The Surveyor General's Survey of India.

A MEMOIR

UPON THE

MAPS OF BENGAL

CONSTRUCTED FROM 1764 ONWARDS

BY

MAJOR JAMES RENNELL, F.R.S.,

In explanation of Rennell's Atlas of 1779; that of 1781; and a Companion Atlas of 1914 which contains those remnants of Rennell's work not published previously.

BY

MAJOR F. C. HIRST, I.A.,
Director of Surveys, Bengal and Assam;

With a chapter upon the legal value of Rennell's Maps

BY

F. D. ASCOLI, F.R.G.S., I.C.S.,
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Superseded by Hirst's "The Surveys of Bengal ... 1764-77" Calcutta 1917. (see p(i) of the later work)

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CONTENTS.

INTRODUCTION.

MUCH misunderstanding exists as to the value and extent of the map records that still remain from amongst those prepared by Major James Rennell, who surveyed in North-Eastern India between 1764 and 1777. Rennell's maps are frequently used in cases concerning land titles in Bengal.

It is generally assumed that Rennell produced an Atlas of "Bengal and Behar" between 1779 and 1781,[1] and that he left no other geographical records that can be used to-day, for the comparing of old and present day conditions in riverain tracts or for any similar or allied purposes. In many cases, even when the famous Atlas has been consulted, those who have used it have not ascertained exactly what its contents are, and, in consequence, often have made use of small scale maps of a definite area, when those on a larger scale are contained in the famous Atlas.

In 1895, Sir Clements Markham published Rennell's life in the Century Science Series; in 1910 Mr. T. H. D. LaTouche edited some of Rennell's diaries, which were published in volume III, No. 8, pages 95-248 of the Memoirs of the Asiatic Society of Bengal, 1910.

As a result of these valuable publications, Mr. F. D. Ascoli, I.C.S., in 1911, on a visit to the India Office, examined some of Rennell's map records, and pointed out that copies of the larger scale maps retained in the India Office did not exist in India, and that, owing to the frequency with which Rennell's maps were used in certain types of land cases, it was essential that copies of these maps be made and sent to India, so that an exhaustive examination of the maps could be made. The maps to which Mr. Ascoli drew attention are described briefly in Sir Clements Markham's Memoir of Indian Surveys,[2] and attention seems to have been distracted from them by a remark made by Markham to the effect that the maps were but of historical interest. Perhaps this accounts for the fact that the maps in Rennell's Atlas of 1781,[3] for years have been assumed to be the only records of value, left by Rennell, that could be put to practical use, *in the directions to which they have been put already*. It will be shown later how fallacious such an idea is.

During 1913, the maps found by Mr. Ascoli were reproduced photographically by Messrs. Penrose and Company, examined and signed by two of my Assistants,[4] and sent to me in India for examination before copies of the maps are distributed. In this memoir I have examined Rennell's work from a point of view that has not been

[1] There were two editions of the Atlas; in these notes I only refer to the 1781 Atlas as it is that most generally used in India.

[2] Page 55 of Markham's Memoir on the Indian Surveys, second Edition, 1878.

[3] Not 1783, which is the date given on the reprint of the Atlas published by the Surveyor-General of India in 1910. The two last plates in the reprint were not included in the original Atlas.

[4] Captain A. H. Gwyn, I.A., and Mr. G. Graham Lee, who gave up their own time whilst on leave for this important duty.

possible in recent years, viz. :—that of its practical use to Surveyors to-day. This very pleasant duty has fallen to my lot at a time of little leisure, but I have not hesitated to record the results of my analysis upon the earliest possible opportunity, because they throw a light upon this remarkable man's work which is sadly and urgently needed.

In this analysis I have been helped greatly by Mr. F. D. Ascoli, who has been kind enough to write Chapter IX in these notes, which refers to the legal value of Rennell's maps. Several of my Assistants have given help, notably Mr. Thomas Shaw, who for the last forty-four years, from time to time, has been employed upon weighing the value of maps of all sorts of descriptions and types from the point of view of the Surveyor. Mr. Shaw's technical opinions upon Rennell's work, therefore, have been of the greatest value.

Mr. J. A. Chapman, Librarian of the Imperial Library, Calcutta, and the Rev. Mr. Firminger, Archdeacon of Calcutta, have also given me valuable help.

Throughout the text I have attempted to give the necessary authority for stated facts by footnotes or direct quotations. In cases upon which doubt may exist I have stated my own views, which are the result of careful consideration.

I shall be very glad to receive any notes that may rectify any statements that are incorrect or that need amplification.

I cannot refrain from taking this opportunity of pointing out that all that has been published regarding James Rennell, with the exception of the Surveyor-General's reprint of the Atlas of 1781 (made in 1910), has emanated from persons not connected with the Survey of India. Rennell was the founder of Scientific Geography in India, and the reason why his labours have received so little direct notice from those who serve, and have served, in the Survey of India, doubtless is the lack of opportunity that the arduous duties of the department leave to its officers. Perhaps the fact that Lambton is considered to-day to be the parent of the Survey of India has led us to forget that Rennell was Rennell.

I must point out that this Memoir only deals with the special case of the practical value of Rennell's maps, so far as the groove of the location of lands, etc., is concerned. It is only in that direction that there is urgent need to discuss the value of the maps. Any conclusions arrived at must be considered to be dependant upon that view and no other.

A list of the maps in the Companion Atlas will be found in Appendix A.

The spelling of names throughout this Memoir is somewhat irregular. It has been necessary to adopt Rennell's own spelling in most cases, so as to render descriptions of his maps intelligible.

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Director of Surveys, Bengal and Assam.

CALCUTTA,
The 24th January 1914.

CHAPTER I.

Rennell's works subdivided.

Marine Surveys.—(*1*) In his early career, Rennell's survey work was entirely limited to Marine Surveying.[1] Whilst in the Navy, from 1756-63, he lost no opportunity to learn Marine surveying, nor to apply his knowledge practically. This Memoir is not concerned with the Marine portion of Rennell's work, and no special reference is made to it ; some details, however, are given in Chapter XI, in which a brief life of Rennell will be found.

Land Surveys and General Geography.—(*2*) It was in 1764 that Rennell started his career as a land-surveyor ; in that year he became Surveyor-General of Bengal in fact, if not by title ;[2] from 1764 till early in 1777 he was employed upon survey work in the areas now known as Behar, Bengal and Assam.[3] The first orders that he received from Vansittart,[4] who gave him his appointment, were to survey the *right* bank of the Ganges river, from the head of the Jellinghi river, to the junction of the Ganges with the Megna ; and to find, and survey, the most convenient dry weather water route from the Ganges to Calcutta.

The original orders were modified in October 1764, when Rennell was told that he *might survey both banks of the Ganges.*[5] It is certain, however, that Rennell anticipated those orders, to some extent at least, from the beginning.[6]

Later on Rennell was authorized to extend his operations to the Megna and Brahmaputra rivers to Goalpara in Assam. This is stated clearly in the Journal. Eventually his task was to produce general maps of his area, which would be useful to officials and to the public.

Finally Rennell's versatility and keenness led him to publish a map of India, and to take an interest in geography and its allied sciences, of almost a world-wide character.

Although Rennell's time, when in India, was strictly supposed to be taken up by his local survey and map compilation work, it will be understood that a man of his attainments would not be limited by that work, and it is certain that early in his career he collected many materials which he used later on ; at the same time, whilst in India, he was essentially a *surveyor ;* after he left India early in 1777, he became a *geographer.* It will be best to keep both these phases of his life quite separate.

Rennell's work as a geographer is dealt with in Chapter XI, and, although that work is capable of much subdivision from an editorial point of view, I have not attempted to subdivide it since the purposes of this Memoir do not demand it.

Subdivision of his work as a land-surveyor however, is necessary, because his methods will not be understood without it. His methods varied very considerably, and without some analysis of them, we cannot form any opinion as to the relative value of the different types of his work.

So far as is possible I have attempted to follow Rennell's own ideas in classifying his different surveys. I admit that there is not very much material to go upon, but sufficient remains to give a fair idea of what Rennell aimed at.

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[1] He is said to have made a plan of Chudleigh when about ten years old, but there is no certainty that he made the plan.

[2] See a discussion upon this point on page 19.

[3] But he did little work in Assam.

[4] See page 109, Memoirs, Asiatic Society of Bengal, Vol. III., No. 4, 1910. Mr. T. H. D. LaTouche has edited, in a very able way, those of Rennell's diaries that exist. This publication is referred to hereafter as Rennell's Journal, the pages being those of the volume mentioned above. Usually, however, dates are given and these refer to Rennell's own dates in his Journal.

[5] See Rennell's Journal, October 15th, 1764.

[6] This is obvious from the explanation of Plate (2) of the Companion Atlas—In making that map he surveyed on both banks, and only marks a *portion* of the left bank as unsurveyed accurately.

He started work by making maps on the scale of 500 yards to 1 inch[1] of the Ganges, from the head of the Jellinghi to the Megna. In addition he surveyed portions of the creeks and rivers on the south of the Ganges on that scale. Roughly this work took him about two years.

After that he seems to have decided that he need not use so large a scale for his river surveys, and adopted the scale of 2 inches to 1 mile, or almost half the scale used previously.

Later on—but there is no real certainty of this—he used a much smaller scale, probably 5 miles to the inch, in his survey of uplands.

