

RENNELL AND THE SURVEYORS OF INDIA

G. F. HEANEY

WHEN I WAS ASKED to give a popular lecture on the Survey of India to mark the two hundredth anniversary of the appointment of James Rennell to be the first Surveyor General of Bengal, it was at once apparent that the subject was too large for adequate treatment in the time available. I decided therefore to confine myself largely to the actions and characters of some of those who developed surveying in India. In doing this I must necessarily make little or no reference to many activities and people who would have been mentioned had there been more time.

Before I begin my story proper, I think we should consider what was known of the geography of India before the time of Rennell. Surveying had been practised in India chiefly for revenue assessments long before the coming of the European, but these indigenous surveys gave no indications of geographical positions or bearings, so were of little help to the geographer. Such geographical information as there was of the interior of the country came largely from the work of Jesuit missionaries and other travellers, who in their journeys sometimes observed bearings and distances, checked by astronomical observations. The coastline had been roughly charted by sailors. As an indication of the ignorance of Europeans of Indian geography before the time of Rennell, existing maps showed a river called the Ganga rising in the Deccan and flowing north of east into the Bay of Bengal on the coast of Orissa. The Ganges mentioned by European classical writers was shown as a completely different river flowing from the north in roughly its correct position. Rennell's work showed that the river from the Deccan did not exist, and it was realized that the Ganges and the Ganga, the sacred river of the Hindus, were one and the same.

Following the battle of Plassey in 1757, the East India Company found itself responsible for the administration of huge tracts of country, of the geography of which they knew very little. Surveyors were brought in and given the task of surveying routes and important areas. One of these was James Rennell a young officer of engineers in the service of the East India Company. He showed such zeal and ability that when Clive, then in his second term of office as Governor of Bengal, decided on the production of a general map of all his territory he appointed Rennell, then only just 24 years old, to be Surveyor General, and gave him the task of making it. This was in 1767. I quote from Clive's letter to the Court of Directors in London. After referring to the need for surveys he continues; 'We have appointed Captain Rennell, a young man of distinguished merit in this branch, to be Surveyor General, and directed him to form one general chart from those already made. . . . This though attended with great labour does not prevent him from prosecuting his own surveys, the fatigue of which with the desperate wounds he has lately received in one of them, have already left him but a shattered constitution . . .'

Who was this Captain Rennell and what were his qualifications? Rennell was born in 1742, the son of an artillery officer killed on service in the Low Countries. He joined the navy at the age of 14 and here he learnt his surveying. Three years later he volunteered for service in the East Indies, and after an adventurous five years voyaging and surveying in many parts of this area, he transferred to the East India Company's forces for employment on survey duties. The desperate wounds to

➔ Brigadier G. F. Heaney, C.B.E., was Surveyor General of India from 1946-51.

which Clive referred were received in north Bengal when he and his survey party were in action against a gang of marauders. Rennell received very severe sword cut wounds and had to be carried off the field. Nor was this the only sort of violent hazard he encountered during his work. On another occasion he bayoneted a leopard through the mouth when it attacked him after mauling five of his men. A worse occupational hazard to these early surveyors, however, was the constant threat of illness. The modern surveyor is appalled to read of the number of his forerunners who died during their work of what was usually called fever. In fact, in those days a survey assignment in some areas was virtually equivalent to a sentence of death.

Rennell's assistants were military officers and their task was the making of surveys along roads and rivers, known as route surveys. For these the main instrument for measuring distances was the perambulator, a large wheel with a device for recording revolutions, working on the same principle as the modern cyclometer. Directions were by compass bearing, and position and bearing were checked at intervals by astronomical observations. From these route surveys Rennell was able to compile a map of the whole of Bengal as far west as Allahabad, before he retired in 1777 worn out by sickness and the enervating climate of Bengal. Seventy years after his retirement about half the area covered by Rennell's maps had not been surveyed by any more modern method. To this day his maps are sometimes used as evidence of the positions of rivers in the eighteenth century, where such rivers served as boundaries. Rennell's surveys also had another and unexpected value. In those days some senior officials seemed to think that the ownership of the original maps was their perquisite, and took them with them when they retired to England. It is recorded that some of these originals were discovered by chance in the private collection of a lady of rank and bought (or should I say, bought back?) from her by the Court of Directors for the sum of £100.

