

(1) Number of Pages 24
(2) Date of repair 7-8-1969
(3) Initials of the Referencer _____

MADRAS RECORD OFFICE

GOVERNMENT OF MADRAS

Revenue DEPARTMENT

G.O. No.
~~B.P. No.~~

1841

Press
~~Mis.~~

Dated 29-11-1876 196 .

Not to be folded or roughly handled

*Proceedings of the Madras Government, Revenue Department,
29th November 1876.*

the direction of the Deputy Collector, or that the works be leased out to some enterprising Contractor.

3. Some better mode of raising the water is much desired. The Board will be glad to hear further from Dr. Ratton upon this point, and any proposals which he may make regarding the windmills used in Pondicherry.

(True Extract.)

(Signed) E. LABSON,
Acting Sub-Secretary.

No. 551.

ORDER THEREON, 29th November 1876, No. 1,841.

Separate Revenue, No. 23.

Salt.

THE Government regret to observe that the experiments conducted at Manambadi and Porto Novo have not both been successful, although they were immediately under the supervision and direction of Dr. Ratton. He accounts for the failure by attributing it to neglect, brought about partly by his absence at Madras for one month to attend the Salt Commission. The Government do not understand why effectual measures were not adopted for the conduct of the experiment during Dr. Ratton's absence.

3. Mr. Garstin will endeavour to obtain the required information regarding the Pondicherry Windmills. experiments should be sent

(True Extract.)

(Signed) D. F. CARMICHAEL,
Secretary to Government.

To the Board of Revenue.

Ed. F. R. Bantleman.

1341/2

No. 3,417.

PROCEEDINGS OF THE BOARD OF REVENUE, dated 22nd December 1875.
Read the following Proceedings of the Madras Government, dated 14th December 1875, No. 1,809, Revenue Department:—

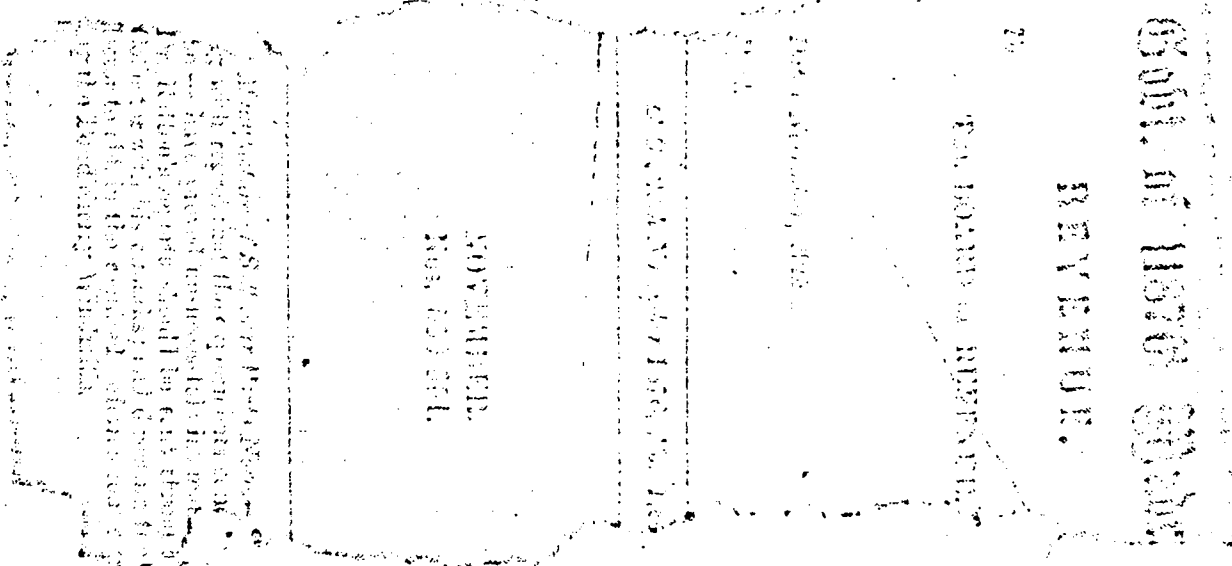
ABSTRACT.—Stating that application will be made to Government of India for permission to retain Dr. Ratton's services for another year, &c., and sanctioning Board's proposals regarding preparation of detailed scheme for experiments in salt being made on a considerable scale.

COMMUNICATED to Dr. Ratton, who is requested to submit proposals for conducting experiments on a large scale in person at Harigoshti after visiting the locality and conferring with the Collector, if necessary.
(A true Extract.)

(Signed) C. A. GALTON,
Acting Sub-Secretary.

To J. J. L. Ratton, Esq., M.D., on Special Salt Duty.
Copy to the Collector of South Arcot.

Ed. J. Tulloch.



1841/2

No. 1,819.

PROCEEDINGS OF THE BOARD OF REVENUE, dated 15th July 1876.

Read the following letter from J. H. GARSTIN, Esq., Collector of South Arcot, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Cuddalore, 20th June 1876, No. 261:—

In forwarding copy of a letter, dated 16th instant, No. 141, from the Salt Deputy Collector reporting on the result of the manufacture of salt at Manambady up to date together with the specimen of salt which accompanied it, I have the honor to observe that the specimen, though not very white, is, in my opinion, much heavier, and therefore superior in quality, to the Killai Salt. I must, however, at the same time remark that the result of the manufacture, so far as quantity is concerned, is decidedly unsatisfactory, as with Dr. Ratton superintending operations not more than 10 per cent. of the dittum has been manufactured during the first half of an exceptionally favorable year, and it seems doubtful if any more salt will be made this season.

ENCLOSURE No. 1.

From W. FREER, Esq., Deputy Collector, Salt Department, to J. H. GARSTIN, Esq., Collector of South Arcot, dated Porto Novo, 16th June 1876, No. 141.

I HAVE the honor to acknowledge the receipt of your official memorandum, No. 155, of the 8th instant, calling upon me to report when the salt manufacture at Manambady will be resumed and on the result of the manufacture up to date.

2. From my diary for the week ending 10th instant you will have observed that the irrigation of the salt-pans was resumed on the 7th instant by Dr. Ratton and baling on the 9th instant; only sixteen and twenty-nine coolies were employed on that and on the following date, respectively, instead of the number stated in my diary of those dates; the condensers are filling rapidly, and to me there appears to be no lack of brine. The Superintendent, of course, says that salt in many of the thirteen pans may be gathered, but I was of Dr. Ratton's opinion till yesterday that, owing to the pans being very soft and filled with silt, it could not be gathered until it had formed into a cake thick enough to be lifted by the hand. Three-tenths of an inch of rain fell last evening and reduced the thickness of the silt.