Throughout his operations he consistently made explanatory maps (on small scales) for general[2] use, producing these from his own larger scale work, or *from that work supplemented by the results of former surveys not executed by Rennell himself or his staff.* The scales of these maps vary considerably.[3]

The remark *italicised* above is of the utmost importance, because *Rennell certainly did not make surveys of anything like the total area of which he produced maps.* In this analysis the question of what areas his surveys covered will be considered as carefully as circumstances permit.

Different types of maps by Rennell.—(*3*) On his maps, Rennell makes use of the following terms :—

Exact survey ; cursory survey—sketch ; plan ; map and general map. And, if we had copies of every single map of these types produced by Rennell, obviously the correct classification from the point of view of the relative accuracy of the maps, would be to put all pictures of the same type together. Unfortunately the records are very incomplete, and to adopt such a classification would be misleading for reasons that need not be entered into here.

After a careful study of those different types of maps which exist, I consider the descriptions given below to be strictly accurate :—

"Exact survey" means the most accurate work that Rennell did.

"Cursory survey" implies less accuracy than exact survey, but nothing in the nature of a sketch. Some definite form of survey was used, but what it was we do not know with any certainty.[4]

"Sketch" means that the results are very approximate indeed, and were dependent upon the eye to a very great extent.[5]

"Plan" seems to mean that accurate survey was used to give a ground plan of such an item as a fort, or perhaps a short length of a creek. Some plans are probably as exact as the exact surveys, but all are not.

"Map" may mean a reduction from a large scale map, or a compilation of the work done by Rennell and his Assistants incorporated with that of other people. *In all cases little trouble seems to have been taken to ensure the details of the maps being faithful reductions of the larger scale surveys.* Very serious differences occur between the larger scale originals, and the "maps" of areas that I have had an opportunity of examining.

"General map" means much the same as "Map."

Classified by their probable relative degree of accuracy, we may place the records in the following order :—

"Exact surveys."—Good work.

"Plans."—Good work, but not necessarily so.

"Cursory surveys."—Fair work that will suffice to give tolerably accurate *general impressions.*

"Maps" and "General maps."—Of little or no practical utility if they are to be used for obtaining, even very roughly, details such as the limits of river banks and sand "chars," etc. But this condemnation must first be substantiated by a proper examination of the records, as the maps, etc., may not necessarily be seriously inaccurate.

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[1] This scale is not quite accurrate. See remarks made on page 4, where Plate No. 2 of the Companion Atlas is described.

[2] He calls them "general" maps in his journal.

[3] From 1 inch to 3 miles to 24 miles to 1 inch with two known exceptions only.

[4] See heading to Plate No. 33 and the description of it on page 9. There Rennell refers to his cursory surveys as being very nearly exact.

[5] On some of the sketch maps Rennell enters the scales as so many "estimated" miles to the inch.

Throughout this Memoir, in which, in due course, every map that has ome down to us is described and examined critically, I have tried to givec the correct impressions of accuracy of the maps.

Classification adopted in the Companion Atlas.—(4) After due consideration of the facts noted above, I have classified Rennell's work thus :—

(1) Five hundred yards to 1 inch plans of the Ganges river and Mendiganj creek.

(2) Two inches=1 mile plans of the Megna and Buriganga from the junction of the Mendiganj creek with the former, to Dacca.

(3) Maps of creeks south of the Ganges, and of the Nattore River.

(4) General maps, and those of upland areas contained in the Companion Atlas.

(5) Maps in Rennell's Atlas of 1781.

(6) Rennell's road and river route charts (Nos. 36 & 37 of the Companion Atlas).

CHAPTER II.

Rennell's "Exact Surveys" of the main Ganges and Mendiganj river from Jellinghi to the Megna near Lakhipur.

1. **Scale used.**—Rennell appears to have made 16 maps upon the scale of 507·5 yards to 1 inch of the *main* channels noted in the heading of this Chapter. Of these maps thirteen remain and three seem to be lost.[1]

The scale used is peculiar, when it is analysed.

The true meaning of the scale is explained by a note upon Plate No. 2 (Companion Atlas) which reads as follows :—

> " Scale 4 inches to a nautic mile or 500 yards to an inch.
> As a Sea (or nautic) mile is 2,030 yards and 69½ of these miles."

The note is incomplete ; the reference to 69½ miles apparently refers to the miles in a degree.

From this note it is clear that Rennell's training as a marine surveyor, at least initially, reflected itself upon his work on the rivers of Bengal, for, deliberately, he commenced work upon a scale only used in marine work. Rennell's training as a marine surveyor reflected itself upon his work on the rivers of Bengal, for, deliberately, he commenced work upon a scale that was dependent upon the nautical mile. It is difficult to know how far his nautical ideas prevailed throughout his service in India. It may be that he thought nautical methods sufficient for land survey purposes right through his career, but this is hardly probable.

Anyhow, the peculiarity of his so-called scale of 500 yards to 1 inch is a very important point, and must not be lost sight of when the maps are used practically, particularly as on some of his later maps the scales are to Statute and British miles.

2. **Description of this series of maps.**—The maps that remain to us are given on Plates 2 to 14, inclusive of the Companion Atlas, and each map is briefly described below. The limits of the areas covered by these maps are as shown on Plate 1 of the Companion Atlas.

3. **Plate 2**—Was numbered No. 1 by Rennell, and covers the river area from about a mile above Jellinghi to Damodar village. The map is on the scale of 4 inches to a nautical mile, or roughly 500 yards to 1 inch. It

[1] Only 13 sheets remain in the India Office. The missing sections fall between Plates 6 and 7, 11 and 12, and 14 and 15 of the Companion Atlas. *Vide* Plate No. 1.

will be observed that there is a slight discrepancy between the scales; Rennell took a nautical mile as 2,030 yards, and so the true scale of the map is rather more than 500 yards to 1 inch.

The survey commenced just above Jellinghi on the 21st May 1764 and was completed on the 28th of that month.

The map shows some, *but not all* of the triangulation and other stations used by Rennell; here and there are double lines which were bases measured with more care than other lines on the map. The methods by which the map was constructed can, however, be gleaned from the map; first of all a base was measured near Jellinghi, and a traverse was run from it to the Damodar end of the map; wherever the traverse crossed deep water triangulation was resorted to, and here and there fresh base lines, were measured. From points on the traverse, bends in the river banks and village sites, etc., were intersected, or triangulated to.

The following points on the map are noteworthy :—

(*a*) The traverse is sometimes on one bank, sometimes on the other and in one place crosses the river.

(*b*) Before Rennell pronounced the river channel to the north of Choccula Sand to be the better for navigation, he made a careful survey of the southern or minor channel.

(*c*) In one place the northern bank was sketched in, but Rennell records the fact by entering on the map the words "the particulars of this shore not exactly known."

(*d*) All the triangulation lines used originally are not shown on the map.

(*e*) It is clear that some portions of the banks, not marked as sketched, were not very accurately surveyed in detail.

(*f*) The Choccula Sand lay between Raita and the position of the Sara Railway Bridge now under construction.

4. **Plate 3**—Covers the Ganges from Damodar to just north of Custee. In the map occasional triangulation lines and bases are shown, but obviously they are but a small portion of the original basis of the work.

The most accurate work appears to be on the south bank of the river, and it is probably certain that the north bank is only fixed approximately.

This sheet was surveyed between 29th and 31st May 1764. Its scale is 500 to 1 inch (approximately).

5. **Plate 4**—Covers from just north of Custee to Gubycundapur.

The map is on the scale of about 500 to 1 inch and covers the main Ganges only, with the headings of the Custee creek [1] to the south, and the mouth of that to Pabna, and also an unnamed creek on the north.

A few triangulation lines are shown on the map, which was made in the field between June 1st and 17th, 1764.

6. **Plate 5.**—From Gubycundapur to Charbagat.

On the south side the Maudapur creek is shown, and details of an accurate survey of it for about 7 miles southwards from its exit from the Ganges.

The width of the water in this sheet was measured from Harrisongkorpur and is entered on the map as 3,720 feet. Such an entry is unusual, as Rennell usually states that the river was "full three miles broad," or something of that sort, in recording widths of the main river. The inference is that his widths even on the large scale maps are often in error appreciably, for unless they were he would hardly have refrained from giving accurate measurements.

The position of a portion of the both banks is marked as partly "sketched."

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[1] See Plate No. 20 for detail Survey of this creek.

The map only shows the main river, a portion of the Maudapur creek and an accurately surveyed minor channel near Gubycundapur. The Maudpur creek was sounded.

The map was made between the 18th and 21st June, 1764, and its scale is about 500 to 1 inch.

7. **Plate 6.**—This map shows the main river from Charbagat to Betturey, together with the Oringberry creek throughout its course.

The mouths of the Rottingunge and Joppergung (Jaffarganj) creeks are shown on the north, and those of the Hageagunge and Boostna creeks on the south of the river. The Jaffarganj creek is approximately the present main channel of the Brahmaputra (Jamuna).

The map is on the scale of about 500 yards to 1 inch, and was made in the field between the 20th September and 8th October 1764.

8. **First missing portion in the series.**—No large scale map exists for the river from Betturey to Mullopara (Plate No. 7), but Rennell constructed one in October 1764 and refers to the survey in his diary. Obviously the original map is lost; if it is ever found, its scale will be about 500 to 1 each.

