his hire, Paramasivan had copies of the Fink and Eldridge's *Restoration of Ancient Bronzes and Other Alloys* published by the Metropolitan Museum, the British Museum's *Cleaning and Restoration of Museum Exhibits*, and soon acquired Nichols' *Restoration of Ancient Bronzes and Cure of Malignant Patina* from the Field Museum. These volumes gave Paramasivan access to contemporary scientific debates on bronze treatments, but also required him to make sound judgements based on his collections' needs and his available resources. The Metropolitan Museum touted the 'absolute safety' of electrolytic reduction of bronzes (Fink and Eldridge 1925, 14) and the Field Museum called the technique 'safe, simple and easily applied,' (Nichols, Laufer, and Farrington 1930, 7), but the British Museum preferred the Krefting's method over the 'direct current method' because it was more controllable (British Museum 1926, 3). Perhaps based on the limited efficacy of the Krefting's method in Ahuja's and his own experience, Paramasivan chose electrolytic reduction (hereafter ER), which was being tested a little over a year after his arrival in Madras:[18]

> The electrolytic method of restoring corroded bronzes has been adopted here in place of the older chemical methods. The great advantages of the former over the latter lies in the fact that instead of simply removing the incrustation it restores the metallic element of the incrustation to the original condition, and that it completely decomposes corrosive salts causing 'bronze disease' even when hidden within the pores of a deeply corroded specimen. In spite of considerable delay in the installation of the electrical machinery, and of the fact that the technique of this method has had to be developed so as to adapt it for use with much bigger specimens than have been so treated

Figure 1. View of the wooden barrels first used as electrolytic reduction tanks. Image courtesy of the Government Museum, Chennai.

> elsewhere, 14 heavily corroded bronzes, many of them about 2 feet in height, have been electrically treated. Twenty-two bronzes, in height from about 6 inches to about 2 ½ feet, have been chemically restored during the last year.

In the new process, bronzes were simply weighed and their surface area measured before immersion in a 2% sodium hydroxide solution, possibly in barrels such as those visible in Figure 1. The bronzes (the cathodes) were wrapped with wire 'much as a parcel is tied with a string' (Paramasivan 1941a, 61) and were connected to metal bars stretched over the barrels and acting as anodes. Additional wires connected the bars to an electrical panel above the barrels. Bulbs in each panel may have illuminated when electricity was flowing. Paramasivan wrote that the process involved the 'electrolytic decomposition of the sodium hydroxide and the evolution of hydrogen at the cathode, which reduces the rust to finely devided [sic] or spongy copper, which can be brushed off, with the result that the decorative details are exposed' (Paramasivan 1941a, 57). Thinner crusts of 2–3 mm in thickness could be removed in three or four days, but thicker crusts required three to six months of treatment. The 'proper working voltage, amperage efficiency … working of the various controls, [and] the reaction at the beginning of, during the progress of and at the end of the reduction'[19] were carefully monitored throughout the process with 'the completion of the treatment indicated by the gassing at the cathode even at low current density' (Paramasivan 1941a, 62). By 1936, Paramasivan had the help of a laboratory attender, Mr. Arokiaswamy (Figure 2) who washed the objects post ER to remove the typical 'heavy greenish sludge,' and any remaining salt or redeposited metallic copper clinging to the surfaces (Harinarayana 1964, 119). Once dried, Arokiaswamy coated the surfaces with wax to gleaming.

Figure 2. View of the washing room with Mr. Arokiaswamy washing bronzes after electrolytic reduction. Image courtesy of the Government Museum, Chennai.

Figure 3. Bronzes before (left) and after (right) electrolytic reduction. Image courtesy of the Government Museum, Chennai.

The treated surfaces of electrolytically cleaned objects had the metallic sheen of stripped metal, a startlingly different appearance from archaeological bronzes that were mechanically or chemically cleaned and therefore red or green-hued. The lack of comment about these differing visual effects perhaps suggests changing esthetic expectations for conservation treatments. Less than a decade earlier (as seen the 1923 advertisement), the museum required any treatment to preserve a green patina as evidence of antiquity. The new preference, however, was for '[restoring] the metallic element of the incrustation to the original condition,'[20] even if this produced a new-looking surface that was sometimes porous. No doubt ER's promise was that it could make images literally emerge unblemished from concretions and corrosion products, and that it promised to find bronze disease even when it was 'hidden within the pores.' The preference for this treatment also suggests a confidence in an 'objective' scientific treatment method reliant on chemical reactions rather than the subjective, fallible work of human hands. There was also the reassurance that the treatment was in keeping with procedures used by some of the leading museum chemists of Europe and North America. ER treatments at the MGM soon proceeded 'six hours a day, six days a week,' such that the museum quickly exceeded its annual electricity allotment (Paramasivan 1941a, 62). Gravely had to request that the Government nearly double the funds sanctioned for electricity costs, costing the equivalent of three quarters of Paramasivan's annual salary.[21]

Figure 4. A bronze image before (left) and after (right) electrolytic reduction. Image courtesy of the Government Museum, Chennai.

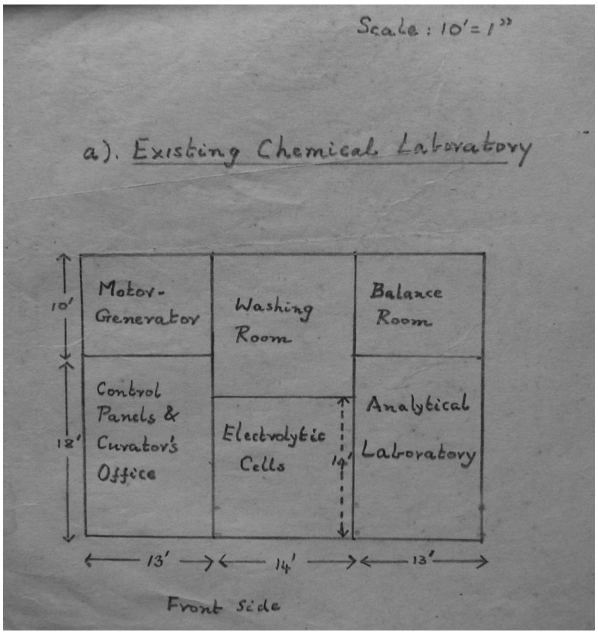

Figure 5. Unpublished plan of the museum laboratory dated March 29, 1956. Image courtesy of the Government Museum, Chennai.