3. In a few days* I will send you a colored plan of the pans according to a survey made by me with the prismatic compass. From it it appears that 1338 cawnies have been enclosed

for the salt-pans and 297 cawnies rejected as unfit. Of the 1338 cawnies three have been reserved for salt-pans and the remaining appropriated for condensers. The three cawnies have been divided into twenty-four pans, each measuring one-eighth of a cawny. Of these, nine pans (1 to 5 and 13 to 16) have been yielding salt, and four others (6 and 7 and 17 and 18), which were irrigated after the heavy rain of the 29th and 30th April last, have not as yet yielded any salt. Three more pans (8, 19, and 20) have been tamped to some extent and require very little preparation to make them fit for the reception of brine, and for these and the remaining eight pans (9 to 12 and 21 to 24) I am of opinion that the present condensers are not adequate to supply brine if the rejected 297 cawnies be not utilized by adding it to the condensers.

4. Dr. Ratton joined the pans on the 17th of January last and set to work laying out the pans according to his new system. With the exception of the fall of 50 inch of rain on the 25th January the season was exceedingly favorable up to 29th April. We commenced gathering salt on the 3rd of April, and 14 garce were gathered up to noon of the 29th April and about 111 maunds after the rain that day, making a total of 14 garce and 111 maunds. Dr. Ratton left on the evening of the 7th May for Madras. The Superintendent did not inform me of the

1875.
Board of Revenue,
MADRAS.

PROCEEDINGS, 22ND DECEMBER 1875, No. 3,417.

Encl.

Received

Dec 1880/76

DECEMBER.

No. 3,417.

Dr. Ratton on Special Salt Duty.—Communicating to—Proceedings of Government regarding the retention of his services for another year, and the proposed salt experiments on a considerable scale, and requesting that officer to submit proposals for conducting experiments in person at Narigoshli in South Arcot District.

departure of Dr. Ratton. After inspecting Markanum Station I returned to Manambady on the 22nd idem, when I found the salt beds drying and the condensers almost so. This should not have been, for from the 8th to 22nd idem the

Date.	Coolies.	Date.	Coolies.
8th	23	16th	51
9th	46	17th	50
10th	36	18th	61
11th	49	19th	43
12th	50	20th	62
13th	51	21st	49
14th	43	22nd	59
15th	50		

Superintendent had from twenty-three to sixty-three coolies employed daily in the pans. There was a fall of 6 inch rain on the 5th idem. It required only thirty-two coolies to keep the sixteen picottas at work, and yet no salt has been scraped from the 29th of April

last. Between the 25th of May and 2nd June I gathered 4 garce and 80 maunds from six pans. The salt in remaining pans, which was not fit to gather, was destroyed by the 8 inch of rain which fell on the evening of the 2nd instant. The entire quantity gathered and stored up to date is 19 garce and 71 maunds, which is a very small portion of the 214 garce which, according to Dr. Ratton's ultimate estimate, we were led to expect from the 1333 cawnies of land enclosed for salt culture.

5. I enclose an average sample of the salt manufactured. It might have been gathered cleaner by a Superintendent with a higher appreciation of cleanliness.

6. I am not prepared to say whether we will be able to gather any more salt from the Manambady Pans this season. Dr. Ratton will probably remain here till the end of July, and I shall endeavor to assist him to the best of my ability.

(True Copy.)

(Signed) J. H. GARSTIN,
Collector.

COMMUNICATED to Dr. Ratton for any remarks which he may desire to make.

2. The specimen of salt will be sent to the Chemical Examiner, who will be requested to analyze it and favor the Board with a report of the result.

(True Copies and Extract.)

(Signed) E. GIBSON,
Acting Sub-Secretary.

To J. J. L. Ratton, Esq., M.D., on Special Salt Duty.

.. the Chemical Examiner to Government, with specimen of salt.

Copy to the Collector of South Arcot.

.. to the Secretary to the Salt Commission.

Ed. A. S. Rodgers.

Manufacture of Salt at Manambady, in South Arcot District.—Communicating to Dr. Ratton, for remarks, Collector's report on results of —, and forwarding specimen of salt to Chemical Examiner for analysis and report.

JULY.
No. 1,819.

Received

Dec 1807/18

Encl.

PROCEEDINGS, 15TH JULY 1876, No. 1,819.

1876.
Board of Revenue,
MADRAS.

No. 2,181.

PROCEEDINGS OF THE BOARD OF REVENUE, dated 24th August 1876.

Read the following letter from J. H. GARSTIN, Esq., Collector of South Arcot, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Cuddalore, 31st July 1876, No. 342:—

In forwarding copies of a letter, No. 165, dated 21st instant, from the Salt Deputy Collector, and of one from Dr. Ratton, dated the 17th instant, No. 134, I have the honor to observe that the result of this year's experiments in the manufacture of salt at Manambadi has been a failure, as out of a ditam of 333½ garce only about 34 had been scraped up to the end of July, and that in an exceptionally dry season and under Dr. Ratton's personal superintendence.

2. I have, however, requested Mr. Freer to use every endeavour to make more salt till the end of September next.

3. I have also, with reference to the Board's Proceedings of the 12th instant, No. 1,779, requested Mr. Freer to continue the daily registry of brine strengths at Manambadi till the end of August, and shall continue it even longer if possible.

4. I am decidedly of opinion that salt works should be established at Manambadi, and that the difficulty of securing a constant supply of brine of a strength nearly equal to that of sea water (3° Beaumé) must be overcome. This I consider is quite possible, though at some expense, by cutting a canal from the mouth of the Vellar past the Porto Novo Custom House and carrying it along the bank of the river to the corner of the present salt works. This canal would be about a mile long. I have requested the District Engineer to favor me with his opinion on the practicability of this scheme and of its probable cost. If the large works at Harigoshti are sanctioned, it will be of the first importance to have a steady supply of sea water available, rather than a questionable supply of water at 2° Beaumé. The difference in volume of water to be lifted would probably be very great, and the saving in cost of steam-power proportionate.

5. In the meanwhile, I have the honor to submit a sketch estimate for an experimental work which I shall be glad if the Board will sanction, as it is the embodiment of the system which I consider is likely to prove most remunerative, while at the same time decidedly most likely to give a larger outturn of salt at a less cost per garce and of a better quality than what we have hitherto been able to manufacture.

6. The work consists of two masonry beds covered with Portland cement, each 40 yards square, one being 18 inches higher than the other, and the beds being separated from each other by a masonry wall 2 feet thick and surrounded on all sides by such a wall. The dividing wall is intended to be pierced with drainage holes 4 inches in diameter at every 15 or 20 feet, to be plugged with copper-covered wooden plugs capable of being easily inserted or removed by the hand. These drainage apertures are to be at a level of 6 inches above the floor of the upper bed, which would be 2 feet deep, while the lower one would be only 18 inches, so that the surrounding wall of the shallower one would be 6 inches lower than that of the deeper one.