The employment of military officers for survey duties which dates from Rennell's time has continued in India to the present day. In this India followed the example of the Ordnance Survey, and since about the middle of the last century recruitment to the administrative grade of the survey department, was largely from officers of the Royal Engineers, with a proportion of officers from the Indian Army. From the time of Rennell to the end of the eighteenth century was the era of route surveys in India; where Rennell had given a lead others were not slow to follow, and before long route surveys were being actively carried out wherever political conditions permitted. The task of the geographer was to compile these separate surveys into maps; and, as many of them were inconsistent with each other, this required skilled evaluation and judgement. The time soon came when something more accurate was required.

In the year 1800 William Lambton, an elderly subaltern in the 33rd Regiment of Foot in the British army, who had studied geodesy in north America, obtained the approval of the Government of Madras for a mathematical and geographical survey of the highest accuracy. This was to consist of triangulation, which was in the first place to be carried across the peninsula, and was to be capable of extension in any direction. For his work Lambton ordered a special theodolite in England. It was an enormous instrument weighing about half a ton when packed in cases for moving, and having a horizontal circle of 36 inches diameter. It arrived in 1802 after an adventurous voyage, during which the ship carrying it was captured by the French and taken to Mauritius. Fortunately for Lambton war was then a more gentlemanly activity than it has since become, and the French sent the theodolite on to the government of Madras with a complimentary letter. Lambton had to start his work virtually from first principles, and his first task was to determine the value, in terms of linear measure, of a degree of latitude and of degrees of longitude at different

latitudes. He started his triangulation with a base line measured near Madras and his first series of triangles, run across the peninsula from east to west, proved it to be about 40 miles narrower than shown on existing maps. After carrying this triangulation south to Cape Cormorin and covering the southern part of the peninsula he worked northwards astride the 78th meridian. By 1818 the value of his work to science had received widespread recognition and it was then taken over by the Government of India and designated the Great Trigonometrical Survey.

Lambton died in 1823 in the field at the age of 70, of tuberculosis, but fortunately not before he had trained a very able successor in George Everest, a young artillery officer. By any standards Lambton was a remarkable man. His scientific career started in the field at the age of 47, when men in India were past their best. He normally worked at his observations right through the rains, and must have had an iron constitution to have avoided being laid low by the fever which soon shattered the health of most of his contemporary surveyors and assistants. There is one well known story which gives a good indication of his character. While the great theodolite was being hoisted to an observation station on top of a building, one of the guide ropes broke and the instrument crashed against a wall. It was apparently damaged beyond repair. This did not however, deter Lambton. He shut himself up in his tent with the theodolite and admitted nobody but his artificers and set to work on it with his own hands. When he emerged from seclusion after six weeks the instrument was again fit for use. I cannot leave Lambton without quoting a tribute from Everest when he first joined him. He refers to Lambton as 'This great and extraordinary man, who when he aroused himself for the purpose of adjusting the great theodolite, seemed like Ulysses shaking off his rags; his native energy appeared to rise superior to all infirmities, his eyes shone with the lustre, his limbs moved with the full vigour of manhood.'