'Preservation Registers' still accessible at the CCL document the laboratory's daily activities but give little information beyond cryptic notes such as 'cleaning,' 'washing', or 'electrolytic treatment.' However, the fact that there are columns for '[chemical conservation] curator's initials,' and '[museum] superintendent's remarks' shows that there was regular discussion of treatments and their outcomes between Paramasivan and Gravely. More extensive documentation was developed for recording ER treatments including electrical inputs applied, electrolyte strength, and duration and results of treatment (Paramasivan 1941a, Tables I and II). In addition to written documentation, 'the [museum] photographer … photographed … certain bronzes before and after chemical preservation which were required for record.'[22] Glass plate negatives dating from the 1940s testify to the dramatic changes in objects (Figures 3 and 4, previously published in Paramasivan 1941a; and Thangavelu 1972, respectively) before and after electrolytic cleaning which transformed objects from 'shapeless and unrecognizable' to 'their original form [complete with] … many interesting details … laid bare' (Paramasivan 1951, 104–105).

The new laboratory

Within a year of Paramasivan's arrival, Gravely asked the Government for 'a small extension' to the existing laboratory.[23] The former restaurant could not accommodate the growing numbers of objects requiring conservation treatment, and its 'unhealthy conditions' were compromising the physical well-being of the chemist. The Government rejected this second retrofit, and instead funded the construction of a new laboratory of a 'permanent nature' even though Paramasivan's job was only temporary. The notion of a permanent Madras laboratory had been raised a decade earlier when Ahuja had suggested sending the most corroded oversize bronzes to the ASI laboratory in Dehra Dun, in north India, for treatment. At the time, the Finance Department of the Government had balked:[24]

> [Officer 'RSL']: My only doubt is whether, for the Rs. 3000 which it is proposed to spend on sending the large bronzes to DD, it would not be possible to arrange the materials for treatment here … [Officer 'VTK']: We may … ask the Superintendent of the Museum to ascertain definitively from the Archaeological Chemist, Dehra Dun, whether some means cannot be found for the treatment of the big idols also here.

The 'means' was the new laboratory, opened at the MGM in 1937.

Completed at a total cost of Rs. 9000, the new 1100 square foot laboratory was built for the ER technique. A drawing of the laboratory Figure 5 shows its general layout. The workspace was fitted with a number of internal doors and windows making it possible to move objects through the laboratory as treatments progressed, to easily move between rooms to check on equipment, and to close off or ventilate certain spaces as needed. This must have been particularly important given the 'atmosphere of irritating vapors and … noise produced by the machinery and … heat generated by the machinery and the switchboards.'[25] The installation of running water and electricity in all the rooms further added to the versatility of the spaces, making treatments possible everywhere.

Photographs dating to the 1950s emphasize the utility of the spaces. The entrance opened into the room where objects were immersed in three welded iron electrolytic cells of varying sizes (Figure 6, previously published by Thangavelu 1972). Each tank was raised off the cement floor with porcelain insulators and individually connected to a circuit controlled by the switchboard in the adjacent room (Paramasivan 1941a, 60). The tanks themselves were significant upgrades from the prior barrels; they functioned as anodes, their riveted seams made them less leaky, and fitted taps made for quicker and safer drainage of the electrolyte. Accession numbers and descriptions of objects in treatment could be written on the tanks for identification, as can be seen from '170/50 Balasubramaniam' inscribed on the small tank. After ER, bronzes were moved into the tiled room visible through the open doorway where Arokiaswamy (Figure 2) meticulously washed any redeposited material from the surfaces using brushes such as those visible in the foreground. Objects were placed directly under taps or inside porcelain sinks as needed, with waste water directed to drains along the back wall of the room. When distilled water was

Figure 6. The electrolytic cells' room with a view into the washing room. Image courtesy of the Government Museum, Chennai.

required, it was brought into the washing room from the urn-like still in the adjacent control panel and curator's room (Figure 7) which also contained the hulking marble-paneled switchboard that controlled the electrical supply to the ER tanks. The current in the largest tank could be varied from 0 to 60 amps, and was adjustable to within 1 amp, while the smallest tank provided more control, ranging from 0 to 5 amps, and adjustable within 0.05 amps. Visible through the open door behind the switchboard is the Metropolitan-Vickers motor-generator which controlled the electrical supply to the ER equipment.

Paramasivan's new laboratory made it possible to address the treatment of heavily corroded large-scale bronzes. Unlike the

> American Museum [which] had to deal with bronzes of about 12 to 18 inches … the bronzes in the MGM are about 4 ½ feet in height. The former is analogous to a laboratory scale of work and the latter to the industrial scale, which demands a technique of its own. (Paramasivan 1982, 3)

One of Paramasivan's main concerns was that as heavy bronzes were lowered into tanks, their weight displaced the electrolyte such that air pockets developed under the bases, preventing reduction there.

> In such cases, a hole is drilled through the top of the pedestal which enables the enclosed air to escape and the electrolyte to fill the hollow. Further, a circle measuring about four inches in diameter is cut through the base of the stand, whereby the electrolytic action between the inner wall of the pedestal acting as the cathode and the bottom of the cell acting as the anode is not prevented. (Paramasivan 1941a, 61)

Some of these drilled holes are visible in several unpublished images at the CCL, primarily for large objects.

Figure 7. The control panel and curator's room, with a view into the room housing the motor-generator. Image courtesy of the Government Museum, Chennai.

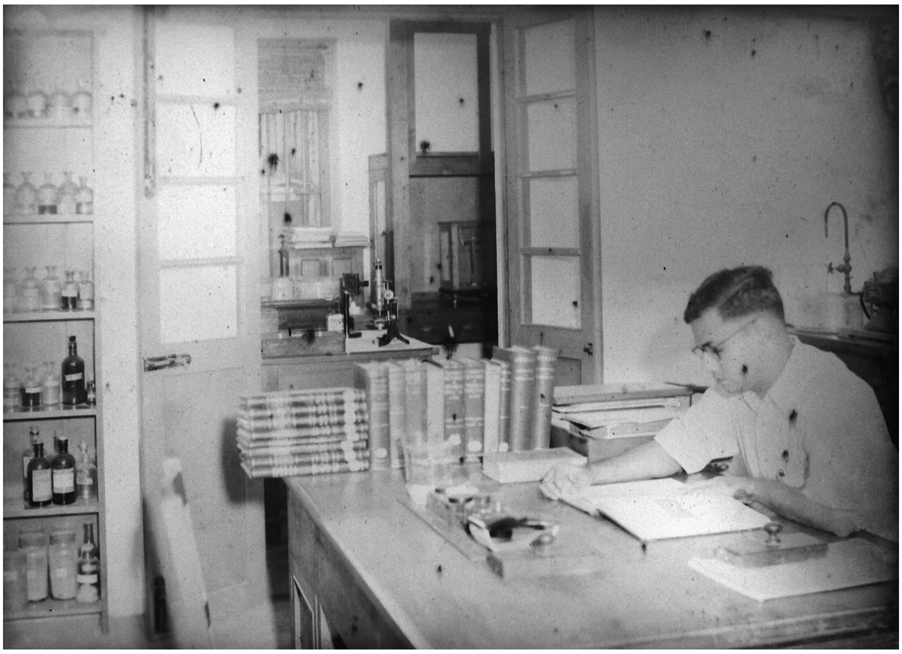

Figure 8. View from the analytical laboratory in the foreground into the balance room in the background. The name of the individual pictured is not known. Image courtesy of the Government Museum, Chennai.