9. **Plate 7**—Covers the Ganges from Mullopara to Monsudabads, and shows on the south Coratcally and Hageagunge creeks.

The map is on the scale of about 500 yards to 1 inch and the survey was made between the 21st to 25th of October 1764.

10. **Plate 8**—Shows the river from Monsudabads to Paunchor; on the north bank two creeks are shown, both being arms of the Issamutey; on the south there are an unnamed creek near Paunchor and the creek to Hobbygunge (Habiganj). Portions of all these creeks were surveyed and are shown on Plate No. 8.

There something wrong in the position of the Neorpour Pagodas; by the map they are under 3 miles from Gohulercandy, but the diary says that were about 14 miles from that village. I believe that the temples are shown they on the Revenue Survey maps.

A straight line is shown across the river from Bunderculla island to the south bank. No measurement is given on the map, and the line is probably one used in the triangulation.

A tiger track is shown on one of the islands; it is not likely to have been mapped, but the map bears no statement to that effect.

The scale is about 500 yards to 1 inch.

The survey was made between the 16th and 25th October 1764, the south bank being surveyed last.

11. **Plate 9.**—From Paunchor and Gopulerkandy to Gonganagore island.

On the map the main Rajnagore "Steeple" is said to bear N 35° 36′ E of Survey station 12, but the station is not marked on the map; it seems to have been at the south end of the Gonganagore Island. The distance of the steeple from station 12 is given as 9,390 yards.

Several creek mouths on both banks are shown and were surveyed; the Budarshon creek to Hobbygunge is shown on the right bank.

A few survey station numbers are shown on the map, but they are of no value, unless further details of Rennell's work are discovered.

The scale is about 500 to 1 inch, and the survey was made between the 5th and 9th November 1764.

12. **Plate 10.**—From Binnetty and the south end of Gonganagore island to Tockya island.

Several creeks are shown and the Bakarganj river was surveyed for about a mile below its exit from the Ganges.

The survey was done between the 9th and 17th November 1764. The scale is about 500 yards to 1 inch.

13. **Plate 11.**—From Tockya island to Kistymarya. The map shows two pagodas, the position of the western of which seems to be accurately mapped. A large channel from the Brahmaputra is shown at the North end of the map.

The scale is about 500 to 1 inch, and the map was made between the 20th and 28th of November 1764.

14. **Second missing portion of the series.**—Between Plates 11 and 12 there is a short gap in the river, of which we have no map on a large scale.

15. **Plate 12**—Shows the Ganges channel from Sunapara to Chormoddanga.

The survey was done during November 1764, and the scale of the map is about 500 to 1 inch.

16. **Plate 13**—Shows the main river from Chormoddanga to Asseycur with about 1 mile of the Mendygunge creek.

The survey was made in November and December 1764, and the scale of the map is about 500 to 1 inch.

At this point the main Ganges is left and the series follows the Mendygunge creek.

17. **Plate 14**—Shows the Mendygunge channel from Asseycur to Comercally.

The survey was made in December 1764, and the map is on the scale of about 500 to 1 inch.

18. **Third missing portion of the series.**—The last 500 yard plan made by Rennell covered the channel from Comercally to the Megna, but unfortunately no copy of the map exists now.

Here ends the main Ganges-Mendiganj river series, all the maps of which are made from *exact surveys*, which work is the best work executed by Rennell.

CHAPTER III.

The main Megna from the Mendiganj creek mouth; the Isamati, Dhaleswari and Burigunga to Dacca.

"Exact Surveys."

1. **Area covered by the series.**—The five maps that cover this riverain area are numbered 15 to 19 in the Companion Atlas. The maps show considerable improvement in drawing. All the maps are on the scale of 2 inches to 1 mile, and their limits are given on Plate 1.

2. **Plate 15**—Is the first of the series and it contains an interesting heading, which gives certain conventional signs used throughout the series of five maps. It will be observed that there is a symbol for village sites determined "mathematically"

This map shows the main river up-stream from the mouth of the Mendiganj creek, the last plate of that survey being missing now. The river is shown up-stream as far as Doycalley Point.

3. **Plate 16**—Shows the Megna from Doycalley Point to Saddoukpour.

4. **Plate 17**—Shows the river from Saddoukpour to Rajabarry; the map shows the temple that still stands at Rajbari, and gives the site of Chandpur.

5. **Plate 18**—Gives the river from Rajabarry to Ferringhy Bazar, and includes a portion of the Issamutti river.

6. **Plate 19**—Completes the series, showing the Issamutti, Dullasery and Beurygonga from Ferringhy Bazar to Dacca.

On the face of map No. 19 are the plans of the two forts of Iddyracpur and Daapeka; the scale unit in the fort plans is the "Toise." The plan of the former could be checked now as the fort still exists and contains the house of the Subdivisional Officer of Munshiganj. The check would not necessarily imply anything regarding the accuracy of the river plans.

7. **General standard of accuracy of this series.**—These maps are probably amongst the best work done upon river surveys by Rennell and his staff. It is probable that their accuracy is greater than that of the maps mentioned in Chapter II.

CHAPTER IV.

The "Creek" Series.

1. **Scope of this series.**—This series, so far as it remains to us, is given in maps Nos. 20 to 31 in the Companion Atlas, The series is very incomplete, and the maps that remain are upon various scales, and represent varying degrees of accuracy.

The surveys of the creeks south of the Ganges were made because Rennell was ordered[1] to find a dry weather water route leading from the Ganges to Calcutta. This necessitated the examination of a number of creeks, and of most of them surveys were made.

The limits of the maps that are extant are given on Plate No. 1.

2. **Plate 20**—Shows the head of the Custee creek, which takes off from the right bank of the Ganges (*vide* Plate 4). The map is described by Rennell as a "Particular plan" of the creek and it appears to have been made by exact survey.

The scale is about 200 yards to the inch, which is the largest scale used on any of the maps in the Companion Atlas.

The map shows soundings in cubits in the dry season, but the only, length of the creek surveyed was from its head to the "bar," where so little water was found that Rennell gave up all hope of using this creek for the Calcutta route.

Particulars of the survey are given in the Journal (9th June 1764).

3. **Plates 21 and 22**—Are Rennell's maps Nos. II and III of the Maudapour creek (Chundna river). This creek leaves the Ganges on the south of Plate 5, but no map exists for it until the creek has left the Ganges for about 10 miles. Doubtless Rennell's map No. I of the Maudapour creek series covered that 10 miles.

The two plates show the creek for the rest of its course to its junction with the Comer creek.

The scale of the two maps is "500 yards to 1 inch," but is probably 507·5 yards to 1 inch.[2]

The plates show soundings at low water. Each map is headed by Rennell as "A Survey." It will be observed that he does not use the term "exact" survey, although the work is on a very large scale. A reference to the heading of Plate 33, however, reveals the fact that these maps were "exact surveys" by Rennell's classification.

The two maps that remain were made in June and July 1764.

[The Comer creek emanates from Plate No. 2 of the Ganges series and runs more or less parallel with the main stream of the Ganges to Hobbygunge to the south of Plate No. 10 of the Companion Atlas. It is joined in its course, from the north by the Maudapour creek (Plates 21 and 22). On Plate No. 33 Rennell remarks that the Comer creek has "had exact surveys as far as the heads of the Burashee and Nobo Gunga and Eastern Comer creek, 1764." Of all these surveys only one sheet on a large scale remains. It is explained below.]

4. **Plate 23**—Shows but some sixteen miles of the Comer creek. The map is exactly similar in construction to Plates 21 and 22, and is upon the same scale.

5. **Other maps of the Comer creek.**—The other remains of Rennell's work on the Comer creek are :—

Plate 24.—"Number VI. A general sketch of the navigable part of the North-West Branch of the Comer creek, including the parts known as the Letty-doman, Culsedaw, and Bagout creeks . . . . . July 1764."	Scale 2 inches to 1 mile.

[1] *See* page 1.
[2] *See* page 2.

Plate 25.—"A general sketch of the Eastern Branch of the Comer creek by J. Rennell, Surveyor. Number I from the head near Metrapour to Cardya, in distance 41 miles. July 1764.		Scale 1 inch to 1 mile.
Plate 26.—"Number V. A general sketch of the Eastern Branch of the Comer creek; from the head of Burrasaat eastwards to Luckeypur westwards; with the depths of water in the dry season particularly described. By J. Rennell, Surveyor.		Scale 1 inch to 1 "estimated" British mile.
N.B.—"This draft contains 9½ miles."		
Plate 27.—The Western Branch of the Comer creek.		Scale 2½ inches to 1 "estimated" British mile.

It is clear throughout that the maps described above are not intended to be accurate.

6. **Plate 28**—Shows the Luricule creek which joins the Ganges near Rajanagore with the Megna. The creek is more or less a continuation of the Comer route from the Ganges on the north-west to the Megna *viâ* Hobbygunge and Rajanagore. The limits of this map are given on Plate 1.

The scale of the map is 1 inch to 1 mile, and the map is fairly exact. In the heading of Plate No. 33, the survey is referred to as a cursory survey made in 1764 "and is very nearly exact."