The plan of working which I propose is to keep filling the upper bed with brine, say, of 3° Beaumé, until it reaches a strength of nearly 25° Beaumé, and then

to drain off the upper 18 inches into the lower bed where the salt would form. The upper bed would then be refilled and the process repeated, the brine being let into the lower one whenever it nearly reached 25° Beaumé in the upper one, and the scraping of salt in the lower one being carried on *daily* after its precipitation had once commenced. The salt scraped would be spread to dry and drain on a small sloping masonry or wooden platform adjoining the lower bed, so that all the drip would flow back into that bed, and there would be no loss. This platform is not provided for in the sketch estimate, but, as the lower bed would cost less than the higher one, the saving would, I think, suffice to pay for this platform, which would be of small size.

7. The merit of the system consists, as it seems to me, in its similarity to the process by which spontaneous salt (which has been proved to be the purest) is formed, namely, by formation in *deep water*. I have come to the conclusion, after considerable observation, that to get it good, salt should form in crystals at the bottom of the water and not on the top as in the case of the shallow irrigations at present so much in vogue. The system has also the great advantage that there is no loss of labor or of brine by percolation while by shutting off the drainage from the upper bed at the high level of 6 inches and then refilling the upper bed; whatever virtues the mother liquors may possess are economised and made use of, while any other salts that form and deposit themselves can be gathered (and stored if of any value) without any prejudice to the process of manufacture. Lastly, the salt is sure to be clean. The disadvantage of the plan is its great initial expense, and I have no figures to enable me to prove that the outturn of salt under it would, area for area, be so much greater than that of the present system as to warrant such an expenditure on a large scale. Still this system, if the manufacture by this system could be carried out all the year round, while there would be probably but little expenditure necessary to keep the works in repair, there would be no loss of time whatever during the manufacturing season, and the cost of manufacture would be very small. In fact, the maximum quantity of salt which could possibly be made on the area taken in hand could be reckoned on with something like certainty, subject only to the vicissitudes of the climate, while that the salt would be of good quality is a consideration not to be overlooked.

8. With these remarks I solicit sanction to expend 6,000 Rupees on the experiment. By comparing the cost of the works, the outturn of salt, and the cost of its manufacture per garce at the end of two years with the cost of the upkeep, the outturn, and the cost of manufacture in an ordinary pan of the same area, we shall be able to see if the results justify or condemn any further similar outlay. The experiment will be very valuable, however, in connection with the introduction of the excise system; for, if it can be shown that an expenditure of 12,000 Rupees per cawny on permanent salt works is more remunerative than making salt according to the old method, the difficulty of finding appropriate sites for salt works is at once overcome.

9. I enclose the estimate with a copy of the District Engineer's letter* forwarding it to me, and would observe

*No. 94, dated 22nd June 1876.

that, if the Board think the expenditure asked for is too large for an experiment, it would be possible to reduce the proposed

work to one half its size, or to substitute an ordinary clay condenser, keeping the masonry work for the crystallizing bed, but it is to the permanent character of the condenser and the absence of percolation, and of any possibly existing chemical action of the brine on the floor of an earthen condenser that I attach much importance, while the advantage of having the experiment carried out on a considerable scale is that much more reliable results are arrived at, and I therefore hope that my proposals may be sanctioned in their entirety.

ENCLOSURE No 1.

From W. FREER, Esq., Deputy Collector, Salt Department, to J. H. GARSTIN, Esq.,

SINCE writing my letter of yesterday, I have received a private letter from Dr. Ratton, in which he states: "I am not quite sure that it would be well to abandon salt manufacture here this year as yet. If the weather holds up as fine as it is to-day, for instance, you might make

* Note.—13½ garces only. There was much salt in the pans when I left on the 18th of June, which had been forming from the 8th of that month, and scraping commenced the day after I left.

a few more garces. I scraped 16 garces* during your absence, notwithstanding that it has rained. Showered more or less every day nearly." The Superintendent has since

been ordered not to give up the manufacture if there be any likelihood of making any more garces of salt. The cost will at the least be 200 Rupees a month.

(True Copy.)

(Signed) J. H. GARSTIN,
Collector.

ENCLOSURE No. 2.

From J. J. L. RATTON, Esq., M.D., on Special Salt Duty, to J. H. GARSTIN, Esq., Collector of South Arcot, dated Porto Novo, 17th July 1876, No. 134.

I have the honor to inform you that I intend proceeding to Madras next week. It rains here every day, and from the lateness of the monsoon I do not suppose that there will be another favorable opportunity for manufacturing salt this year. About 35 garces of salt have been scraped and stored. I have informed the Salt Deputy Collector of my approaching departure, and have ordered the Salt Superintendent to write to him for further instructions.

(True Copy.)

(Signed) J. H. GARSTIN,
Collector.

ENCLOSURE No. 3.

From Major H. R. MEAD, R.E., District Engineer, South Arcot, to J. H. GARSTIN, Esq., Collector of South Arcot, dated Cuddalore, 22nd June 1876, No. 94.

Your No. 147 of 20th June 1876.

I have the honor, as requested, to send you a sketch estimate of the cost of making a permanent salt-pan covered with Portland cement.

2. I consider a platform of this sort should have a masonry work built round it, and think that the Portland cement should rest on a bed of 9" thickness of concrete; it is necessary that the Portland cement should have a perfectly rigid floor, as, if that fails, it must crack and break up.

(True Copy.)

(Signed) J. H. GARSTIN,
Collector.

ENCLOSURE No. 4—Estimate.

REFERRED to Dr. Ratton for his opinion.
(True Copies and Extract.)

(Signed) E. GIBSON,
Acting Sub-Secretary.

To J. J. L. Ratton, Esq., M.D., on Special Salt Duty,
with estimate to be returned.

Copy to the Collector of South Arcot.
,, to the Secretary to Salt Commission.

Exd. A. Grubert.

Salt Works--at Mannabadi in South Arcot District.--Referring to Dr. Ratton, for his opinion, letter from Collector requesting sanction for Rupees 6,000 for construction of two ornamental masonry beds in connection with--

AUGUST.
No. 2,181.

PROCEEDINGS, 24TH AUGUST 1876, No. 2,181.

1876.
BOARD OF REVENUE,
MADRAS.

Encl

No. 2,656.

PROCEEDINGS OF THE BOARD OF REVENUE, dated 25th October 1876.

Read the following letter from J. J. L. RATTON, Esq., M.D., Special Salt Duty, to E. GIBSON, Esq., Acting Sub-Secretary to the Board of Revenue, dated Madras, 13th September 1876:—

I HAVE the honor to inform you that, in accordance with Board's Proceedings, No. 3,417, dated 22nd December 1875, I proceeded to Harigoshti in January last for the purpose of opening and conducting in person a large salt ~~manufactory~~ ^{factory} which was to have been an experiment in its way, and a crucial test of the capabilities of this coast for producing a first rate commercial salt cheaply. The experiment would also have settled such open questions as the relative cost of manufacturing salt by contract and departmentally, the absolute cost of salt manufacture, &c., and it would have got rid of, or established as facts, many theories which yet encumber the subject of salt culture.