The straightforward discussion of an intervention that would be seen today as rather invasive, with no mention of replacing the drilled pieces or filling the holes suggests that it was not controversial at the time. Paramasivan described the minimally decorated bases as 'unimportant' to the overall esthetic value of the object, and in fact, these drilled holes may have been seen as visually harmonious interventions since many large bronze images were traditionally cast with similarly placed holes in order to secure them onto carrying platforms during processions. The drilled-out sections were also useful on their own, becoming samples for Paramasivan's analytical research on the composition of copper alloys.

Paramasivan also acquired equipment for the laboratory which hints at his expanding role. A man of precision, he purchased instruments including voltmeters from London's Weston and Co., Optical and Scientific Equipment Makers; a Sartorious model U.S.A chemical balance and weight box; and a Rendell's Rate of Drying Meter, all likely associated with the ER treatments. He also became interested in environmental monitoring, buying a 'Casella hair hygrograph with daily clock No. 622 and 365 daily charts' and a 'S&M Thermograph No. 2360 Meteorological office pattern, daily timing complete.'[26] Paramasivan began to pursue chemical analyses, and his purchases from London's Gallenkamp and Co., and Baird and Tatlock, suggest that he acquired glassware for this purpose. He also repurposed equipment already at the museum including a polarizing light microscope from London's J. Swift and Co. (visible on the sill in Figure 8) and a Weston 'slide lantern machine,' used for delivering 'popular lectures'[27] in the museum theater (seen on the bench in Figure 7). Also visible in Figure 7 is an urn-like 1930s Indian-made distillation apparatus from the Andhra Scientific Co. which remained in use into the 1950s.

Also carefully maintained was the Metropolitan-Vickers motor-generator, the workhorse of the ER process which was repaired regularly on account of it 'being a very costly one perhaps unobtainable these days.'[28] As his colleague N. Harinaryana recalled, Paramasivan

> was meticulous and precise in going over the details of organization of the Laboratory, the special furniture required for it and the equipment to be acquired for making it well-equipped for the enlarged range of work it was expected to undertake. (Harinarayana 2002, 31)

Despite Paramasivan's significant contributions to the museum, his position remained temporary until 1938. Even after sanctioning the construction of a laboratory, the Government was unwilling to let him permanently staff it. This lack of commitment exasperated Gravely whose letters to Government emphasized Paramasivan's unique scientific knowledge and museum experience, and reminded the Government of the chemist's crucial role in maintaining the financial and cultural value of the museum collection. He noted that all reputable 'museums in Europe and America have found themselves obliged to include chemists on their permanent staffs.'[29] He also warned the Government of the consequences of leaving the laboratory without permanent scientific staff:[30]

> The need for the work of a skilled archaeological chemist will continue as long as the museum exists; for this has evidently already been recognized by Government who have accordingly sanctioned a new laboratory so that it may be conducted more efficiently.

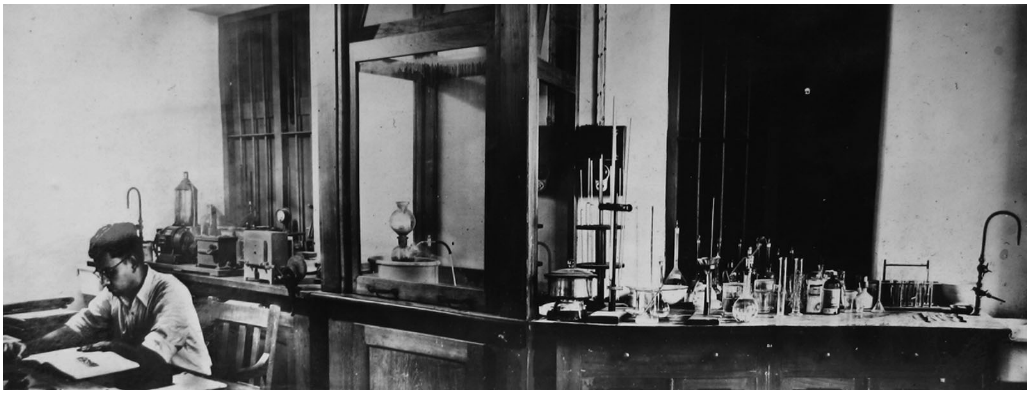

Figure 9. View of the analytical laboratory. The name of the individual pictured is not known. Image courtesy of the Government Museum, Chennai.

> But this laboratory, the use of which has now begun, will only be valued so long as there is a fully qualified and efficient archaeological chemist to work in it.

None of these justifications persuaded the Finance department, with one officer commenting: 'Since 1930 he [Paramasivan] has not been able to get a better paid job and he is not likely to get one hereafter. Even if he leaves it should be quite easy to get an equally competent man.'[31] In 1938, however, due to a rule limiting the length of time a government position could remain temporary, Paramasivan became permanent staff seven and a half years after his arrival in Madras, and only after building himself a laboratory to work. Considering the images of the analytical laboratory (Figures 8 and 9) with this perspective makes the space all the more important. In this room, Paramasivan surrounded himself with the accoutrements of a scientist: a vented fume cupboard; a work bench with the necessary equipment and glassware; chemical and object storage cabinets; and reference books and papers.[32] 'From here, [Paramasivan] could see everything that was going on, who was coming and going,' and though there are no photographs of Paramasivan utilizing the laboratory he designed, one can imagine the import of his occupying this room, and taking up his rightful space (N. Harinarayana, personal communication, September 21, 2009).

Collections in 'sound condition': working across the museum

Paramasivan's first project was to conserve bronzes for the *Catalogue of the South Indian Hindu Metal Images in the Madras Government Museum*. The 1932 volume, co-authored by Gravely and T. N. Ramachandran, curator of Archaeology, discussed the over 300 bronzes in the museum collection, of which nearly half were conserved for the publication.[33] The introduction specifically acknowledges Paramasivan,

> without [whose] help many of the images described below could not have been satisfactorily dealt with, their details being more or less completely obscured by corrosion. This work, especially since the installation of the apparatus for electrolytic treatment, has been invaluable to us. (Gravely and Ramachandran 1932, 2)

Also included in the publication were several post-conservation photographs of objects; the electrolytically cleaned bronzes appear conspicuously cleaner and metallic, underscoring the transformative nature of the chemist's work. Without Paramasivan's treatments, many of the identifying characteristics such as inscriptions, ornaments, or hand gestures would have remained illegible, and the objects undatable by these features. While Gravely and Ramachandran were dependent on Paramasivan's revelatory work to assist in attributing these bronzes, their reliance on stylistic analysis to place these objects into a chronology of Indian art concerned them. They wrote: 'the dating of Hindu metal images is a matter of very great uncertainty. Most of it is sheer guess-work and some of the dates assigned are demonstrably ridiculous … Are any clues available to the dates [of objects without inscriptions]?'(Gravely and Ramachandran 1932, 20). This desire for a more reliable and objective approach to the study of bronzes would in fact become a lifelong research passion of Paramasivan's; well into the 1980s, he was engaged in applying new analytical techniques for 'fingerprinting' bronzes in the effort to associate material characteristics and manufacturing techniques with time periods.