7. **Plate 29**—Is obviously a rough sketch, with no scale upon it. The sketch purports to show the Bally creek which seems to be the creek shown on Plates Nos. I and VII of Rennell's Atlas of 1781 as entering the Hooghly just below Bally.

8. **Note on the direction of later surveys.**—An examination of Plate 28, and the Mendiganj River series (Plates 12, 13 and 14), shows that Rennell had discovered two routes from the Ganges to the Megna, the Luricole route lying to the north of the other, and affording a quicker and safer route than the Mendiganj river. We have also seen that in the Megna River Series (Plate 13 to 19) Rennell had mapped the Megna, Isamatti, Dhaleswari and Buriaganga up to Dacca. We have also seen that the Mendiganj channel met the Megna at Plate No. 15, and the Luricole channel at Plate No. 17.

In Rennell's time the main Brahmaputra ran on the east of Dacca, and not, as it does now, down the Jamuna channel, far to the west of Dacca. Thus Rennell's operations would continue up the Megna till its junction with the Brahmaputra, and thence up the latter, past Mymensingh and the Western end of the Garo Hills to the Assam Valley.

Rennell continued his operations up the Megna and Brahmaputra to Mymensingh (Bygonbarry), and stopped accurate work at that place.[1] Unfortunately there are no remains of large scale surveys for these areas.

9. **Plate 30.**—But from Dacca to Assam, *viâ* Mymensingh, there existed (and exists) a channel known as the Luckhya river, which was examined by Rennell on his return journey from Chilmari and Mymensingh in 1765. Plate No. 30 shows the Luckya route from Dacca to the Brahmaputra.

The map is drawn on the scale of 3 miles to 1 inch, and is not accurate. It is described in Rennell's Journal as a sketch (*vide* entry on July 25th, 1765).

10. **Plate 31**—Gives the results of a survey by Rennell and his Assistant Richards, in 1766 and 1767, from the Ganges, *viâ* Pabna and Nattore, to Dinajpore (Raagunge). The map is on the scale of 3 miles to 1 inch. I can find no reference to its accuracy except for the portion near Pabna which is referred to in the heading to Map No. 33, as having been made from a "Cursory Survey." It may be taken that no portion of the map is strictly accurate.

The limits of this map have not been shown on any index map.

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[1] *See* Journal dated the 14th July 1765. *See* also the Journal later, when he made a new and more accurate survey of the reaches above Mymensingh town.

CHAPTER V.

General maps in the Companion Atlas.

General description of Plates 32 to 34.—(1) Plates Nos. 32, 33, 34 and 35 are general maps of two distinct types. The first two are really index maps made by Rennell to illustrate portions of his river survey operations in Bengal. Plates 34 and 35 are upland maps in which portions of the riverain areas may or may not have been copied from Rennell's large scale work, but the actual upland survey is based entirely upon *route* surveys executed by Rennell and his staff, or it may contain some of their work with incoporations of the work of previous surveyors.

Plates 34[1] and 35[2] have been found in recent years in India, and they seem to be maps constructed by Rennell as stepping stones towards the 12 mile to 1 inch plans in his Atlas of 1781. Further, it is probable that the scale (5 miles to 1 inch) was the scale actually used by Rennell in the field for his *uplands* surveys, all of which were based upon route surveys.

Each of these four maps is described in detail below :—

2. **Plate 32**—Is an index on the scale of 2 miles to 1 inch of Plates 16 to 19 inclusive, and the Luricule creek (Plate 28). The map should not be used for any but index purposes, because Plates 16 to 19 and 28 are on larger scales and are likely to be more accurate.

This plate includes a ground plan of the British Factory at Dacca on the scale of about 23 yards to 1 inch.

3. **Plates 33**—Is merely an index to *some of the* river surveys made by Rennell between 1764 and 1767. The scales is 3 miles to 1 inch.

There are two very important things to notice in this map : The first is its heading which is given in detail below :—

"A map of the Great River Ganges from Jellenghee to its junction with the Megna, including the several branches on both sides as far as they have been surveyed.

Together with the River Megna from Luckipour to the mouth of the Issamutty and the environs of the City of Dacca, 1767."

Secondly follows a very important note showing what the basis of the map is. The note contains information without which this memoir could not have been written.

Rennell states that the *Ganges* is laid down from an *exact survey* taken in 1764. He refers to Plates 2 to 14 of the Companion atlas. For the gaps that occur in that series, Plate No. 33 is upon a larger scale than any record left by Rennell for those areas. If Plate 33 is examined against any 500 yard plan of the Ganges it will be found that the discrepancies between the two are sufficient to condemn the former for relaying purposes.

The Pabna River—Is from a cursory survey made in 1766. It is shown on Plate 31 on the same scale. The two depictions of the river agree tolerably well, but if the bend in the opposite bank to Pabna Town is examined it will be observed that the two maps disagree.

From this fact, and similar observations elsewhere, it may be inferred that it will not be possible to put down accurately on the ground, the river banks as they existed in Rennell's time. The inference I gather is that Rennell did not intend either this Plate or Plate 31 to be used for relaying purposes.

The Chunnunah and Comer Creeks—Have had exact surveys as far as the heads of the Burashee and Nobo Gunga and Eastern Comer creeks. If the Maudapour creek (Plate 21) is examined against Plate 33, sufficient differences will be found to condemn the latter as a plan to relay anything from. So that we can only expect to use the 500 yard plans for these two creeks where they exist, *i.e.*, for the area covered by Plates 21-22

[1] I obtained the copy reproduced here from Mr. J. C. Jack, I.C.S.

[2] I found a trace of this map in the Dhubri Record-room a few years back. Plate 35 has been copied from that trace.

and 23.[1] We have the alternative of using such plates on Nos. 24 to 27 inclusive, but those have been condemned already in this Memoir.

With regard to the river systems, it is fortunate that Rennell published Plate XX of his Atlas, for it is essentially a River plate and gives us an opportunity of examining his work from that point of view. Plate 34 purports to be made from details surveyed by Rennell, Richards, etc., between 1764 and 1773, and it is on the same scale as Rennell's Atlas, Plate XX, viz., 5 miles to 1 inch.

It will suffice to look carefully at the rivers round Baminy and the position of Baminy itself upon both those maps. There a glance will suffice to show that one or the other is too inaccurate for relaying purposes.

Again, if Plate 18 is compared with the river shown on Plate 34, we find great discrepancies. On the former Rennell shows village sites fixed "trigonometrically" by definite symbols, and it is possible to examine the direct distances between such villages as are shown on both maps. I find that in that examination differences of a quarter of a mile are common, and that in some cases much larger differences occur.

Further, the shapes of islands differ materially upon the two maps.

In the face of these facts the 5 miles plan is obviously unreliable as a medium for obtaining accurate details on the ground now, of facts in Rennell's time.

I do not propose to go into details regarding the upland work, on Plate 34. The map is only used in cases in which river details are concerned and it is not necessary therefore to consider the accuracy of the route surveys, upon which the uplands details were based.

The remarks made above dispose of the accuracy of Plate 33 for relaying purposes and we can at once dispose of the remaining rivers not so far dealt with but mentioned in the map heading to Plate 33. They are—the Burashee, Mudomatty, Budarashon or Hobbygunge, the Western Ganges by Goanuddy, Backergunge and Sutalury, the Issamutty (except where surveyed in the scale of 2 inches to 1 mile)[2] and the Dollasery (excepting the portion shown in Plate 19).

The heading to Plate 33 shows that Rennell did not lay claim to accuracy in these cases.

Plate 34—Is a map that is used fairly frequently in the Bakarganj district in dispute cases in which the width and movements of rivers are concerned, but from what has been written already, it will be gathered that its value is very doubtful indeed. The plate has been discussed already.

Plate 35—Is based much more upon upland surveys than Plate 34. The map is of no interest in this discussion, and there is little doubt but that except as a general indication of topography and roads in Rennell's time, the value of the map is merely historical.

CHAPTER VI.

Rennell's road and river route charts of Bengal.

Plate 36.—(*1*) The Map of Inland Navigation (Plate 36) has been included in the Companion Atlas, as it is sometimes used as inferential evidence as to which streams were navigable throughout the year in Rennell's time. Those who use the map seem to forget that it really illustrates lists of wet and dry season water routes that were compiled and published by Rennell.

Some years ago I purchased an edition of a book called "A Bengal Atlas," 1781; which gives a very brief description of the Plates in the 1781 Atlas, and also includes the Inland Navigation routes and Plate 36.[3]

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[1] Even then there is is some doubt as to whether these three plates are as accurate as Plates 2 to 19 inclusive.

[2] Plates 18 and 19.

[3] I have not included this publication with those given on pages 20 and 21, because it had been rebound when I brought it. I know of no other copy of this work, but other copies of the map occur in Rennell's publications.

The route lists are very important indeed, because they do not always agree with the map. The map shows "passages navigable throughout the year" by continuous lines, and those only navigable in the rainy season by dotted lines. The detailed routes are given alternatively, where necessary, in the route *lists* by the passages open in the dry and wet seasons. Thus there is no reason to suppose that the map in the book in my possession is not an index to the routes.

On examination of the map with the detailed routes, I find that the two do not always agree. Thus a portion of a route may be shown on the map as only open in the rainy season, whilst the route book shows the passage open all the year round. I refrain from giving a definite example since it might create dispute.

For the reasons given above, it will be well that the map be not accepted as correct until the route book has been consulted.