2. I regret to say that I was unable to do any thing towards the realization of the Harigoshti Project; partly perhaps owing to the appointment of the Madras Salt Commission by the Secretary of State rendering it undesirable to commence new works on a large scale, but mainly, I believe, owing to the general financial pressure existing this year, the necessary funds were not forthcoming, and nothing in the way of practical work could be done.

3. Whilst the correspondence about the Harigoshti salt-pans was going on, at the Collector's request I turned my attention to a small swamp adjacent to the Porto Novo Iron Works on which Mr. Freer, the Salt Deputy-Collector, was laying out separate salt-pans, designed on the principle of the model ullum shown in my report of November 1872, which ullam is at best but a scientific modification of the common Native salt work. Mr. Freer had made six of these ullums in the previous year, and was just about to put them into order for the current year's work when I joined. With the Collector's approval and Mr. Freer's assistance I determined to convert the whole swamp, or as much of it as could be depended upon, into a saline on the French system.

4. The area of the swamp is about sixteen cawnies. Eight cawnies in the best part had been cleared and prepared for salt manufacture by Mr. Freer in the season of 1875. Of the remaining eight cawnies about three were pretty well suited for salt work, two capable of being converted into salt-pans at some expense, and the remainder at so low a level, so overgrown with mangroves, and so riddled with crab burrows, as to be unfit for immediate use. The encircling canal since completed has drained this bad bit, the mangrove bushes have been cut down, and I dare say that, as the neighbouring works alter its physical characteristics, the crabs will abandon it, as they are of the largest and least troublesome variety.

5. The fall of the ground aided me in converting the thirteen cawnies available for salt work into a saline on the French system without losing the benefit of, or diminishing the value of, the work already accomplished by Mr. Freer. The swamp has a double inclination, sinking from south to north and from west to east. Mr. Freer's ullums were arranged in parallel rows running north and south, the condensers south, the beds north. His condensers fell in with my arrangements as did some of his

salt-beds, but others, two or three, I judged it advisable to convert into inner or strong brine condensers as they were situated too far from the platform for cheap and rapid salt storage.

6. It may not be amiss to notice briefly here the salient contrasting features of the two systems. The Native system presupposes a salt estate broken up and divided into any number of small separate holdings which act independently of each other. These holdings are termed ullums. They are complete in themselves, though not perfect, having piccotahs, condensers, channels, path, salt-beds, etc. It follows that salt-beds are scattered over the whole estate, some near and others far from the storage platform, that work people are still more scattered, that police work is difficult, manufacturing superintendence impossible to one or two officials, that divided interests interfere with harmonious work, labor is multiplied and wasted, and the estate is worked at a maximum of cost and yet not to the best advantage. The French system presupposes a large estate—the larger the better—belonging to one proprietor. In it the salt-beds are grouped around the storage platform and the condensers are so disposed that brine flows from its source automatically from one to another of these, gaining in strength as it proceeds until it reaches the salt-beds fit for the crystallising process. This system admits of the application of machinery beyond the motive power of a cooly. It reduces waste labor, police and general superintendence, and cost to a minimum. In fact, the French is to the Native system what the capitalist is to the laborer.

7. Accompanying this report will be found a survey plan of the salt-pan referred to, prepared by Mr. Freer, which will illustrate my remarks. In the first instance as the surface of the ground was sandy in parts, cracked and fissured, and had been excavated here and there to search for potter's clay, I sank the foundation of the clay wall running round the outer circumference of the salt-work down until it reached the solid clay substratum, which was found at an average depth of about 2½ feet. I find this wall a better protection against loss from leakage out of the saline, a quicker and a less expensive work than tamping the whole area of ground to be irrigated.

8. At the highest part of the swamp—its south-west corner—the baling station was established, and from thence the outer condensers, twelve in number, were taken down a gentle incline to the east point where, following the fall of the ground, they turned and ended at the channel passing from No. 12 to the inner condensers through the finishing condensers colored red in the plan. The first eight condensers are double. The fall north is so rapid that it was found necessary to keep the brine up on the high ground by means of a clay wall running east and west through the first eight condensers. Mr. Freer distinguishes the two rows thus formed with blue and yellow colors, but there is really no difference between them; the brine poured out into condenser No. 9 was of the same strength from either row.

9. From No. 12, the last of the so-called outer condensers, the brine preparing for salt manufacture flows through a channel to the inner set of condensers 13, 14, 15, and 16, which are on a lower level. The baling station at the north-west corner of No. 16 is at the lowest point in the level of the condensers. When the brine reaches this baling station it is pumped up to the finishing condensers 17, 18, 19, and 20, marked red in the plan. From 20 it is distributed to the two rows of salt-beds through the high level and low level feeding channels.

10. The salt-beds are in two rows fronting the platform. All are not completed as yet, for, inasmuch as a portion of the swamp was rejected as unfit for condensing, a proportionate number of salt-beds had to be suppressed. The upper row of beds is at a higher level than the lower, and any bed on the upper can be drained completely into any other on the lower row. This arrangement which has excellent practical results was obtained from the natural confirmation of the ground without extra labor. The lower row of beds drain into the swamp on the east or into the canal when low.

11. The condensers, with the exception of those which had been tamped by Mr. Freer a year previously, were not prepared in any way. The beds were trodden until the clay was dry and hard, not a brittle but a tough hardness. Much difficulty was experienced in hardening some of the beds. Owing to the rapid fall in level and the excavations, &c., existing in the outer condensers, as soon as the latter were irrigated, springs appeared in some of the salt-beds, condenser brine filtering down through cracks and rising to its own level in weak parts of the salt-beds. This difficulty was overcome for a time by carefully kneading the clay at the weak spots, but the springs re-appeared in great numbers in the salt-beds after they had been irrigated for salt and crystallisation had commenced.

12. These springs soften the salt-beds and make it impossible to gather the salt with the wooden rake in the common way. As our aim was to let salt crystallise as long as possible and gather it by hand in cakes, it did not matter very much. The springs did not diminish the salt crop, though they appeared to do so by dissolving the salt round their apertures which were thus marked by a black unsightly circular patch of exposed clay about the size of a breakfast plate, raised above the level. On the contrary as the eruption of brine is in hot weather evaporated by the sun as fast as it enters the bed it increases the crop of salt, and it is moreover an indication that the flow is to, not from, the bed, as sometimes happen. To prevent springs from softening the bed floors for the future, I would strongly recommend that the outer condensers get a good cattle tramping next year before the beds are remade.