Perhaps it was this early successful research with Gravely and Ramachandran that opened up the possibility of working with the museum's other collections and their curators. This cross-departmental collaboration was not supported by Gravely whom Paramasivan later criticized for his 'mistaken notion that several of the objects of the museum other than bronzes do not require treatment' (Gravely n.d.). Thus, it is unclear how Paramasivan initially expanded his role beyond bronze conservation, but he was soon treating stone sculpture and iron implements because they were 'in imminent danger of total decay and also need[ed] treatment most urgently if they are to be saved.'[34] He became engaged in projects with 'at least three of the five scientific sections of the Museum (viz Archaeology, Numismatics and Anthropology sections) [who depended] on the archaeological chemist for putting and keeping important parts of their collection in sound condition.'[35] By 1935, his work had expanded to include ceramics, wood, and wall paintings. His research into problems of museum display made him invaluable even to the Zoology and Botany departments, as he was conducting 'investigations into the most suitable materials on which to print labels that will not be liable to rapid destruction by insects.'[36]

These collaborative projects, perhaps begun on Paramasivan's own initiative, became all the more important when the museum was evaluated for the 1935 publication *Museums of India*. Funded by the Carnegie Corporation of New York, this survey of 105 Indian museums and art galleries assessed museum practices in India and compared it with museum work in other British territories. Led by S.F. Markham, Empire Secretary of the Museums Association, and H. Hargreaves, the former Director General of the ASI, the report was critical of Indian museums, though the MGM was one of a few institutions among others in Bombay, Calcutta, Dehra Dun, Darjeeling, and Gwalior lauded for their 'very high efficiency' (Markham and Hargreaves 1936, 88). The MGM was praised for its important collections, well presented and labeled exhibitions, and public reach. In the words of the report, 'It is also one of the few institutions where researches are being carried out in connection with the treatment and preservation of museum exhibits' (Markham and Hargreaves 1936, 77). The MGM's integration of conservation into its overall mission stood in contrast to other Indian institutions where a lack of collaboration and an inequity in the status of museum staff left collections at risk. Markham and Hargreaves chided museums where the employment of an archaeologist chemist:

> … had the curious effect of making certain curators feel that the preservation of their exhibits is outside their province, and is the duty of those specialist officers, and we were surprised to find several curators and heads of departments not only ignorant of curatorial practice but apparently content to see priceless exhibits disappearing under the attacks of moths, beetles and other pests. (Markham and Hargreaves 1936, 58)

But chemists were not exempted from criticism. The 'unwise designation' of these technical specialists as 'archaeological chemists' had given an unfortunate impression that their work was 'restricted to the treatment of metals and stone' and that 'textiles and woodwork are regarded as a little below their dignity' (Markham and Hargreaves 1936, 58–59). That the MGM escapes this criticism and is in fact applauded for 'much useful work being done' must be credited in part to Paramasivan's conviction that preservation not be restricted to bronzes, and Gravely's willingness, even if grudging at first, to allow Paramasivan to work beyond his official job description.

Gravely took the opportunity of the *Museums of India* to internally evaluate the work at the MGM, requesting his scientific staff to contribute to a report entitled 'Methods Suggested for Improving the Usefulness of the Museum' (Gravely n.d.). In it, Paramasivan wrote that 'the severe criticism of Mr. Markham on preservation work in India, while throwing great responsibility on me … also strengthened my hands' (Gravely n.d.). He compiled a three-page summary of objects by museum department that he believed most in need of examination and treatment, as well as a list of 16 'problems of preservation' by material type. These problems, Paramasivan argued, could only be addressed if there was a continual process of monitoring the entire collection through 'joint study' by specialists across museum departments. Doing so would establish both short-term and long-term conservation priorities, identify rates of deterioration of various exhibits, and limit damage, 'for I believe prevention better than cure' (Gravely n.d.). Furthermore, this deliberate work was necessary for both the short and long term as, 'at a time when there is a paucity of workers in India, a survey like this will be useful also for future workers, and will, moreover, establish a certain amount of continuity in preservation work in this museum' (Gravely n.d.). As a result of this proposal, the MGM was soon one of the few Indian museums to implement quarterly checks of collections by both curators and the chemist working in collaboration.

Being able to rally such a 'systems' approach requiring cross-institutional support is remarkable considering that Paramasivan, as a temporary hire, had a lower institutional status and salary than his colleagues. Even when he was finally made permanent staff, he was paid less than a 10th to a quarter of his colleagues' salary, and half of what Ahuja had been paid a decade earlier. Though Gravely did not persuade the Government to pay Paramasivan an equivalent salary to his other scientific staff, he successfully lobbied for a change in his title. In 1938, all 'six scientific assistants [at the museum were] … designated as curators.'[37] While a new title of 'Curator of Chemical Conservation' did not improve Paramasivan's financial standing, it provided the same academic status as the other specialists in the museum. Even so, unlike the other curators at the museum who controlled and literally held the keys to certain collections, Paramasivan as curator was in an awkward position, unable to claim a part of the collection as his 'own' and yet was charged with conserving all of the museum's objects. Perhaps what the new title offered, however, was a clearer sense of shared responsibility for the collection. For example, in 1942 when objects were moved to the interior of the country for fear of German and Japanese attacks, knowledge of the whereabouts of the valuable bronze collection and keys to its storerooms were given to only to the superintendent, the curator of archaeology, and the curator of chemical conservation.[38]

The city and its environs

While cross-departmental collaborations within the MGM were key to expanding Paramasivan's scope of work within the museum, this changing role came with other frustrations:

> It is rather very difficult for one man to study the ravages in all the materials, find out their origin and nature, work out suitable methods of preservation and adopt them. To attempt to do everything single-handed is equivalent to one person attempting to do the curatorial work pertaining to all the different sections of the museum. (Gravely n.d.)