After Lambton's death Everest took over as Superintendent, Great Trigonometrical Survey, and in 1830 he was appointed Surveyor General of India in addition. Lambton's aim had been to cover the whole face of the country with triangles; but after his death, in order to save money and speed the rate of progress, the Surveyor General of the time, Valentine Blacker, proposed running series of triangles along meridians at distances of one degree, joined by cross series at intervals of about six degrees of latitude. This plan was adopted by Everest and was known as the grid-iron system. With the course of time it has been extended to cover the whole of the Indian peninsula and Burma. Before the First World War a connection was carried across the Pamirs in the north to join up with Russian triangulation in Central Asia, and during the Second World War a connection was made from Iraq across Iran to join it with the geodetic triangulation of Iraq. The work begun by Lambton and carried on by Everest had thus by this time become perhaps the greatest single system of triangulation in the world. Everest, even after he became Surveyor General, regarded the GTS and especially the completion of the Great Arc astride the 78th meridian to the Himalayas as his main responsibility; and he had the satisfaction before he retired in 1843 of completing this great undertaking to which he had devoted the best years of his life.

Five years after Everest's retirement, geodetic observers working in Bihar near the foothills of the Himalayas made observations to a hitherto unnoticed peak on the northern skyline. It was designated Peak No. 15 on the observers' field charts, but on computation of their observations it turned out to be the world's highest mountain. After trying in vain for some years to find a local name for the peak, Andrew Waugh, Everest's successor, obtained permission to name it after Everest, whose work had led to its discovery. The name Mount Everest has thus become a house-

hold word throughout the world, though few people now know who Everest was or why the peak was named after him.

The extension of the Great Trigonometrical Survey to Kashmir led to the most romantic era in Indian surveys. Between 1855 and 1865 Thomas Montgomerie, a very able engineer officer and the recipient in 1865 of the Gold Medal of this Society, was engaged on the survey of Kashmir. While there he conceived the idea of exploring the little known areas between India and the Russian empire then rapidly expanding into Central Asia; and after his return to Dehra Dun he put his ideas into effect. To do this he used natives of the border territories trained as surveyors, who posing as traders or ordinary travellers were able to pass unremarked in areas where a European would never have been allowed. For the areas west of Tibet, Montgomerie used Pathans, who made numerous journeys northwards across the mountains to the valley of the Oxus and Eastern Turkestan. All of them endured dangers and hardships, and some of them met violent deaths but they brought back route surveys of vast areas of which little or nothing was previously known.

Tibet, however, presented special problems. The orders of the Emperor of China at that time were that no Mogul, Hindustani, Pathan or European should be admitted to Tibet. The only exceptions were traders from one or two border areas in the Himalayas. Among the first to be selected for Tibetan exploration was Nain Singh a young schoolmaster from a village in northern Kumaon. He was the first and one of the greatest of the surveyors who during the next twenty years penetrated Tibet in disguise. His first assignment was to go to Lhasa the capital of Tibet, then a mystery city, and determine its geographical position. After considerable difficulty he crossed the Tibetan border from Nepal after signing an agreement that should he be found to have visited Lhasa his life would be forfeited. He then joined a caravan on its way to Lhasa disguised as a Tibetan lama. Walking apart from his companions apparently telling his beads and turning his prayer wheel at intervals he proceeded down the valley of the Tsangpo and thence to Lhasa. His beads and prayer wheel were, however, specially arranged and constructed; and were not for religious devotions. They enabled him to record his paces and conceal astronomical observations made surreptitiously at night. After a stay of several months in Lhasa he returned to India with a vast amount of new geographical knowledge. After this he made several other trans-frontier journeys, and in 1877 was awarded the Gold Medal of this Society. Perhaps the most remarkable journey made by these Tibetan explorers, known as 'the Pundits', was that by Kishen Singh a cousin of Nain Singh. In 1878 he set out to cross the Tibetan plateau from south to north. Having crossed it he was robbed by bandits near the Tsaidam depression, and soon afterwards one of his servants decamped with much of what the bandits had left. Kishen Singh was literally reduced to begging, but he still went on and kept up his observations. After an absence of four years when he had long been given up for dead, he returned by a more easterly route having accomplished his mission and more, with complete success. I cannot leave the Tibetan explorers without a reference to Kintup, the illiterate servant of a survey trained Tibetan lama, who was sent to determine whether the river Tsangpo was in fact the upper reaches of the Brahmaputra of Assam. The lama betrayed his trust and after crossing the Tibetan border sold Kintup into slavery to a monastery and then disappeared. After two years Kintup escaped, but instead of returning to India, he attempted to complete the task allotted to his late master. He made his way down the Tsangpo until further progress through the gorges where the river turns south, was impossible. He then threw into the river logs marked in a particular way. These logs were to have been spotted and identified by watchers in Assam. Only then did Kintup return to India and safety.