The route book gives the following information :—

Routes Nos.	1 to 163	from	Calcutta.
Ditto	164 ,, 277	,,	Dacca.
Ditto	278 ,, 401	,,	Murshidabad.
Ditto	402 ,, 510	,,	Patna

Finally, the book gives area statistics for Bengal and Bihar.

Plate 37.—(*2*) Plate No. 37 is taken from a book on road routes published by Rennell in 1778. The only copy that I know of is in the Imperial Library in Calcutta, and it is from that book that Plate 37 has been copied and reproduced. The only value of the map from the point of view of this Memoir is that it shows the routes that Rennell and his Assistants most probably followed in their surveys of *uplands*. Thus it will be along the roads shown on the plate that the most accurate work (except on the rivers surveyed "exactly") will be found.

CHAPTER VII.

A description of the maps given in Rennell's Atlas of 1781.

Plates I to VIII.—(*1*) Rennell's Atlas consisted of an index map showing the limits of the 8 plans upon which Bengal fell, and a Table of Contents briefly describing the 21 plates themselves.

The first 8 plates cover the area from Sylhet on the East to Buxar on the West, and from the Himalayas to the Bay of Bengal. The descriptions of the plates are as follows :—

	Description.	Scale.	Inscribed to—
Plate	*I.*—The delta of the Ganges with Chittagong and Tippera on the East, with a ground plan of the Sumookgur Fort.	1 inch = 12 miles	Francis Russell.
,,	*II.*—Monghyr and Birbhum	1 inch = 12 miles	Brigadier-General Richard Smith.
,,	*III.*—Patna and Shahabad	1 inch = 12 miles	Sir Hector Munro, K.C.B.
,,	*IV.*—North Bihar	1 inch = 12 miles	Brigadier-General John Caillawd.
,,	*V.*—Purnea, Rangpur, Dinajpur, Cooch Behar, Goalpara.	1 inch = 12 miles	Hugh Inglis.
,,	*VI.*—Sylhet, Tippera, North Dacca, Pabna and Rajshahi.	1 inch = 12 miles	Thomas Kelsall.
,,	*VII.*—Midnapore and Burdwan, etc. ...	1 inch = 12 miles	Harry Verelst.
,,	*VIII.*—Ranchi, Palamau and Hazaribagh ...	1 inch = 12 miles	Major Jacob Camac.

The above plates have been used frequently in land cases, although for reasons given already the maps can never have been intended to be put to such uses. The river delineations disagree greatly with the larger scale maps that have been discussed earlier in this Memoir and with the 5 mile to 1 inch plates given towards the end of Rennell's Atlas ; the upland portions

cannot be considered to be accurate, except perhaps near the main roads. Further, the area mapped was not entirely produced from surveys by Rennell. We learn from his Memoir that much of the delta face was taken from Ritchie's maps of about 1770, and from his journal that the Hooghly River was taken from maps by Major Polier made previously to 1764. How far the work of others was incorporated with that of Rennell and his Assistants probably we shall never know.

Putting aside the question of accuracy in the maps, relaying on the ground now from such a small scale could but introduce gross inaccuracies.

General maps, Plates IX and X.—(*2*) Plate IX of the Atlas is on the scale of 1 inch to 24-25 miles, and is inscribed to Warren Hastings. The map shows the area included in Plates I to VIII, and is nothing more than an index map, from which the general topography of "Bengal and Bihar" may be seen at a glance. The remarks made about the accuracy of Plates I to VIII apply with greater force to Plate IX.

Plate X is inscribed to Johur Cartier and is on the scale of 1 inch to 24 miles. It covers what are now the United Provinces and Delhi. The map is outside the scope of this discussion.

Plate XI—Is inscribed to Lord Clive and is on the scale of 1 inch to 5 miles. The map shows the neighbourhood of Murshidabad, with the Ganges on the North, the Jellinghi on the East, and the Cossimbazar River on the West. It is uncertain how much of the details are taken from Rennell's own surveys. I think that the Jellinghi and *most* of the Ganges shown on the plate are from Polier's maps.

Plate XI gives a plan of the Battle of Plassey on the scale of 1,500 yards to 1 inch; it was probably made by Rennell in June 1764 on his way from Calcutta to the Ganges. If so, he would have been on the ground just seven years after the battle was fought. It is probable that this plan is only fairly accurate so far as river banks are concerned.

Plate XII.—The environs of Dacca.—(*3*) Plate XII is on the scale of 2 miles to an inch and shows Dacca and its environs. It seems probable that the plate is the result of surveys made by Rennell himself round Dacca, the results of his river surveys also being incorporated with upland details. The map might be used for relaying purposes in the areas accurately surveyed by Rennell, but the larger scale maps of which have been lost. The map will need careful examination, however, before such use is made of it.

Plates XIII to XX.—(*4*) Plates XIII to XX are river plates which show the main rivers from near Cawnpore to the sea. Their descriptions are given below :—

	Description.	Scale.	Dedicated to—
Plate	*XIII.*—Cawnpore to Allahabad (Ganges-Jumna River).	1 inch = 6 miles	Sir Robert Barker Kt.
,,	*XIV.*—Allahabad to Patna (Ganges River) with large scale plans of the Chunar and Allahabad Forts.	1 inch = 5 miles	Nil.
,,	*XV.*—Patna to Surdah (Rajshahi) (Ganges River) with large scale plans of the Patna and Monghyr Fortifications.	1 inch = 5 miles	Nil.
,,	*XVI.*—Surdah to Noorpur (Ganges River) with some northern streams covering Rennell's large scale survey on Plates 2 to 8 inclusive of the Companion Atlas.	inch = 5 miles	Nil.
,,	*XVII.*—The Ganges on plates 9 to 23, with the Megna to its junction within the Brahmaputra; with a horizontal section of the Jellinghi river bed.	1 inch = 5 miles	Nil
,,	*XVIII.*—The Brahmaputra *vid* Mymensingh and Dhubri to a few miles beyond Goalpara Hill—with a plan of the Delamcot Fort and a sketch of it.	1 inch = 5 miles	Nil.
,,	*XIX*—The Hooghly River from near Krishnagar to the seas, with a sounded chart of the mouth of the Hooghly, and a plan on a larger scale of the Battle of Oudanulla	1 inch = 5 miles	Nil.

Plate XX—Shows a portion of the Northern Sunderbans from near the Haringhata River westwards. The map is on the scale of .5 miles to 1 inch, and is dedicated to Charles W. Boughton Rouse. This plan has been discussed on page 10.

Plates XIII to XX cannot be considered to be really accurate ; but if they *must be* used, they should take precedence of any maps on smaller scales.

Plate XXI.—(5) The last Plate (XXI) shows a view of the Oudanulla Fort before the siege in 1763, and another of the Chunar Fort after its capture in 1764. This plate is only of historical interest.

This concludes the maps given in the original Atlas of 1781.[1]

CHAPTER VIII.

Rennell's methods of surveying.

General remarks.—(1) Already a number of references have been made to the different standards of accuracy that Rennell's work exhibits, but only so far as I have been able to avoid them. The references, however, will have given the reader a fair idea of the general relative accuracy of the different maps described. In this Chapter it will be necessary to discuss such records of Rennell's methods as will lead to a final and incontrovertible conclusion as to when the maps that we now have access to, will give reliable help and when they will not.

Before considering Rennell's actual methods, there is one point that may be made here since it affects the accuracy of Rennell's maps, but is independant of his methods. I refer to the long period that has occurred since the maps were made, and to the distortion that climatic conditions (putting aside bad handling), must have introduced into the paper on which the maps are drawn.

The question of the paper distortion due to climate alone, is not yet understood and it is not easy to speculate as to the amount of such distortion that has occurred. It may suffice to say that Captain Lyons, F.R.S., in discussing the matter with direct reference to the paper used in the Cadastral Survey of Egypt —which he carried out himself has assumed three distinct types of distortion, viz., diurnal, annual and secular.

So far as we are concerned, we may merely be careful against any rigid comparison based upon scale alone of one of Rennell's maps with a modern map. If distortion is found to be great, it must be taken into account even to the extent of making a new scale.

Rennell's methods of surveying.—(2) With regard to Rennell's methods and the instruments he used, we now have the following sources to draw from :—

(*a*) His Journals from 1764-1767, and their appendices.
(*b*) Mr. LaTouche's remarks on the diary on page 4 of his introduction.
(*c*) Rennell's Memoir of a map of Hindustan 1783. [2]
(*d*) The evidence of Rennell's maps themselves.

Of these sources items (*a*) and (*d*) are by far the most important.

Doubtless other sources will come to light in the course of time, but at present the above are all that we can draw upon.

The following information is obtainable from the sources mentioned above :—

(*a*) Latitudes were observed sparingly at first, but from 1766 onwards every few days. (Journal's).
(*b*) Magnetic " Variations " (Declinations) were observed very frequently and corrections used to the nearest minutes. (Journals).

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[1] But see foot-note on page (i) regarding the extra plates that were included in the Surveyor-General's reprint of the Atlas.

[2] There is no need to consider other editions of the Memoir, because they do not contain other information on this point than that given in the 1783 Edition.

(*c*) Rennell used a Hadley's Quadrant initially ; afterwards a Land Quadrant, and a Theodolite (November 21st, 1767).