Paramasivan began to look outward for scientific collaborators to pursue technical questions related to the museum collection. As previously mentioned, chemist Erlam Smith was an important mentor and supporter, particularly during his early tenure. In fact, Paramasivan's assistant Arokiaswamy came from Smith's laboratory at Presidency College where he had received chemical training as well as improved his fluency in reading and writing English. Additionally, as British scholars embedded in scholarly institutions, both Smith and Gravely likely played an important role in introducing Paramasivan to other scientists in the city. Paramasivan expanded these relationships by identifying unique ways to utilize the spaces that were now open to him. For example, at the Barnard Institute of Radiology at the Madras Medical College, the first such research facility in South Asia, Paramasivan worked with the director Captain T.W. Barnard in 1935 to produce 'shadowgraphs' of 'four bronzes images from Negapatam.'[39] He used this new technology to:

> show the depth of the corrosion and the extent to which it has penetrated into the body of the image at different places, as well as showing its varying nature. Where the shadow shows that the original form of the outline has been retained in spite of corrosion, restoration yields very good results. Preliminary study with X-rays thus gives very valuable indications as to the best method of treatment and the results to be expected from it.[40]

X-ray technology seems to have become a standard pre-treatment analysis for 'specially valuable and heavily corroded bronzes,' suggesting that this collaboration continued for some time (Paramasivan 1941a, 58).

Another relationship perhaps brokered by Gravely or Smith that was significantly deepened through Paramasivan's own research interests was his decade-long collaboration with the metallurgists and chemists at the region's commercial railway company. As Paramasivan would later write:

> There are many metallic antiquities, whose exact methods of fabrication have to be worked out experimentally to reconstruct the technical skill and technical achievements of the ancients in the field of metallurgy. A beginning was made in this direction in the Madras Government Museum, supplemented by the facilities available at the Chemical and Metallurgical Laboratories of the Madras and South Mahratta [M &S M] Railways, Madras. (Paramasivan 1982, 6)

Though Paramasivan required the permission of R. McLean, chief mechanical engineer, and G.C. Mills, chemist and metallurgist, to use the railway laboratories, his most important collaborator was an Indian metallurgist named K.P.S. Nair (Figure 10).[41] They appear to have visited each other's laboratories regularly, with Paramasivan bringing samples and smaller objects to the Railways' laboratories, and Nair visiting the museum to see immovable objects, as he did on several occasions with members of his family in tow (A. Nair, personal communication, September 16, 2009). The relative ease and regularity of their contact may also explain why Paramasivan soon became interested in the study of ancient iron alloys in the museum collection, as contemporary iron alloys were Nair's specialization in the Railways.

The two scientists' familiarity is reflected in Paramasivan's publications *Investigations on Ancient Indian Metallurgy* where Nair is acknowledged as someone 'with whom the author has discussed some of these [technical] problems' (Paramasivan 1941c, 93). In these articles, Paramasivan examines several ancient copper alloys from three distinct perspectives: compositional information gleaned through chemical analyses, metallurgical observations from cross sections, and condition assessments based on their current state of preservation. The publications reproduce cross sections that were made in the Railways laboratories, and notes written on the backs of the original photographs testify to Paramasivan's interactions with Nair. The cross sections were critical to Paramasivan's argument that aspects of original manufacture, from alloy choices to working methods, indisputably influenced the long-term preservation of objects. For example, he states that while an ancient copper alloy bowl from Adichanallur may have originally been prized for its silvery tone (due to its high tin content) and its graceful shape (formed from extensive cold-working after quenching), these material characteristics also contributed to the cracking and losses in the object's current state (Paramasivan 1941b). In comparing bronze coins from the second and ninth

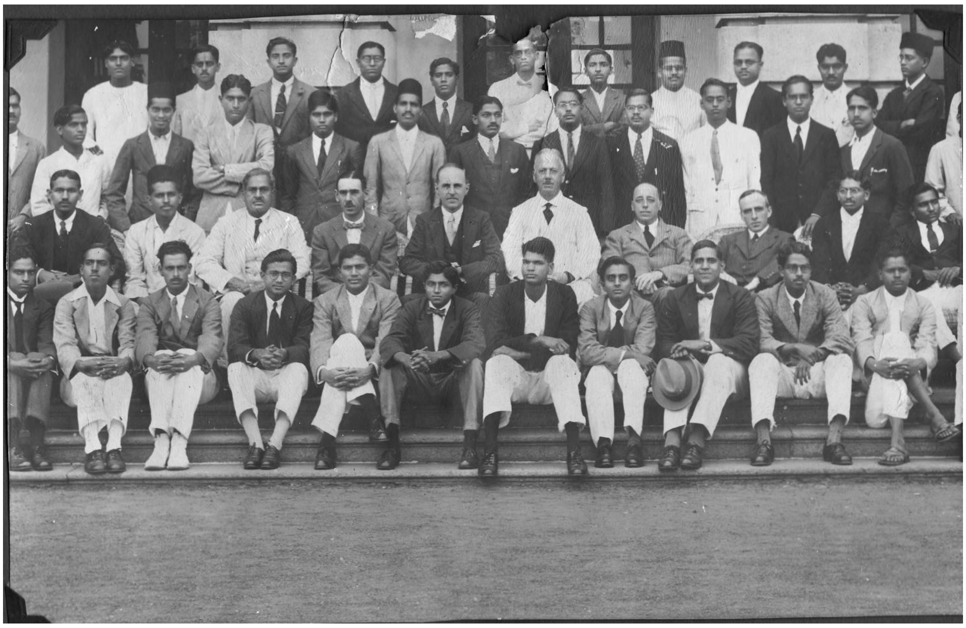

Figure 10. The staff at the Madras and South Mahratta Railways Chemical and Metallurgical Laboratories, c. 1940s. R. McLean, Chief Mechanical Engineer, is seated in the second row, third from the right. K. P. S. Nair, Metallurgist, is second from the right in the front row. Image courtesy of K. B. Nair.

centuries, Paramasivan used cross sections to identify casting with no post-casting cold-working as the manufacturing technique for both alloys. The earlier coin, however, had a high tin content that made for a more pourable metal that cooled to a harder coin than the ninth century coin; this led him to ask why by the later Chola period 'the art of coinage under the [earlier] Andhras deteriorated.' (Paramasivan 1941c, 92). This interest in associating intentional material and manufacturing choices with particular time periods and cultures, and later conservation condition of objects remained a life-long passion for Paramasivan.

Paramasivan also began to work with Indian religious authorities and practitioners in his capacity as the museum's archaeological chemist. During the early twentieth century, the MGM received hundreds of archaeological objects from all over south India as a result of the Treasure Trove Act, a national law that provided a process by which antiquities found buried on private lands could be purchased by government museums (Guha-Thakurta 2004). Much of this material was religious in nature, including the Hindu, Buddhist, and Jain bronzes that Paramasivan had been hired to conserve. While some of these objects had been removed from their findspots with the 'consent' of local populations, many communities and their religious leaders opposed this state-sanctioned removal of devotional objects for preservation in secular museums.[42] Hindu temple authorities found their own ways to resist these acquisitions, including refusing non-Hindus and lower caste Hindu museum officials access to sacred temple spaces, and dis-allowing documentation of proposed acquisitions. In a letter to the MGM in 1932, the trustees of the Srirangam Temple Devasthanam stated that 'photographing *Vigrahams* [bronze images] is not permitted as it is against *Sastras* [religious texts], *Mamool* [tradition] and custom of this temple. You may depute some caste Hindus to personally see the Vigrahams and report to you.'[43] High-caste Hindus including Paramasivan and Ramachandran, the MGM's curator of archaeology, could enter these restricted spaces.