13. It is interesting to note that the beds occupy a site previously in great part overgrown with deeply rooted mangrove bushes averaging about 6 feet high. The roots were grubbed up with care before the beds were made and no expense so to speak was spared. Yet I fear that the beds are still injuriously affected and that the springs spoken of were led through the thick clay to the surface along the tract of roots broken and hidden in the soil. For this reason, and because the north-east portion of the site is at too low a level to be easily and thoroughly drained, I do not think the site a very happily selected one, yet I believe it will in time answer its purpose very well. I had only to take it as I found it and endeavor to turn it to the best advantage.

14. A good many large crab burrows were found in the outer condensers 7, 8, 9, 10, and 11 previous to their irrigation, but as I anticipated the crabs left and the burrows filled up after they had been for sometime submerged by brine at about 5° Beaumé.

15. Nothing else worth noticing occurred during the formation of the works. Work commenced on the 18th of January; the wall round the saline was finished on the 24th; piccotahs were erected and the condensers were commenced on the

25th. The condensers were filled as they were finished one after another, and by the middle of March all were completed and filled. Two salt-beds were then got ready and irrigated, and on the 3rd of April the first scraping of 210 maunds of salt was had from these two beds.

16. In the meanwhile other beds were being pressed forward with all the labor available. Two new ones were irrigated on the 3rd and by the end of the month eight beds having an aggregate superficial area of 57,600 square feet were at work. On the 29th of April rain temporarily put a stop to work. At that date there was about fifteen garce of salt in store. Considering that this was less than one month's scraping from about a fourth of the full complement of salt-beds belonging to the saline, I think it a very fair outturn for a newly turned site.

17. From the 29th of April to the 8th of May, the day of my departure for Madras to appear before the Madras Salt Commission, nothing more could be done, as there was heavy rain on the 29th and 30th April and on the 5th and 6th of May. I arrived again at Porto Novo on the 7th of June and found the outer condensers dry, the inner condensers nearly so, the piccotahs stopped, and all work suspended. This is what occurred during my absence as I learnt from Mr. Freer—See also his letter to the Collector of South Arcot, No. 141, dated 16th June 1876, in Board's Proceedings, No. 1,819, dated 15th July 1876. From the date of my departure to the date of Mr. Freer's arrival at Porto Novo, 22nd May, nothing whatever was done. Mr. Freer found the salt-beds drying and the condensers almost dry. He then set to work and scrapped 4 garce and 80 maunds of salt from six pans between the 25th May and 2nd June. On the evening of the 2nd of June 8 of an inch of rain fell, so Mr. Freer stopped all work for a day, and I found the saline on the 8th idem in the state described.

18. As far as manufacture is concerned, I had now to begin work all over again; to refill the condensers, condense the brine, and prepare salt-beds for its reception. I commenced on the 9th. On the 17th the coolies absented themselves. On the evening of the 24th half an inch of rain fell. On the 1st and 2nd of July the coolies absented themselves. On the 6th of July one-third of an inch of rain fell. On the 8th, 9th, 11th, 12th, 13th, 14th, 15th, and 17th, we had very heavy showers. Again on the 22nd we had smart rain, and as the weather looked very broken and the season was long past its prime, I decided to leave the Porto Novo saline and prepare this report on its merits. I left on the 25th of July.

19. When I left we had 41 garce and 57 maunds of salt in store. It took me about a fortnight from the 9th of June to get the saline into working order. Many of the old salt-beds were at that time so soft that I turned them into condensers, and used for crystallising purposes new beds which were rapidly pushed on to completion. These came into operation at dates up to the middle of July. If I had eight good beds representing one cawnie of crystallising surface at work during the period under notice it is the most. With these the saline turned out 20 garce and 106 maunds of salt up to the 24th of July in most unfavorable weather. On the whole the saline worked well and I am satisfied with it.

20. For myself I was laid up in February with a severe attack of dysentery and was incapacitated from active superintendence of the work until near the end of March. Again I was absent on duty from the 8th of May to the 7th of June.

Owing to these causes I cannot give as good an account of the work as I might otherwise be able to do.

21. I have left the baling business to the last as I wish to draw particular attention to it. It is the most important and, as regards present arrangements, the most expensive part of salt manufacture. Its importance results from the fact that the whole success of the saline depends upon the due and continuous supply of brine. If the supply is diminished or cut off for a single day a certain number of condensers run dry; if for two days very nearly the whole outer series stand empty, and when baling is recommenced the weak brine hurries through the empty condensers until it reaches the inner set, when the prepared brine is at once reduced several degrees in density. When in good working order the brine in our condensers registered as follows: In the 8th condenser 5° Beaumé, in the 11th 8° Beaumé, in the 12th 10° Beaumé, in the 15th 13° Beaumé, and so on. One day's stoppage and renewal of baling work would reduce the brine in the 15th condenser to 8° Beaumé. In addition to the loss of density an absolute scarcity of brine is felt in the finishing condensers for the supply of the salt-beds. Practically when the brine supply depends upon cooly labor there are at least five or six stoppages in the season caused by Native feasts, cholera, scares, &c. In addition on Sundays half the balers are dispensed with. And then there are the usual number of individual absenters from time to time, the result of family bereavements.

22. As to expense, the cost of salt manufacture once the saline is completed divides itself, excluding superintendence, into the cost of supplying the work with brine and the cost of gathering and storing salt. The first item is when the saline is supplied with brine by cooly labor, incomparably the heaviest; it is in fact a crushing charge upon the manufacture. We require twelve cawnies of irrigated surface 178,460 gallons or 28,800 cubic feet of brine a day. The average lift was about 5 feet. For this purpose we employed the ordinary lever piccotah armed with a bucket and worked by two men. We found by actual experiment, making all allowances for waste and idleness, that these piccotahs only raised 1,881.5 cubic feet per working day. We consequently required, deducting bunds, ridges, and other dry surfaces, about fifteen piccotahs to keep the saline going. Fifteen piccotahs were accordingly erected and for some time worked, but one of them giving away we continued with fourteen with difficulty for the rest of the season. These piccotahs cost standing about Rupees 140; the piccotah men, twenty-eight in number, cost Rupees 168 a-month. Rupees 168 a-month is a crushing charge for the brine supply of a 12-cawny saline, and when the saline is completed to thirteen cawnies as it will be at the beginning of next year, seventeen piccotahs, costing Rupees 204 a-month, will have to be employed.

23. Working with piccotahs we have then, though but a small initial outlay for machinery, a very heavy monthly bill for labor. Piccotahs, too, are not altogether free from the drawbacks of more expensive machines. They get out of order frequently, often smash, and at the salt-pans seldom last through three seasons. In addition to the bill for labor there is the loss incurred in manufacture owing to the various stoppages noticed in paragraph 21.