(*d*) Chains were used for measuring distances and the chains were sometimes checked (June 4th, 1764).

The two measures given in the Journals gave chain errors of 6 inches and 8·5 inches.

(*e*) Refraction was considered in computing latitudes (Journals), but the latitude of Luckhipur differed by 3 minutes by two observations.

(*f*) Distances were recorded at least to decimals of furlongs (Journals.)

(*g*) Triangulation across rivers, etc., was used from traverse lines or bases. (*See* Plate No. 2 of the Companion Atlas.)

(*h*) In uplands chain traverses were the basis of the Survey. (22nd June 1765.)

(*i*) Bearings to temples were taken to the nearest minute (2nd Novem- 1764) ; it is not clear how far triangulation was made by means of bearings.

(*j*) No orders were issued for the survey of both banks of rivers till 15th October 1764. But it is clear that Rennell, at least sometimes, anticipated the order.

(*k*) Marks were left on the ground at the end of the survey of each length of river, and picked up when the next section was surveyed. (4th November 1764.)

(*l*) Peaks fixed in the Garo Hills, 80 miles away, were expected by Rennell to help him in his work later on. (26th October 1765.)

(*m*) Relied upon road surveys altogether in his work in North-Western Bengal. (Journal, 1766.)

(*n*) Polier's old survey of the Jellinghi is considered good enough for the general maps of Bengal. (9th May 1764.)

(*o*) Rennell went to Luckhipur in the hope of getting " some materials " for making a general map of Bengal. (2nd February, 1765.)

(*p*) Rennell hopes to use Plainsted's Sylhet maps in the general compilation. (9th January 1765.)

(*q*) Rennell refers to some details in his maps being based upon the reports of pilots. (July 1765.)

(*r*) Rennell proposes to use Verelst's route map to Cospour (in Cachar) in the general map. (February 1766.)

(*s*) Rennell thinks of using Plainsted's maps of the lower Megna and the Chittagong Coast in his compilation. (June 1766.)

(*t*) Clive orders a general map of Bengal, in which it would suffice if distances were not exact, but " cursorily " fixed. (10th October 1765.)

(*u*) Difficulty found in surveying river banks covered with jungle. (14th July 1764.)

(*v*) " The river is fallen sufficiently for showing the exact bed of it, and the further we proceed up the greater we find the fall." From this it may be inferred that many of Rennell's maps do not show the limits of perennial waters. (24th October 1764).

(*w*) Rennell was engagedi n copying " drafts " of the river. (25th November 1764.)

(*x*) Rennell was making a set of maps of the Ganges on a scale proper for " Common use." (1st January 1765.)

(*y*) A set of maps, "both general and particular," were sent to the Governor. (20th March 1765.)

(*z*) Rennell refers to considerable differences between his cursory survey earlier in 1765, of the Brahmaputra to the North of Mymensingh, and an accurate survey then being made. In the meantime some maps of the earlier survey had been sent to the Governor. (26th October 1765.)

(*aa*) Rennell considers the positions of Sandip and Hatya to be doubtful in (Plainsted's ?) maps. In his final maps the Islands are very much out of position. (July 1766.)

Thus we any conclude that no general or small scale maps may be used in any circumstances that demand the accurate discovery to-day of river details as they existed in Rennell's time. In short, excepting Plates 2 to 20, and possibly Plates 21, 22 and 23 have no map records left by Rennell that are of any real practical value in the land cases for which they are so often used. There is doubt as to the value of Plates 21 to 23, which cannot be cleared up from the details that are available.

To the above may be added Plates XIII and XX of the 1781 Atlas, which may perhaps be fairly correct.[2]

CHAPTER IX.

The legal value of Rennell's maps.

By F. D. ASCOLI, F.R.G.S., I.C.S.

THE survey of Major Rennell was first used for revenue purposes on an extensive scale during the diara survey of Babu Parbati Charan Ray. Under the instructions of the Board of Revenue, large releases of land from resumption under Act IX of 1847 were made by the Commissioners of the Dacca Division on the basis of Rennell's maps (*vide* Commissioner to the Board No. 1039A., dated 17th February 1880). The maps used for the purpose of relay were the small scale compilations in the Bengal Atlas. In the letter above referred to, the Commissioner remarks:—"There is no doubt, however, that they (Rennell's maps) are the best available evidence of the condition of things at the time of the Permanent Settlement." At that time the value of Rennell's maps for revenue purposes had not been contested in the Courts of Law and the decision of the Board of Revenue that whatever was surveyed by Rennell as land should be admitted to have been included within the Permanent Settlement must be interpreted as an act of grace and not as one founded on a legal obligation. Subsequently the relevancy of Rennell's maps in such circumstances has been the subject matter of several decisions of the Courts, notably Sarat Chandra Sinha *versus* Kshitis Chandra Ray (C. L. J. XII, page 219), the Secretary of State for India in Council *versus* Kalika Prasad Mukherji (C. L. J. XV, page 281) and Hemanta Kumari Debi *versus* the Secretary of State for India in Council (C. L. J. III, page 566). The issue discussed in these cases is whether Rennell's maps can be held to afford any direct evidence regarding the inclusion of lands within permanently-settled estates at the time of the decennial settlement. It may be remarked that the decennial settlement was concluded in different districts between the years 1789 and 1792 and that Rennell's original surveys were made in 1764 and the few years immediately succeeding.

It may be noted that Rennell's survey was made under the authority of Government (*vide* orders of Hon'ble Henry Vansittart, Governor of Fort William, dated 6th May 1864); the maps were not made for the purpose of any cause, and therefore a presumption of accuracy attaches to them under section 83 of the Indian Evidence Act (Act I of 1872). How far these maps are in themselves relevant facts regarding the inclusion of lands within permanently-settled estates requires more detailed examination.

In Annada Hari Basak *versus* the Secretary of State for India in Council (C. L. J. III, page 316) it is clearly laid down that the onus of proving that any particular lands were included in the permanent settlement of 1793 is on those who affirm that such was the case; that the *thak* and survey maps are valuable evidence of the state of things at the time they were made, but such state of things cannot be presumed to have existed at the time of the permanent settlement (*cf.* Jagadindra Nath Ray *versus* Secretary of State for India, I.L.R. 30 Calc., 291). It was further held that *chittas* of 1777 were not evidence of the state of things at the time of the Decennial Settlement.

[1] Plate 34 may be of use, but I very much doubt it.

[2] But see remarks on page 13.

This latter reference would refer with equal force to the evidentiary value of Rennell's maps. The Court thus showedi ts unwilligness to accept as a proof of the boundaries of permanently-settled estates documentary evidence prepared only some 12 years before the Decennial Settlement, or even a map prepared in later years with the object of defining the boundaries of estates, as they existed at the time of survey. It is clear then that Rennell's maps cannot be admitted as proof of the boundaries of estates or even of the existence of land in 1793, the more so, as they were not prepared as revenue maps. It is true that in certain plates of the Bengal Atlas (*e.g.*, Plates VI—IX), the boundaries of certain parganas have been shown, but as has rightly been laid down in Secretary of State for India *versus* Kalika Prasad Mukherji (C. L. J. XV, page 281) the survey was made for the purpose of showing the courses of rivers and the different land routes through the country. Rennell produced topographical and not revenue maps, and it may be noted that the major portion of Rennell's original work was complete before the East India Company assumed the full control of its land revenue in 1772.

The following quotations from reported cases will show clearly the attitude of the Courts towards Rennell's maps and the unvarying adherence to the doctrine laid down in C. L. J. III, page 316. I quote first from Lord Davey's judgment in Hemanta Kumari Debi *versus* the Secretary of State for India (C. L. J. III, page 566) :—" The earliest documentary evidence is an extract from Rennell's survey map dated the 7th July 1780 (it may be noted that this is the date of publication and not of survey) and therefore nearly contemporary with the Decennial Settlement on which the permanent settlement was based. This map shows that the disputed land was dry land, but beyond this general remark it does not appear to their Lordships to afford any safe inference either for or against the first appellant." I need only note that in this case the Privy Council accepted Rennell's map as showing the land in existence in the supposed year of survey, but denied that it showed that the land was included within the boundaries of any specific estate.

In Sarat Chandra Sinha *versus* Kshitis Chandra Ray (C. L. J. XII, page 219) the practicability of using Rennell's maps for the purpose of defining the boundaries of estates permanently settled in 1793 was finally laid to rest. " His (the appellant's) contention is, " runs the judgment, " that the rights of the parties ought to have been determined not with reference to the Survey map, but on the basis of the map of Major Rennell. " After dealing with the difficulty of relaying the map, the judgment proceeds :—" In the third place, as has been repeatedly pointed out by this Court, the map of Major Rennell was not prepared for revenue purposes. There is further nothing to show that when the Decennial Settlement was made in 1789 . . . the survey made by Major Rennell and his associates was adopted as the basis of settlement . . . Under these circumstances we are unable to uphold the contention of the appellant that the map of Major Rennell ought to be accepted as the basis for the determination of boundaries of the estate of the plaintiff. If we were to do so, we should have to use the map for a purpose for which it was never intended to be used ; it would not be right to accept as a basis for the determination of boundaries of permanently-settled estates, a survey which had been made 25 years before, for the purpose of showing mainly the courses of rivers and land routes throughout the country." This ruling is followed directly in Secretary of State for India *versus* Kalika Prasad Mukherji (C. L. J. XV, page 281).