Governmental attempts at preserving sites (rather than objects) of archaeological value were also stymied by these religious restrictions. In 1936, J.B. Blakiston, Director General of the ASI, asked Gravely to send Paramasivan to the famed Brihadisvara Temple in Thanjavur as 'none but Hindus can enter this *prakara* [in the main shrine of the temple] and as [he] … appeared to be the only Hindu to whom the preparation of a report on what was needed could be entrusted.'[44] The ASI's senior-most chemist was Mohammad Sana Ullah, a Muslim, who was barred from entry. Paramasivan was therefore requested to work at several temples in south India throughout his tenure at the MGM, and though these outside projects took him away from his museum work for weeks at a time, Gravely recognized the social relevance of Paramasivan's work:[45]

> Only Hindus have access to the Tanjore [Thanjavur] paintings, and as Mr. Paramasivan seemed to be the only Hindu who was qualified to subject them to expert examination I felt bound, in view of their very special importance, to agree to send him to see them … It is not, however, in the interests of Government that his conservation work here should be thus interrupted, and I consider that it should only be permitted for reasons of very special public importance

> such as the need that had arisen for precise knowledge as to the dangers that were generally believed – as it unfortunately proved correctly – to be threatening the Tanjore paintings. The [Sittannavasal] Pudukottai paintings are of equal importance and much more widely known and I feel that the Durbar should be given every possible help in their desire to get them preserved for future generations.

As Paramasivan's expertise in Hindu wall paintings grew, he was also requested to examine extant paintings at Buddhist and Jain sites. His work on these materials and techniques appeared in scholarly journals including *Technical Studies in the Field of the Fine Arts*, *Nature*, and *The Proceedings of the Indian Academy of Sciences*, among others. His articles and unpublished reports typically include chemical analyses of the ground layers, pigments, and binders; reproduced drawings that mapped conditions and sequences of paint layers; and even showed the early in situ use of new techniques such ultraviolet light examination and infrared reflectography to identify original paints and later additions (see Paramasivan n.d., 1936, 1937a, 1937b, 1937c, 1938a, 1938b, 1939a, 1939b, 1939c, 1939d, 1939e, 1940). Paramasivan's research also suggested new information that did not always corroborate the established understanding of Indian wall paintings. For example, his findings at the Brihadisvara temple led him to claim that the true-fresco technique was already in use in India by the eleventh century during the Chola period (Paramasivan 1937c). Sana Ullah, working from samples removed from the site by Paramasivan himself, disputed the findings, and cited prominent art historian Ananda K. Coomaraswamy's claim that 'the fresco technique was probably introduced in the time of Akbar [the sixteenth century] through the influence of European artists visiting his Court' (Sana Ullah 1937). Paramasivan wrote a rejoinder questioning Sana Ullah's results and restated his claim with the support of Stella Kramrisch, another prominent historian of Indian art (Paramasivan 1937b). He would later warn:

> the results of scientific research on cultural property are more important than the scientifically yet-to-be-proved processes described in … [ancient] texts, which are often empirical and out of context, as the writer has personally learned by comparing these texts in the original (and not through translations) with the scientific results of investigations on wall paintings. (Paramasivan 1976a, 23)

Paramasivan's experience underscores the enduring problem of reconciling literary sources and archaeological and scientific findings, particularly when physical evidence refutes long-held ideas about ancient artistic practice. His Indian wall paintings research continues to be extensively cited, particularly since more recent analytical work on these sites has been only minimally published.

'So few of us … so widely scattered'

As Markham and Hargreaves pointed out in *Museums of India*, much work remained to build the capacity of Indian museum specialists, even compared with their British counterparts working in India:

> At the present time the lead in museum technique is given to the world from Northern European and North America and whilst the European curator from India could keep in touch with these developments during his leave periods, his Indian successor inevitably finds it more difficulty to keep up to date … Thus if the Indian curator is to keep abreast of his colleagues in other parts of the world, visits at not too distant intervals to other areas seem to be an absolute necessity. (Markham and Hargreaves 1936, 40)

However, as there was no institutional funding for Indian curators to travel abroad for training and exposure, Paramasivan relied on imported publications, or learned second-hand through the experiences of Smith and Gravely (Paramasivan 1976a, 88). In April 1933, this dynamic changed when Paramasivan initiated a correspondence with Rutherford John Gettens at Harvard University's Fogg Art Museum, one of the conservation field's central figures. In a series of letters between 1933 and 1936, the two scientists exchanged information on technical questions, learned about each other's conservation challenges, and acknowledged a sense of the loneliness that both Paramasivan and Gettens felt as conservation scientists creating their own professional identities. While it is hard to imagine Gettens feeling alone given his positions at Harvard and the Fogg, he told Paramasivan that 'it gives me great pleasure to get in touch with other chemists working in my own field since there are so few of us and we are so widely scattered.'[46] Paramasivan's reply echoed Gettens' words:[47]

> As you say, chemists working in this field are so few and far apart that it is difficult to get immediate information and help, especially in India, which is far separated from centers of scientific activity in this field both in Europe and America. Even for such a big country like India, there are only two places, where restoration work is being carried on, viz, Dehra Dun and Madras, separated by a distance of 2000 miles. So you could appreciate our difficulties.

Paramasivan's isolation is underscored by his initial request to Gettens to describe 'all the details about the various scientific methods which you apply for examining and preserving works of Arts and the equipments you have for them.'[48] While Paramasivan clearly admired Gettens, stating he would 'write to [him] now and then for light and enlightenment,'[49] the letters read as a conversation between peers sharing information, and emphasize how many similar concerns were being addressed by the two scientists. Gettens' collegiality and genuine curiosity about Paramasivan's work is evident, especially in wanting to learn about his Indian colleague's experience of the 'agencies which cause the rapid destruction of bronzes.'[50] Both scientists were concurrently involved in treatments of archaeological bronzes using ER, but Paramasivan worked on a much larger scale. As Gettens wrote, 'I am much interested in the size of the bronzes that you are treating. Bronzes of this size must present rather unique problems and technical difficulties … Most of the work done … in this country has been confined to comparatively small objects.'[51] In addition to comparing notes on current bronze treatments, they sent each other their own publications, shared equipment preferences, and introduced each other to their physical spaces. Gettens described his laboratories, and those of other conservation colleagues including Karl Brittner in Berlin, Fernando Perez at the Louvre, and Harold Plenderleith at the British Museum.[52] Paramasivan in turn 'showed' Gettens India, sending him photographs of the Taj Mahal for Christmas in 1933, and in 1934, a 'miniature South Indian [Hindu] shrine.'[53] On receipt of the shrine, Gettens wrote that it would be added to his and Mrs. Gettens' 'personal collection of Oriental pieces of art and archaeology … [and] will be a constant reminder of our friend in India.'[54]