He reported to the survey authorities and being illiterate gave them a detailed verbal account of where he had been. He convinced them that the Tsangpo and Brahmaputra were parts of the same river. Unfortunately the watchers for the logs who had been waiting in Assam were withdrawn during Kintup's captivity, so his story could not be verified and was not generally accepted. I am glad to report, however, that many years later his work was confirmed by other explorers, and Kintup, then an old man, was recalled from retirement and rewarded for his outstanding devotion to duty. Here I must leave the work of the Great Trigonometrical Survey and turn to other activities.

About the time that Lambton began his precise triangulation in 1800 another name was coming to the fore in survey circles in Madras. Colin Mackenzie was an officer of engineers and he was the first to initiate the system whereby a complete topographical survey of one area was made, before moving on to the next. His work was on the scale of one inch to the mile and was based on triangulation, which as Lambton's work progressed, was linked to this. Mackenzie was perhaps lucky in that an Austrian army officer with fresh ideas arrived in India in 1803 on the staff of the Governor of Madras. His name was Troyer and he brought with him considerable experience of survey work in Europe. He was soon commissioned in the army in India and appointed instructor in surveying at the newly formed Madras Military Institution. Troyer's great contribution to surveying in India was the introduction of the planetable and the method of three point resection. From this time until the beginnings of surveying from air photographs between the great wars in the twentieth century, the planetable was used as the main instrument for topographical surveying throughout India. It was ideally suited for Indian conditions and for the people who used it. From the early 1820's when Indians were first employed as planetablers, they showed remarkable aptitude for this work, and I personally, even after many years of dealing with them, never ceased to be astonished at the accuracy, output, and quality of drawing of the better planetablers. Planetable surveying, in fact, developed into an art at which only those with real aptitude could hope to excel. Fortunately it was always possible to obtain large numbers of applicants from whom to select the most talented.

In 1810 Mackenzie was appointed Surveyor General of Madras, and in 1815 with the abolition of the posts of Surveyor General in the three Presidencies, he was appointed to be the first Surveyor General of India. This date marks the beginning of an all-India survey authority, though it was not until 1878 that the three different cadres controlled by the Surveyor General, the Great Trigonometrical Survey, the Topographical, and Revenue Survey branches were combined into one department henceforth known as the Survey of India.

The responsibility of the surveyor does not end with his surveys. He must publish them in the form of maps. In the early days copies of original surveys had to be made by hand and were regarded as highly secret documents. As the demands for maps increased other methods of reproduction became necessary. In the 1820's the lithographic printing of maps was begun in Calcutta. It seems to have got off to a thoroughly bad start, and some years later we find one of its advocates recording that, 'The Court of Directors sent out a lithographer. I believe they have sent out two or three at different times, but they have all died, sinking in part under mental disappointment and possibly under maladies incidental . . . to India. They just lived long enough to teach some persons the nature of lithography, to set some local presses to work . . . and to satisfy the authorities . . . of the immense value of this art.' The lithographers seem in time to have got over their mental disappointments and maladies, as soon after the middle of the nineteenth century the Surveyor

General's office had a thriving lithographic establishment which, in addition to maps had the distinction of printing the first Indian postage stamps.