The effect of these rulings is to show that the release of lands during the Diara Survey (1880—1882) on the grounds that the lands were in existence at the time of Rennell's survey and were accordingly presumed to lie within the boundaries of permanently-settled estates, has no legal justification. The Courts have, however, accepted Rennell's maps as correctly showing the condition of the country in the year of survey in Homanta Kumari Debi (quoted above) and again in Sarat Chandra Sinha *versus* Kshitis Chandra Ray (C. L. J. XII, page 219), where it was held that Major Rennell's map had been rightly used to determine the course of the River Bhagirathi before the time of the permanent settlement. It appears then that the only use to which

Rennell's map can be put for revenue purposes is as subsidiary evidence in locating places the existence of which within certain estates at the time of the Decennial Settlement is proved by documentary evidence, but the position of which is not shown in the Thakbast or Survey maps. As a specific example may be quoted Rajnagar Pargana lying mainly on both banks of the river Padma in the districts of Dacca and Faridpur. This pargana was partitioned under the orders of Government by Mr. George Thompson between the years 1790 and 1792 ; the partition papers, on which the permanent settlement was concluded, are still in existence and include the names of several villages not shown in the Thakbast or Survey maps, but clearly identifiable in Rennell's maps. The partition papers alone are insufficient to locate the position of the villages without the aid of Rennell's maps, which thus become valuable evidence. In such circumstances the possibility of knowing which of Rennell's maps are reliable and capable of relay is invaluable, in deciding whether they can be accepted as evidence or not. The maps in themselves are not facts relevant to the inclusion of lands shown in them within the boundaries of permanently-settled estates, but in the circumstances above described they may become under section 9 of the Indian Evidence Act (1 of 1872) relevant in explaining and supporting the inference suggested by the partition papers.

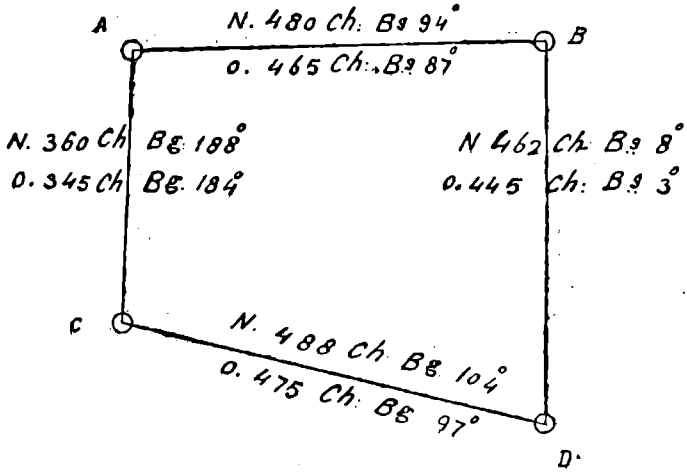
CHAPTER X.

How to relay on the ground from Rennell's maps, or to transfer his details to modern maps.

THE question of the practical use of these maps has now been narrowed down to few maps mentioned at the end of the last chapter.

The first object must be to obtain fitting points between old and new conditions that satisfy certain demands.

Let us assume that a modern 1" = 1 mile map[1] shows four villages sites[2] and that those villages are given on Rennell's map. Their positions by the two maps would be examined on a chart such as that below ;—



[1] If a 4" = 1 mile map is available all the better, provided that it has been made properly. I have for about 10 years advocated the proper provision of these maps for the large rivers of Bengal, but so far without success.

[2] Usually the village sites compulsorily will be the basis of comparison, but if more defined points are available, they should be used.

On this chart A, B, C and D are four villages selected for examination. The figures and letters written along the rays between the village sites are explained thus :—

N.—New map details (1″ = 1 mile let us say).
O.—Rennell's (500 to 1 inch, let us say.)

The distances are scaled off the maps and entered on the chart in chains After each distance the bearing obtained from the map is entered.

The figures can now be examined on a statement, such as that below :—

		Old bearings corrected by—6″	
Bearings.—Difference from	A to B	7°	93°
Ditto	B to D	5°	9°
Ditto	D to C	7°	103°
Ditto	A to C [1]	4°	188°
Mean differences in bearing		6°	

Distances	Old.	New.	Difference.	Add 3 per cent. mean difference.	New distance corrected.
A B ...	480	465	−15	14	479
B D ...	462	445	−17	13	458
D C ...	488	475	−13	14	489
C A ...	360	345	−15	11	356

In the final comparison, which we may say will be upon the scale of 4 inches to 1 mile, it is essential that there be no serious doubt about the identity of the four points chosen as fitting points. An examination of the figures given above will show that a sufficiently close identity has been arrived at to give a suitable basis for comparison.

The bearings differ from 4° to 7°, and the mean difference is 6°.

The distances, if 3 per cent. is added, compare closely. Thus we may say that the four villages are relatively in the positions that they occupied initially and may proceed with the comparison.

We assume that the *new* map is correct and in comparing shall *force* Rennell to come into line with that map. Thus we correct his bearings still further and make them agree with the modern bearings, and we do the same with the distances, and by computing (by Gale's Traverse system) can eventually plot the four villages on the 4″ = 1 mile scale and compile Rennell's work on that scale. On the modern map the details of the modern river channel can be shown clearly in a distinctive colour.

Rennell's work will then have to be transferred to the 4-inch plot. In order to get rid of the distortion evenly, it may be necessary to cut up the 4-inch plot by diagonals and cross-lines, so that the distortion may be divided evenly. This is a matter that calls for the greatest care and for handling by experts accustomed to such work.

It may be explained here that the method suggested above is the only one that can be used with the least chance of errors accumulating, and it requires modification to suit individual cases.

In concluding it may be pointed out that the example given above is one in which Mr. Thomas Shaw recently made a comparison from a map by Rennell in order to test the work of a certain Civil Court Commissioner.

The case of comparing one of Rennell's smaller scale maps is similar to that described above, but a good deal more intricate. A definite example need not be given, because the maps on small scales have been condemned already as useless for relaying purposes. I do not pretend to have exhausted

[1] This case is an actual one described later. In the original companion the diagonal C B was also considered.

this interesting subject in this chapter. As a rule, no two cases of comparison will be quite identical, and those who attempt such comparisons should beware of average errors in excess of 3 per cent. in distance or a 7 degrees in bearing, and should never attempt a comparison without first of all mastering the full details give in Rennell's Journals with regard to the area in question.

CHAPTER XI.

Rennell's Life and his work as a Geographer.

NEARLY all the details given in this chapter have been taken from Sir Clements Markham's life of Rennell, to which reference has been made already in the introduction to the Memoir.[1] It is close upon twenty years since that book was published, and Mr. LaTouche's researches have thrown some further light upon the subject.

Further, there are one or two points which at present are undecided, upon which I can throw some little light. Lastly, I have felt compelled by my own interest in Rennell and his labours to hope that Sir Clements Markham will not mind a heavy contribution being levied upon his own efforts, because that contribution may perhaps result in a really careful search being made in India for further treasures such as those of which we have received copies from England so recently.

James Rennell was born on December 3rd, 1742, at Chudleigh, near Exeter, and was the son of Captain John Rennell of the Artillery, who was killed in action in July 1747. After his demise the family estates were sold and young Rennell lived in limited circumstances with his mother and sister.

In 1752 Rennell was practically adopted by Gilbert Burrington, Vicar of Chudleigh. But for this man's large-heartedness and the kindness of his family it seems probable that the world would have heard less of Rennell.

It is said that at the early age of 12, whilst still with the Burringtons, Rennell made a plan of Chudleigh and its neighbourhood.

In January 1756, Rennell entered the Navy, being rated as a Captain's servant. In actual fact he was a midshipman.

For about two years he cruised in the *Brilliant* Frigate on the Spanish Coast and in the English Channel and in 1758 saw service in the Seven Years' War, being present at the landing at Cancalle. In that year he constructed a plan of the St. Cas Bay, and from then onwards seems to have lost no opportunity of putting to practical use such knowledge of surveying as he had obtained—or could obtain.

In 1759 Rennell assisted in the capture of two valuable prizes off the South West corner of England, and took leave to see his friends towards the end of that year. Whilst on leave it was arranged that he should go to India on the *Norfolk*, but on his way to join that vessel, he was wrecked in the *Torrington*. He missed the *Norfolk*, but eventually sailed for India in the *America*. On his way to Madras, he constructed plans of various harbours, and his intention, should he see no proper chance of advancement in the Navy, was to enter the Naval service of the East India Company.

On October 6th, 1760, Rennell served as a volunteer at the cutting out of a large French Frigate and a merchantman anchored beneath the guns of Pondicherry, which was then under siege by the British. The losses during this hazardous performance were 8 killed and 30 wounded.

During November and December 1760 Rennell made a plan of the Trincomali Harbour, returning thence to Pondicherry where he narrowly escaped with his life during a hurricane which sunk many companion vessels. He was present at Pondicherry until the fortress fell on January 17th, 1761; thence he proceeded to Bombay.

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[1] The reader is very strongly advised to obtain this publication, which gives very lucidly in a very complete manner, full details of Rennell's life, his aims, and his work. "Major James Rennell and the rise of modern English Geography"—Cassell & Co., Ltd., 1895.