In only his second letter to Paramasivan, Gettens stated that 'it occurs to me that the special methods used to treat bronzes of [large] size would be an interesting subject for an article by you for *Technical Studies [in the Field of the Fine Arts]*.'[55] While acknowledging the journal's primary emphasis on western approaches to the fine arts, Gettens insisted that a broader perspective was welcome. 'We should like to hear about your own work there in India. You must have very many interesting and peculiar problems.'[56] Paramasivan did publish in *Technical Studies*, but on wall paintings rather than bronzes. In fact, his early investigations into wall paintings began concurrently with his correspondence with Gettens. He wrote in 1934 to Gettens of 'a very interesting problem, which is coming up to me for study and investigation [at the Brihadisvara temple].'[57] He was aware that a study of the paintings 'may revolutionise our ideas of South Indian paintings,' and sought Gettens' advice on practitioners who might advise on methods to remove and remount the later overpaints as well as preserve the lower original paint layers. Gettens provided detailed notes on the procedures developed at the Fogg for the removal and transfer of Asian wall paintings and even forwarded his colleague George Stout's notes on the Harvard procedure (Balachandran 2007; Bewer 2010).[58] It is unclear how much these notes impacted the treatment proposals Paramasivan put forward as this work, completed years later when he joined the ASI, was never published. However, given that very few conservation specialists were working on techniques of removal and transfer of Asian wall paintings aside from Gettens and Stout at the Fogg, and F.H. Andrews at the Central Asian Antiquities Museum in New Delhi, this kind of first-hand advice must have been invaluable (Andrews 1934).

Paramasivan's initial manuscript submission for *Technical Studies* focused on the technical analysis of the Brihadisvara wall paintings, and sought to characterize the earlier eleventh century Chola period paint layers and the later seventeenth century Nayak overpaints. Letters tracking the process of editing Paramasivan's manuscript offer a rare glimpse into the peer-review process at this early stage of the development of conservation science. This was likely the first time that Paramasivan had encountered this level of professional scrutiny of his research, writing to Gettens and Stout that he was 'indebted … for all the troubles you have both taken to improve upon my article.'[59] Revisions requested included suggestions for clarifying the structure of the argument, more clearly differentiating between the different paint layers, and adhering to the preferred editorial style. Gettens gently challenged Paramasivan, however, on his finding that the pale blue color present in the earlier wall paintings was the result of mixing ultramarine with lime, asking whether it was more likely that the pigment was used without being purified and thus appeared less intense. This query was a result of the fact that Gettens was working on a study of wall painting fragments containing ultramarine from Bamiyan, Afghanistan, at the time, and believed the latter to be the case (Gettens 1938). Ultimately, Paramasivan omitted his claim in the final paper (Paramasivan 1937c).

The letters following the peer-review process also reveal the challenge of creating a consistent language for conservation science at this early stage in the field's development. Unlike other journals, *Technical Studies* required original research on 'some technical phase' related to the fine arts (Brommelle 1977). This demanded a new scholarly literature that was equally invested in scientific evidence and artistic practice, and that presented these two different kinds of investigations together in an applied, interdisciplinary way. Attempting to speak these different languages called for a consistent vocabulary, no matter the cultural context. To this end, Gettens and Stout asked Paramasivan to standardize his vocabulary:[60]

> We note that in describing these wall paintings, you have kept as near as possible to the old Italian terminology which has been carried into English by translators of Cennino Cennini and others. Since we are trying to establish a uniform terminology, we prefer to have these terms translated into their best English equivalents … We have, therefore, taken the liberty to change the following terms used in your article: *fresco buono* – true fresco; *fresco secco* – lime medium on plaster; *fresco a secco* – tempera on plaster; *rinzaffo* – rough plaster; *intonaco* – finish plaster.

As Paramasivan was likely more familiar with Italian terms because of their history of use in publications even within Indian contexts,[61] this request left him concerned about the precision of his findings in secondary translation:[62]

> I have given English equivalents for the Italian terms, but I do not know whether I have made myself perfectly clear. Kindly go through the terms again. I may state here again that the Chola paintings have been executed in *freso-buono* technique and the Nayak paintings in the fresco process. I believe I can use the expression 'true fresco' for the first and 'lime medium on plaster' for the second.

This exchange highlights an enduring challenge of the inherently interdisciplinary conservation field, i.e. that of producing a literature that is rigorously scholarly, takes into account different cultural contexts, and yet remains accessible to researchers in different disciplines.

Conclusion

> Science in India is no way inferior to science in any other country. – Paramasivan (1976a)

In his 1977 review of *Technical Studies* for *Studies in Conservation*, Norman Bromelle stated that while some findings had been superseded since their publication, there were 'articles of continuing value'; on his short list were Coomaraswamy's work on Indian painting 'supplemented by a study of the material of mural painting at Tanjore by Paramasivan, and more distantly, by Gettens of wall paintings in Afghanistan and Chinese Turkestan' (Brommelle 1977, 199). Though both Coomaraswamy and Gettens continued to publish extensively, further cementing their careers, Paramasivan publications ceased once he left the MGM in 1946 to join the ASI. He later wrote (Paramasivan 1976b: 22).

> In the Madras Museum, I was able to conduct research and publish … but when I was transferred to the [ASI] … I could not proceed with scientific research with the same tempo. Whatever I did, was on my own and that too, with considerable difficulty and frowned [upon] from the official hierarchy.

Ironically, though his publishing profile diminished in his new position, Paramasivan's public profile grew, giving him the ability to oversee the work at important sites such as Ajanta, Ellora, and the Brihadisvara temple, and providing institutional funding to travel to Europe and Egypt to meet with conservation practitioners and visit archaeological sites and museums. In 1958, he was invited to join the Management Committee of the International Institute for the Conservation of Museum Objects (now the IIC, under whose auspices this journal is published) as part of an effort 'to increase the international character of the Institute'; in this role, he worked closely with some of the giants of the conservation field including Brommelle, W.G. Constable, P.B. Coremans, S. Keck, I. Rawlins, S. Rees Jones, A. Van Schendel, M. Hours, Gettens, and Stout (International Institute for the Conservation of Museum Objects 1958). This relationship extended further to 1961, when he chaired the session on 'Fragile Archaeological Materials' at the first IIC conference in Rome.