I must now move forward to the early years of the present century. By this time practically the whole of India had been covered by topographical surveys, but many of these were long out of date, and all were without contours, hills being represented by hachures or form lines. Map reproduction techniques too had fallen behind those of advanced countries and topographical maps were printed in black or black and brown. With the arrival in India as Commander-in-Chief of Lord Kitchener, who had been in his early years a survey officer, it was recognized that something drastic must be done to meet the demands of the country for modern maps. An expert committee was set up in 1905 and following their recommendations there was a far reaching reorganization of both the methods and structure of the Survey of India. The paramount need was for a contoured map on the scale of one inch to a mile printed in colours, to be revised at regular intervals of about 25 years. This required a greatly enlarged topographical establishment, so it was decided to transfer to the Provinces responsibility for the large scale revenue surveys which from the early years of the nineteenth century had been a major activity.

From this time, until the Second World War, may be described as the golden age of planetable surveying in India. At the close of the rains each year in the autumn topographical survey parties took the field all over India and Burma working on a long term programme. Each party was organized into two or three camps with up to ten planetablers in each; in addition topographical triangulators and traversers basing their work on the Great Trigonometrical series of triangles, fixed points in areas to be surveyed in coming seasons. For the next six months the planetabler worked for a minimum of 8 hours a day (it was more often 10), for six days in the week. Sundays were rest days to enable him and his assistants to wash their clothes; otherwise there were no holidays during the field season. The planetabbling methods used and the output per surveyor depended largely on the type of country. In open hilly country known as good 'sketching' country an output of 60 square miles per man per month could be reached by the better planetablers; whereas in the dense jungles of Burma and Assam, where traverses by planetable had to be carried out laboriously up the beds of dry streams, half this amount might be creditable. The surveyor and his men lived off the country, and in less inhabited areas took their food with them. The life was hard and lonely with constant dangers from sickness and sometimes from wild animals; but through it all the average planetabler developed a great pride in his work; and on occasions showed remarkable courage, resourcefulness and diplomatic skill. As an example, in the early 1920's, surveyor Chiragh Shah, a Mian Khel from the Kohat district of the North West Frontier Province, was sent to survey an area of unadministered territory in Waziristan. This had been pronounced safe by the local political officer. Pathan tribesmen are, however, not always predictable and on the night of his arrival his tent was fired at by the men from a nearby village. He reported the matter to his camp officer, and the latter arranged for a flight of R.A.F. planes to be flown low over the area to encourage Chiragh Shah and to impress the tribesmen. The planes soon spotted his survey umbrella on a hilltop. Chiragh Shah was at work as usual. A few days later his camp officer received an urgent message from him, requesting him to ensure that the Political Officer took no punitive action against the village concerned as such action would cause him great embarrassment. He was now living as a guest in the house of the village headman who had been responsible for the shooting.

Or take the case of two surveyors working in a remote part of the Burma-Assam border country in the early 1930's. I was in charge of their survey party and had

been told by the political authorities that it was not safe to go more than ten miles west of the river Chindwin, into the unadministered Naga Hills territory, without escorts of 75 rifles per surveyor—which were not available. In particular, I was warned that a remote village called Makware, which was said to be able to muster 600 spearmen, was likely to be very hostile. No contacts had been made with it for 25 years, since it had been burnt down by a military expedition as a punishment for raids on villages along the Chindwin. I explained the position to two specially selected surveyors, and told them to do the best they could, but not to run any undue risks. After a month or so, one of them, a Garwali named Narayan Singh, sent in a message to report that he had finished working in the area near the river and was going further into the hills. Then there was silence. After a further two months we were getting anxious, when to our relief his mail runner arrived with his work reports, at his camp officer's headquarters. He was accompanied by an obviously nervous Naga, who had difficulty in making himself understood. This individual turned out to be none other than the headman of the legendary Makware village, where Narayan Singh had been staying for some weeks. By sheer force of personality he had got the headman to accompany his mail runner as guide and escort back to the river. Narayan Singh then carried his surveys right up to the Assam border in hitherto completely unknown country. Zahur Ali, the other surveyor who was working in the adjoining area to the south, also worked right up to the Assam border; and when he returned he brought a remarkable request from one of the villages where he had been camping. This was that the Government of Burma should take over the administration of their village area. Coming as it did from independent, freedom-loving tribesmen, this seemed extraordinary; but further enquiries from Zahur Ali showed that there was more behind the request than met the eye. The villagers had told him that shortly before his arrival they had carried out a most successful raid on a neighbouring village from which they had brought back, so they said, no less than 40 human heads. Since then they had lived in fear of reprisals, and would welcome the protection of the Government. I asked Zahur Ali whether he felt safe camping in the village. He said that he felt all right during the daytime, but that at night the villagers used to get so drunk that he never knew what they might do; so after a few days he left and camped in the jungle a mile or two away. Their request for the administration of their village to be taken over was not granted. I never heard whether the villagers had kept their heads.