24. The question arises, is there any cheap and efficient substitute for cooly labor in raising brine. I believe there is. The mule tampon described in my report

on the French salines raises brine 3.3 feet and discharges it at the rate of 263 cubic yards an hour. One such tampon would have done our work in a day of four hours. We need not lift our brine 5 feet, not even four feet I believe. The site is not 3 feet above high tide level. It is because Natives build up a sort of catch reservoir for the piccotahs, and only come to work at fixed hours whether the canal is high or low, that the brine has to be raised about 5 feet. For the tampon we could manage a lift of less than 4 feet, and one such tampon altered to suit the level, and one bullock and a cooly, would do our work at a cost of about Rupees 30 a-month, inclusive of interest on capital sunk in the purchase money.

25. It is not however to the tampon but to the windmill pump that I look for assistance. From conversation that I have had with a French Engineer at Pondicherry, I believe that the windmill pumps will help us out of our difficulty better than any thing else. I have been waiting for detailed information from this gentleman, but I understand he has a delicacy in furnishing it without a formal authorisation from the Pondicherry Government. This I am sure the Board will be able to obtain on due application being made. A good deal of information on this subject is to be obtained from Pondicherry where, as far as I can make out, windmills have been much more used than in Madras. I saw one working in the Governor's garden as I passed through Pondicherry this year. It is essential to note in this connection that during the salt season, i.e., from January to August, there is wind enough on this coast to work a windmill, and that the lift required is as a rule less than 5 feet at the salt-pans.

26. With reference to Proceedings of the Board of Revenue, dated 15th July 1876, No. 1,819, communicated for my remarks, and of the 24th August 1876, No. 2,181, covering letters from South Arcot, referring to the factory nature of the outturn from the saline, and under my personal superintendence, I beg to draw attention to the fact that during the whole season the saline was under construction. It is not finished yet. From the 3rd to the 29th of April when rains began 15 garces of salt were scraped from less than a quarter of the full strength of the salt-beds belonging to the saline; all that were then ready. This performance was very satisfactory. It was full of promise. I have already reported that I left the place at this juncture to attend the Salt Commission sitting at Madras, and that I found the saline practically abandoned on my return in June. The salt season was then just over, and if the promise of April was not fulfilled in the interval I can only suppose it to be the result of neglect. At any rate the Porto Novo saline is but a small model of the French works, and the conclusion to be drawn from such an experiment cannot be considered final.

No. 1.—Plan.

SUBMITTED for the information of Government.

2. Dr. Ratten's experiment, though not highly successful, has not been altogether barren of results. The Board recommend that it be continued next year under the direction of the Deputy Collector, or that the works be leased out to some enterprising Contractor.

3. Some better mode of raising the water is much needed. The Board will be glad to hear further from Dr. Ratten upon this point and consider any proposals which he may make regarding the windmills used in Pondicherry.

(A true Copy and Extract.)

Acting Sub-Secretary.

To the Secretary to Government, Revenue Department,
with plan to be returned, and copies of Board's Proceedings,
22nd December 1875, No. 3,417; 15th July 1876, No. 1,819;
and 24th August 1876, No. 2,181.

To J. J. L. Ratten Esq., M.D., on Special Salt Duty.

Copy to the Collector of South Arcot.

October 1876, No. 2,656:—
Read the following letter from J. J. L. RATTON, Esq., M.D., Special Salt Duty,
to E. GIBSON, Esq., Acting Sub-Secretary to the Board of Revenue, dated
Madras, 13th September 1876. In accordance with Board's Proceedings,

I HAVE the honor to inform you that, in accordance with Board's Proceedings, No. 3,417, dated 22nd December 1875, I proceeded to Narigoshli in January last for the purpose of opening and conducting in person a large salt manufactory which was to have been an experiment in its way, and a crucial test of the capabilities of this coast for producing a first rate commercial salt cheaply. The experiment would also have settled such open questions as the relative cost of manufacturing salt by contract and departmentally, the absolute cost of salt manufacture, &c., and it would have got rid of, or established as facts, many theories which yet encumber the subject of salt culture.

2. I regret to say that I was unable to do any thing towards the realization of the Harigoshti Project; partly perhaps owing to the appointment of the Madras Salt Commission by the Secretary of State rendering it undesirable to commence new works on a large scale, but mainly, I believe, owing to the general financial pressure existing this year, the necessary funds were not forthcoming, and nothing in the way of practical work could be done.

of practical work could be done. Ashtij salt-pans was going on, at the Collector's request I turned my attention to a small swamp adjacent to the Porto Novo Iron Works on which Mr. Freer, the Salt Deputy Collector, was laying out separate salt-pans, designed on the principle of the model ullum shown in my report of November 1872, which ullum is at best but a scientific modification of the common Native salt work. Mr. Freer had made six of these ullums in the previous year, and was just about to put them into order for the current year's work when I joined. With the Collector's approval and Mr. Freer's assistance I determined to convert the whole swamp, or as much of it as could be depended upon, into a saline on the French system: The swamp is about sixteen cawnies. Eight cawnies in the best

4. The area of the swamp is about sixteen cawnies. Eight cawnies in the best part had been cleared and prepared for salt manufacture by Mr. Freer in the season of 1875. Of the remaining eight cawnies about three were pretty well suited for salt work, two capable of being converted into salt-pans at some expense, and the remainder at so low a level, so overgrown with mangroves, and so riddled with crab burrows, as to be unfit for immediate use. The encircling canal since completed has drained this bad bit, the mangrove outside have been cut down, and I dare say that, as the neighbouring works alter its physical characteristics, the crabs will abandon it as they are of the largest and least troublesome variety.

5. The fall of the ground aided me in converting the thirteen cawnies available for salt work into a saline on the French system without losing the benefit of, or diminishing the value of, the work already accomplished by Mr. Freer. The swamp has a double inclination, sinking from south to north and from west to east. Mr. Freer's stills were arranged in parallel rows running north and south, the condensers south, the beds north. His condensers fell in with my arrangements as did some of his salt-beds, but others, two or three, I judged it advisable to convert into inner or

No 4809
 Received 18:6. 1840
 Board of Directors,
 MADRAS.

PROCEEDINGS, 25TH OCTOBER 1876, No. 2,656

Deputy Attorney General

Received 10

OCTOBER.
No. 2,656.

Manufacture of Salt.—near Porto Novo in South Arcot District.—Submitting to Government report of Doctor J. J. L. Patton on — and recommending that the experiment be continued next year under the direction of Deputy Collector and that the works be leased out to some contractor.

Griffiths

1781-8

The Engr. refers to the same

that the experiment conducted at
Channabadi and Port Moresby
was both been successful, although
they were immediately met
the confusion and division of
Dr. Ratten. It seems from the
papers by attributing it to
neglect, brought about partly by
his absence at Sharpe for one
month is also the Salt Commission.
The Govt. do not understand
why systematic measures were not
adopted for the conduct of the
experiment during Dr. Ratten's
absence.
It is also marked that Dr. Ratten's
reports on system were about the same thing as the
reports on the latter in 1885.
The Govt. will understand the position of
the Govt. regarding the presence of
the Govt. in 1885.

strong brine condensers as they were situated too far from the platform for cheap and rapid salt storage.