While Paramasivan's long and pioneering career has received mention in the history of conservation in India (Raj, Rajagopalan, and Sundaram 2000; Kshirsagar and Deotare 2002; Dhar 2008), this article's focus on his early career in particular offers a cautionary tale still relevant today for the conservation field as a whole. The tendency of institutional leadership to build facilities but not permanently staff them, or to ignore conservation concerns until the needs of collections become acute is as recognizable today as in Paramasivan's experience nearly 90 years ago. The unwillingness of institutions to recognize the unique expertise of conservation staff and appropriately remunerate them continues to plague the profession. The expectation that conservation departments address the needs of all collections while also producing and publishing research remains as unsustainable as it was in Paramasivan's day. Finally, the lack of parity between specialists in conservation departments and other museum staff is still endemic, limiting conservation departments' access to funding and curtailing their freedom to pursue research that is not in direct service to other departments' goals. Paramasivan's ability to confront and navigate these restrictions in the early twentieth century shows the continuing promise that science holds when applied creatively and collaboratively for the preservation of cultural material and the communities that claim them. In 1983, at the age of 74, Paramasivan advocated for a 'mobile laboratory' that would traverse the south Indian state of Tamil Nadu to document and conserve the approximately 32,000 bronzes in religious use in over 4000 Hindu temples in the region (Paramasivan 1983). Though never funded, this literal outreach was proposed as a way of making conservation more accessible to rural communities, while allowing the gathering of new research that would otherwise remain unknown. For Paramasivan, a community-engaged conservation practice was intricately related to a research-orientated practice; both were needed in order to ensure the long-term preservation of cultural heritage, and both could happen beyond the laboratory's traditional confines.

Abbreviations

The following abbreviations are used to refer to the sources of cited archival documents:

Chemical Conservation Laboratory Archives, Government Museum, Chennai (CCLA)
Conservation Department, Freer Gallery of Art, Smithsonian Institution (FGA)
Government Museum Chennai Archives, Chennai (GMCA)
Tamil Nadu State Archives (TSNA)

Notes

1. Government Order (hereafter G.O.) Nos. 1–81, Law (Education), 21 May 1936, TSNA.
2. G.O. No. 989, 27 May 1930, Edu (MS series), TSNA.
3. Raman received his Nobel prize in physics in 1930.
4. G.O. No. 989, 27 May 1930, Edu (MS series), TSNA.
5. G.O. No. 770–1/24, 25 June, undated year, Law (Edu), TSNA.
6. G.O. No. 521–1/33, 20 March 1933, Law (Edu), TSNA.
7. G.O. No. 1770, 17 June 1896, Public, Government Museum Chennai Archives, Chennai (GMCA).
8. G.O. No. 521–1/33, 20 March 1933, Law (Edu), TSNA.
9. G.O. No. 96, 18 January 1928, Edu (Mis 96), TSNA.
10. G.O. No. 559–1/23, 27 June 1923, Law (Edu), TSNA.
11. G.O. No. 544, 20 March 1928, Edu, TSNA.
12. G.O. No. 107–1/28, 8 September 1928, Law (Edu), TSNA.
13. While an earlier laboratory was set up in the Indian Museum, Calcutta, it was associated with the Archaeological Survey of India which specifically conserved sites and site-related rather than museum collections.
14. G.O. No. 2376, 19 November 1930, Law (Edu), TSNA.
15. Letter from Ram Singh Ahuja to Gravely, 18 June 1924, TSNA.
16. G.O. No. 1917, 6 November 1931, Law (Edu), TSNA.
17. G.O. No. 19179, 6 November 1931, Law (Edu), TSNA.
18. G.O. No. 1224, 26 August 1932, TSNA.
19. G.O. No. 1917, 6 November 1931, Law (Edu), TSNA.
20. G.O. No. 1224, 26 August 1932, Edu, TSNA.
21. Letter No. 1424, 1 May 1933, GMCA.
22. G.O. No. 1224, 26 August 1932, Edu, TSNA.
23. G.O. No. 1917, 6 November 1931, Law (Edu), TSNA.
24. G.O. No. 770–1/24, 25 June 1924, Law (Edu), TSNA.
25. G.O. No. 117, 19 January 1935, Public (Services), TSNA.
26. G.O. No. 1625, 21 July 1937, Edu, TSNA.
27. G.O. No. 968, 22 July 1918, Home (Edu), TSNA. This slide machine was likely purchased from Weston and Co., England, in 1916.
28. G.O. No. 704, 14 March 1949, Edu, TSNA.
29. G.O. No. 521–1/33, 20 March 1933, Law (Edu), TSNA.
30. G.O. No. 712, 22 September 1936, Edu, TSNA.
31. G.O. No. 712, 2 April 1937, Edu, TSNA.
32. Letter No. 1014–1/35, 25 September 1935, GMCA.
33. G.O. No. 1917, 6 November 1931, Law (Edu), TSNA.
34. G.O. No. 1917, 6 November 1931, Law (Edu), TSNA.
35. G.O. No. 117, 19 January 1935, Public (Services), TSNA.
36. G.O. No. 712, 2 April 1937, Edu, TSNA.
37. G.O. No. 1254, 3 June 1938, Edu, TSNA.
38. G.O. Confidential Memo 9043A/42-5, 25 March 1942, GMCA.
39. G.O. No. 1565, 2 August 1935, Law (Edu), TSNA.
40. G.O. No. 1565, 2 August 1935, Law (Edu), TSNA.
41. This metallurgist is the author's own grandfather.
42. This is the subject of a longer paper forthcoming by the author.
43. Letter from MS Raghunatha Thathachariar to Gravely, 11 October 1932, GMCA.
44. G.O. No. 1081, 21 May 1936, GMCA.
45. Letter No. C 6–2/37, 18 March 1937, GMCA.
46. Letter from Gettens to Paramasivan, 5 June 1933, FGA.
47. Letter from Paramasivan to Gettens, 6 July 1933, FGA.
48. Letter from Paramasivan to Gettens, 27 April 1933, FGA.
49. Letter from Paramasivan to Gettens, 16 November 1933, FGA.
50. Letter from Gettens to Paramasivan, 5 June 1933, FGA.
51. Letter from Gettens to Paramasivan, 4 October 1933, FGA.
52. Letter from Gettens to Paramasivan, 11 January 1934, FGA.
53. Letter from Paramasivan to Gettens, 6 December 1934, FGA.
54. Letter from Gettens to Paramasivan, 22 January 1935, FGA.
55. Letter from Gettens to Paramasivan, 4 October 1933, FGA.
56. Letter from Gettens to Paramasivan, 5 June 1933, FGA.
57. Letter from Paramasivan to Gettens, 1 August 1934, FGA.
58. Letter from Gettens to Paramasivan, 9 January 1935, FGA.
59. Letter from Paramasivan to Gettens, 10 September 1936, FGA.
60. Letter from Gettens to Paramasivan, 5 August 1936, FGA.
61. Italian restorers L. Cecconi and Count Orsini conserved the Ajanta paintings between 1920 and 1922. See Singh and Arbad (2013) for a brief history of conservation at Ajanta.
62. Letter from Paramasivan to Gettens, 10 September 1936, FGA.

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