At this time an expedition left India to conquer Bourbon and Mauritius ; Rennell went, but the expedition never matured, but he was absent from India for some months, during which he executed plans of the Harbour of Port Maturin. March of 1762 saw him back at Madras.

About this time Rennell had hoped to be well in the running for his Lieutenancy in the Navy, but influence was insufficient, and he considered the question of joining the East India Company. He was not to join the Company's service, however, until he had been upon a long cruise in the direction of the Philliphines, during which he was specially employed as a surveyor, making coast surveys and constructing charts. All that remains of his work on this cruise are five charts, all dated 1762 :—

Bay of Carmorto, Nicobar Islands.
Quedah.
Sambalan Isles Strait of Malacca.
Malacca.
Aboi Harbour, N. W. Borneo.

These charts engraved by Dalrymple are preserved in the India Office.

It is uncertain how long this eastern cruise lasted, but by April 1763 Rennell had returned to Madras, and his services on the cruise secured him the offer of the command of a small ship belonging to the East India Company. He had to refuse the offer, as his Captain was away, and his discharge from the Navy could not be arranged at short notice.

The Peace of Fontainbleu, which was signed on the 10th February 1763, resulted in Rennell being discharged from the Navy, as the large staff kept up during the Seven Years' War was reduced as soon as peace was established. In July of 1763 he was out of a job, but fortunately received command of a ship of the East Indian Navy, on a pay of £ 300 per annum. But his luck had not really turned, for his ship was lost some three months later during a hurricane which sunk nearly all the vessels then at Madras. Rennell had the good fortune to be on shore at the time or he must have lost his life.

He was fortunate to obtain command of a small private vessel, the *Neptune*, which was to be employed landing troops for the siege of Madura. This duty he carried out with credit, and during it managed to make surveys about Cape Calimar and the Pamben Channel, and of the Palk Strait. Upon his return to Madras he received the thanks of Government and a substantial pecuniary reward.

He proceeded to Calcutta in the *Neptune* ; there, through the influence of Tophan, an old shipmate who had left the Navy for the Company's service and had prospered greatly, received a commission as Probationer Engineer at Fort William—which was then under construction. He was also made Surveyor-General of Bengal at the same time through the influence of Captain Tinker, under whom he had served in the Navy. Mr. LaTouche is of opinion that Rennell was not made Surveyor-General of Bengal until January 1st, 1767, and he bases this contention upon the opening words of Rennell's Journal for 1767, which read thus :—

"The 1st January 1767, I was appointed Surveyor-General." Rennell, however, is quoted as having written himself[1] that he received his appointment as "Surveyor-General of the East India Company's dominions in Bengal," a few days before his commission in the Engineers.

Although the two statements by Rennell seem to be conflicting, they are not really so. The explanation is that Rennell became Surveyor-General of *Bengal* in April 1764, and Surveyor-General of *India* on 1st January 1767. This view is substantiated by the fact that Colonel Call, Rennell's successor in office, was Surveyor-General of India[2] and not of Bengal.

Thus at the very early age of 21 Rennell received his chance, and it cannot be said that he did not make the best use of it.

The remnants of Rennell's work as a surveyor have been discussed already in this Memoir, but it is unfortunate that his actual movements are

[1] Page 41 of Markham's "Major James Rennell and the rise of Modern English Geography"—1895.
[2] *See* page 55 of Markham's Memoir on the Indian Surveys, 1875.

not known during the greater part of his career in Bengal. The diaries published by LaTouche give his career up to March 1767.

During that time he was employedu don the river surveys of Bengal, and did little else excepting to survey the country shown in Plate No. 34, and to execute a route survey across the Sunderbans. In February 1766 he was almost hopelessly wounded and partially crippled for life in an affair with Sunyasis in North Bengal.[1] He recovered partially by June 1767, when he took the field again.

But in October 1765 he had received orders to produce a map of Bengal, and it seems probable that he spent less of his time in the field from 1767, by which year he had accumulated a great deal of extraneous material for his map. His diary shows that even before 1767 he had begun to rely upon Richards upon occasions when his health was bad, or when mapping work demanded great personal attention.

Markham gives the following dates for field work done by Rennell from 1767 onwards :—

1767-68	...	Districts near the Brahmaputra and in Rangpur and Rangamati (Goalpara) and on the right bank of the Bhagirati. In Northern Bengal he had a near escape from an ambush.
1768-70	...	Up the valley of the Brahmaputra to the East, where he nearly lost his life from an attack from a leopard, which he killed with his bayonet.
1771	...	Commanded a force against an armed contingent of robbers in Northern Bengal, and dispersed the robbers. He marched three hundred and twenty miles in fifteen days.

I cannot find where Sir Clements Markham got part of his information for the years 1767-70,[2] but cannot help thinking that it is not wholly correct. But this may be imagination on my part, for I must admit that Sir Clements Markham had access to many papers that are not available in this country.

Rennell married Jane Thackeray on 15th October 1772 in Calcutta, and the union was avery happy one indeed. At the end of 1776, his labours being finished so far as collecting materials for the Bengal Atlas was concerned, he prepared to leave India, starting eventually from Calcutta in March 1777. After a stay in St. Helena, the family proceeded home in January 1778, and were very nearly lost at sea on the voyage to Portsmouth, during a violent storm.

Eventually Rennell received a pension of £600 per annum.

His career from when he entered the Navy had been a very adventurous one. In addition to the dangers that have been described already, he passed through scurvy epidemics unscathed, and was much exposed to the dangers of the Bengal climate ; a constant martyr to fever, he escaped from India only to suffer long illnesses in 1781 and 1782 ; but his constitution can hardly have been ruined, or he could not have lived tlll his 88th year.

Rennell may be said to have become a geographer from when he arrived in England in 1778. From then, until his death in 1830, he worked more or less constantly, producing amongst others the following publications :—

1778	...	"A description of the roads in Bengal and Behar, etc."
1778	...	First chart published, with a Memoir afterwards used in Purdy's navigation.

[1] Markham gives a graphical description of this affair on pages 47—49 of his life of Rennell. The date given for the fight, however, is misprinted as 1776. The fight occurred in February 1766, *vide* Rennell's Journal.

[2] The dates upon Map No. 33 seem to show that Rennell finished work in that area in 1767. I do not think therefore that he went further up the Brahmaputra, as stated by Markham, after that year. Further, Rennell only shows the Brahmaputra in his Atlas to the point he reached in 1767.

APPENDIX A.

Table of Contents of the Companion Atlas.

Plate 1.—

PART I.—Index map for the Ganges series. Plates 2 to 14.
„ II.—Index map for the Mendiganj Channel and Megna series. Plates 15 to 19.
„ III.—Index map for the Creek series. Plates 20 to 30.

GANGES SERIES—

Plate 2.—Jellinghey to Damodar	Scale, 500 yards to 1 inch.
„ 3.—Damodar to Custee	„	„
„ 4.—Custee to Gubycundapour	„	„
„ 5.—Gubycundapour to Charbagat	„	„
„ 6.—Charbagat to Bettury	„	„
„ 7.—Mullopara to Monsudabads	„	„
„ 8.—Monsudabads to Paunchor	„	„
„ 9.—Paunchor to Gonganagore Island	„	„
„ 10.—Gonganagore Island to Tockya Island ...	„	„
„ 11.—Tockya Island to Kistimarya	„	„
„ 12.—Mendiganj Channel (Sonapara) to Chormoddadanga	„	„
„ 13.—Chormoddanga to Asseycur	„	„

MENDIGANJ CHANNEL—

Plate 14.—Asseycur to Comercally	„	„

MEGNA RIVER SERIES, MENDIGANJ—

Plate 15.—Megna mouth to Docally point	„	2 inches to 1 mile.
„ 16.—Docally Point to Saddoukpour	„	„
„ 17.—Saddoukpour to Rajabari	„	„
„ 18.—Rajabari to Ferringhy Bazar	„	„
„ 19.—Ferringhy Bazar to Dacca	„	„

CREEK SERIES—

Plate 20.—Custee Creek	„	200 yards to 1 inch.
„ 21.—Portion of Maudapore Creek	„	500 yards to 1 inch.
„ 22.— ditto	„	„
„ 23.—Portion of the Comer Creek	„	„
„ 24.—North-west branch of Comer Creek ...	„	2 inches to 1 mile.
„ 25.—Portion of east branch of Comer Creek ...	„	1 inch to 1 mile.
„ 26.—Balance of east branch of Comer Creek ...	„	2 inches to 1 mile.
„ 27.—West branch of Comer Creek	„	„
„ 28.—Luricole Creek	„	1 inch to 1 mile.
„ 29.—Bally Creek		Not to any scale.
„ 30.—Luckya Creek	Scale	3 miles to 1 inch.
„ 31.—Rivers between Dinajpur (Raagagunge) and the Ganges	„	„

MISCELLANEOUS—

Plate 32.—Index to Plates 16 to 19 and 28		.....
„ 33.—Index to river surveys to 1767		.....
„ 34.—Dacca, Tippera and Bakarganj ...	Scale	5 miles to 1 inch.
„ 35.—Cooch Behar and Goalpara	„	„
„ 36.—Inland Navigation Routes		.....
„ 37.—Road map of Bengal		.....

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