6. It may not be amiss to notice briefly here the salient contrasting features of the two systems. The Native system pre-supposes a salt estate broken up and divided into any number of small separate holdings which act independently of each other. These holdings are termed *ullums*. They are complete in themselves, though not perfect, having piccotahs, condensers, channels, path, salt-beds, etc. It follows that salt-beds are scattered over the whole estate, some near and others far from the storage platform, that work people are still more scattered, that police work is difficult, manufacturing superintendence impossible to one or two officials, that divided interests interfere with harmonious work, labor is multiplied and wasted, and the estate is worked at a maximum of cost and yet not to the best advantage. The French system pre-supposes a large estate—the larger the better—belonging to one proprietor. In it the salt-beds are grouped around the storage platform and the condensers are so disposed that brine flows from its source automatically from one to another of these, gaining in strength as it proceeds until it reaches the salt-beds fit for the crystallising process. This system admits of the application of machinery beyond the motive power of a cooly. It reduces waste labor, police and general superintendence, and cost to a minimum. In fact, the French is to the Native system what the capitalist is to the laborer.

7. Accompanying this report is a survey plan of the salt-works. In the instance as the surface of the ground was sandy in parts, cracked and fissured, and had been excavated here and there in search of potter's clay, I sank the foundation of the clay wall running round the outer circumference of the salt-work down until it reached the solid clay substratum, which was found at an average depth of about 2½ feet. I find this wall a better protection against loss from leakage out of the saline, a quicker and a less expensive work than tamping the whole area of ground to be irrigated.

8. At the highest part of the swamp—its south-west corner—the baling station was established, and from thence the outer condensers, twelve in number, were taken down a gentle incline to the east point where, following the fall of the ground, they turned and ended at the channel passing from No. 12 to the inner condensers through the finishing condensers colored red in the plan. The first eight condensers are double. The fall north is so rapid that it was found necessary to keep the brine up on the high ground by means of a clay wall running east and west through the first eight condensers. Mr. Freer distinguished the two rows thus formed with blue and yellow colors, but there is really no difference in them; the brine poured out into condenser No. 9 was of the same strength from either row.

9. From No. 12, the last of the so-called outer condensers, the brine preparing for salt manufacture flows through a channel to the inner set of condensers 13, 14, 15, and 16, which are on a lower level. The baling station at the north-west corner of No. 16 is at the lowest point in the level of the condensers. When the brine reaches this baling station it is pumped up to the finishing condensers 17, 18, 19, and 20, marked red in the plan. From 20 it is distributed to the two rows of salt-beds through the high level and low level feeding channels.

10. The salt-beds are in two rows fronting the platform. All are not completed as yet, for, inasmuch as a portion of the swamp was rejected as unfit for condensing, a proportionate number of salt-beds had to be suppressed. The upper row of beds is at a higher level than the lower, and any bed on the upper can be drained completely into any other on the lower row. This arrangement which has excellent results was obtained from the natural conformation of the ground, without extra labor. The lower row of beds drain into the swamp on the east or into the canal when low.

11. The condensers, with the exception of those which had been tamped by Mr. Freer a year previously, were not prepared in any way. The beds were trodden until the clay was dry and hard, not a brittle but a tough hardness. Much difficulty was experienced in hardening some of the beds. Owing to the rapid fall in level and the excavations, &c., existing in the outer condensers, as soon as the latter were irrigated, springs appeared in some of the salt-beds, condenser brine filtering down through cracks and rising to its own level in weak parts of the salt-beds. This difficulty was overcome for a time by carefully kneading the clay at the weak spots, but the springs re-appeared in great numbers in the salt-beds after they had been irrigated for salt and crystallisation had commenced.

12. These springs soften the salt-beds and make it impossible to gather the salt with the wooden rake in the common way. As our aim was to let salt crystallise as long as possible and gather it by hand, in fact, it did not matter very much, but the springs were thus marked by a black unsightly circular patch of exposed clay about the size of a breakfast plate, raised above the general level. On the contrary as the eruption of brine is in hot weather evaporated by the sun as fast as it enters the bed it increases the crop of salt, and it is moreover an indication that the flow is to, not from, the bed, as sometimes happen. To prevent springs from softening the bed floors for the future, I would strongly recommend that the outer condensers get a good cattle tramping next year before the beds are remade.

13. It is interesting to note that the beds occupy a site previously in great part overgrown with deeply rooted mangrove bushes averaging about 6 feet high. The roots were grubbed up with care before the beds were made and no expense so to speak was spared. Yet I fear that the beds are still injuriously affected and that the springs spoken of were led through the thick clay to the surface along the tract of roots broken and hidden in the soil. For this reason, and because the north-east portion of the site is at too low a level to be easily and thoroughly drained, I do not think the site a very happily selected one, yet I believe it will in time answer its purpose very well. I had only to take it as I found it and endeavour to turn it to the best advantage.

14. A good many large crab burrows were found in the outer condensers 7, 8, 9, 10, and 11 previous to their irrigation, but as I anticipated the crabs left and the burrows filled up after they had been for some time submerged by brine at about 5° Beaumé.

15. Nothing else worth noticing occurred during the formation of the works. Work commenced on the 18th of January; the wall round the saline was finished

*Proceedings of the Madras Government, Revenue Department,
29th November 1876.*

on the 24th; piccotahs were erected and the condensers were commenced on the 25th. The condensers were filled as they were finished one after another, and by the middle of March all were completed and filled. Two salt-beds were then got ready and irrigated, and on the 3rd of April the first scraping of 210 maunds of salt was had from these two beds.

16. In the meanwhile other beds were being pressed forward with as much labor available. Two new ones were irrigated on the 3rd and by the end of the month eight beds having an aggregate superficial area of 57,600 square feet were at work. On the 29th of April rain temporarily put a stop to work. At that date there was about fifteen garce of salt in store. Considering that this was less than one month's scraping from about a fourth of the full complement of salt-beds belonging to the saline, I think it a very fair outturn for a newly-turned site.

17. From the 29th of April to the 8th of May, the day of my departure for Madras to appear before the Madras Salt Commission, nothing more could be done, as there was heavy rain on the 29th and 30th April and on the 5th and 6th of May. I arrived again at Porto Novo on the 7th of June and found the outer condensers dry, the inner condensers nearly so, the piccotahs stopped, and all work suspended. This is what occurred during my absence as I learnt from Mr. Freer—See also his letter to the Collector of South Arcot, No. 141, dated 16th June 1876, in Board's Proceedings, No. 1,819, dated 15th July 1876. From the date of my departure to the date of my return on 1st May, nothing whatever was done.

to work and scraped 4 garce and 80 maunds of salt from six pans between the 25th May and 2nd June. On the evening of the 2nd of June 8 of an inch of rain fell, so Mr. Freer stopped all work from that date, and I found the saline on the 8th idem in the state described.

18. As far as manufacture is concerned, I had now to begin work all over again; to refill the condensers, condense the brine, and prepare salt-beds for its reception. I commenced on the 9th. On the 17th the coolies absented themselves. On the evening of the 24th half an inch of rain fell. On the 1st and 2nd of July the coolies absented themselves. On the 6th of July one-third of an inch of rain fell. On the 8th, 9th, 11th, 12th, 13th, 14th, 15th, and 17th, we had very heavy showers. Again on the 22nd we had smart rain, and as the weather looked very broken and the season was long past its prime, I decided to leave the Porto Novo saline and prepare this report on its merits. I left on the 25th of July.

19. When I left we had 41 garce and 57 maunds of salt in store. It took me about a fortnight from the 9th of June to get the saline into working order. Many of the old salt-beds were at that time so soft that I turned them into condensers, and used for crystallising purposes new beds which were rapidly pushed on to completion. These came into operation at different dates up to the middle of July. If I had eight good beds representing one cawnic of crystallising surface at work during the period under notice it is the most. With these the saline turned out 20 garce and 106 maunds of salt up to the 24th of July in most unfavorable weather. On the whole the saline worked well and I am satisfied with it.

20. For myself I was laid up in February with a severe attack of dysentery and was incapacitated from active superintendence of the work until near the end of

*Proceedings of the Madras Government, Revenue Department,
29th November 1876.*

March. Again I was absent on duty from the 8th of May to the 7th of June. Owing to these causes I cannot give as good an account of the work as I might otherwise be able to do.

21. I have left the baling business to the last, as I wish to draw particular attention to it. It is the most important and most expensive part of salt manufacture. Its importance arises from the fact that the whole success of the saline depends upon the due and continuous supply of brine. If the supply is diminished or cut off for a single day a certain number of condensers run dry; if for two days very nearly the whole outer series stand empty, and when baling is recommenced the weak brine hurries through the empty condensers until it reaches the inner set, when the prepared brine is at once reduced several degrees in density. When in good working order the brine in our condensers registered as follows: In the 8th condenser 5° Beaumé, in the 11th 8° Beaumé, in the 12th 10° Beaumé, in the 15th 13° Beaumé, and so on. One day's stoppage and renewal of baling work would reduce the brine in the 15th condenser to 8° Beaumé. In addition to the loss of density an absolute scarcity of brine is felt in the finishing condensers for the supply of the salt-beds. Practically when the brine supply depends upon cooly labor there are at least five or six stoppages in the season caused by Native feasts, cholera, scares, &c. In addition on Sundays half the balers are dispensed with. And then there are the usual number of individual absences from time to time, the result of

family business. As to expense, the cost of salt manufacture once the saline is completed divides itself, excluding superintendence, into the cost of supplying the work with brine and the cost of gathering and storing salt. The first item is when the saline is supplied with brine by cooly labor, incomparably the heaviest; it is in fact a crushing charge upon the manufacture. We required for twelve cawnics of irrigated surface 178,460 gallons or 28,800 cubic feet of brine a day. The average lift was about 5 feet. For this purpose we employed the ordinary lever piccotah armed with a bucket and worked by two men. We found by actual experiment, making all allowances for waste and idleness, that these piccotahs only raised 1,851.5 cubic feet per working day. We consequently required, deducting bunds, ridges, and other dry surfaces, about fifteen piccotahs to keep the saline going. Fifteen piccotahs were accordingly erected and for some time worked, but one of them giving away we continued with fourteen with difficulty for the rest of the season. These piccotahs cost standing about Rupees 140; the piccotah men, twenty-eight in number, cost Rupees 168 a-month. Rupees 168 a-month is a crushing charge for the brine supply of a 12-cawnic saline, and when the saline is completed to thirteen cawnics, as it will be at the beginning of next year, seventeen piccotahs, costing Rupees 204 a-month, will have to be employed.

23. Working with piccotahs we have then, though but a small initial outlay for machinery, a very heavy monthly bill for labor. Piccotahs, too, are not altogether free from the drawbacks of more expensive machines. They get out of order frequently, often smash, and at the salt-pans seldom last through three seasons. In addition to the bill for labor there is the loss incurred in manufacture owing to the various stoppages noticed in paragraph 21.

*Proceedings of the Madras Government, Revenue Department,
29th November 1876.*

24. The question arises, is there any cheap and efficient substitute for cooly labor in raising brine. I believe there is. The mule tampon described in my report on the French salines raises brine 3-3 feet and discharges it at the rate of 263 cubic yards an hour. One such tampon would have done our work in a day of four hours. We need not lift the water more than 3 or even four feet I believe. The site is not 3 feet above the level of the sea. The Natures could up a catch reservoir for the piccotahs, and only come to work at fixed hours whether the canal is high or low, that the brine has to be raised about 5 feet. For the tampon we could manage a lift of less than 4 feet, and one such tampon altered to suit the level, and one bullock and a cooly, would do our work at a cost of about Rupees 30 a-month, inclusive of interest on capital sunk in the purchase money.

25. It is not however to the tampan but to the windmill pump that I look for assistance. From conversation that I have had with a French Engineer at Pondicherry, I believe that the windmill pumps will help us out of our difficulty better than any thing else. I have been waiting for detailed information from this gentleman, but I understand he has a delicacy in furnishing it without a formal authorisation from the Pondicherry Government. This I am sure the Board will be able to obtain on due application being made. A good deal of information on this subject is to be obtained from Pondicherry where, as far as I can make out, windmills have been much more used than in Madras. I saw one working in the Governor's garden as I passed through the city, and that the lift required is as a rule less than 5 feet at the salt-pans.

26. With reference to Proceedings of the Board of Revenue, dated 15th July 1876, No. 1,819, communicated for my remarks, and of the 24th August 1876, No. 2,181, covering letters from the Collector of South Arcot, referring to the unsatisfactory nature of the outturn from the saline under notice in an unusually dry season and under my personal superintendence, I beg to draw attention to the fact that during the whole season the saline was under construction. It is not finished yet. From the 3rd to the 29th of April when rains began 15 garrce of salt were scraped from less than a quarter of the full strength of the salt-beds belonging to the saline; all that were then ready. This performance was very satisfactory. It was full of promise. I have already reported that I left the place at this juncture to attend the Salt Commission sitting at Madras, and that I found the saline practically abandoned on my return in June. The salt season was then just over, and if the promise of April was not fulfilled in the interval, I can only suppose it to be the result of neglect. At any rate the Porto Novo saline is but a small model of the French works, and the conclusion to be drawn from such an experiment cannot be considered final.

ENCLOSURE No. 1.—Plan.

SUBMITTED for the information of Government.

2. Dr. Ratton's experiment, though not highly successful, has not been altogether barren of results. The Board recommend that it be continued next year under