In the early 1920's the Survey of India used vertical air photography for large scale forest surveys in Burma; and soon afterwards it was being increasingly used for mapping areas of tribal territory on the North West Frontier, inaccessible to ground surveyors. The department has been criticised for slowness in using air surveys on any considerable scale. The reasons for this were economic. With a large body of highly skilled planetablers available the relatively small-scale surveys required could be produced at a much lower cost than would have been possible by the air survey methods developed at that time. On larger scales, air survey was much more promising, and with the development of new types of camera, planes with higher ceilings, and above all air survey plotting machines, the gap in costs between ground and air surveys was rapidly narrowing, when the outbreak of war in 1939 brought topographical surveying in India virtually to a standstill.

During the War, vast amounts of mapping and map production were carried out by the Survey of India in India for the armed forces. I would, however, be doing less than justice to the department were I to say nothing of the work of those of its personnel who joined the forces. Practically all officers and technical personnel of the right ages volunteered for active service in the army. In 1941 several military

survey units formed almost entirely from Survey of India personnel were sent out to the Persia-Iraq area. Here maps were urgently needed, firstly of northern Iraq and in the following year of western Iran. Aircraft for air photography were hard to come by in those days of shortages; but mechanical transport was generously provided and could move largely at will over the hard mud deserts of Iraq, and the plateaus of western Iran. In these areas the Survey of India planetablers really came into their own. They surveyed vast areas previously blank on the map and discovered depressions in the deserts of Iraq and mountain ranges in Iran, some up to 10,000 feet high, previously unknown to geographers. Although their bearing as soldiers may sometimes have caused misgivings to the strictly military eye, their skill, industry and output as surveyors deeply impressed the army authorities who were generous in their appreciation. Later in the war these same units were employed in making surveys and providing maps for the forces in South-east Asia. Here air photography was abundantly available and the whole series of one-inch maps of Burma which had taken decades to survey on the ground was revised in a few months.

Here I must bring my story to a close. In August 1947 India was partitioned and the Survey of India with its personnel and assets was divided between India and Pakistan. I personally stayed on another four years with India; and when I left I had the satisfaction of leaving a Department which, although responsible for a smaller area than before partition was larger than it had ever been and whose services were increasingly in demand by the Government of India.

As a postscript I would add that last summer the present Surveyor General of India spent a day with us at our home in the country and gave me some account of his department. His departmental budget is now about six times what it was in my time; he has nearly three times as many survey units as I had, and the number of the latest pattern air survey plotting machines at his disposal was beyond the most optimistic imaginings of my day. In conclusion I like to think that if James Rennell could see the work of his successors, and the vast organization which has developed from his pioneer work, he would feel that the surveyors of India had been worthy of the lead he gave them two hundred years ago.

References

- Markham, C. R. 1871 *A Memoir on the Indian Surveys*.
 Mason, Kenneth 1923 Kishen Singh and the Indian explorers. *Geogr. J.* 62, 5: 429-40.
 Phillimore, R. H. 1945-58 *Historical Records of the Survey of India*, Vols. I-IV. Dehra Dun.
 Survey of India General Reports.
 Personal recollections of the author.

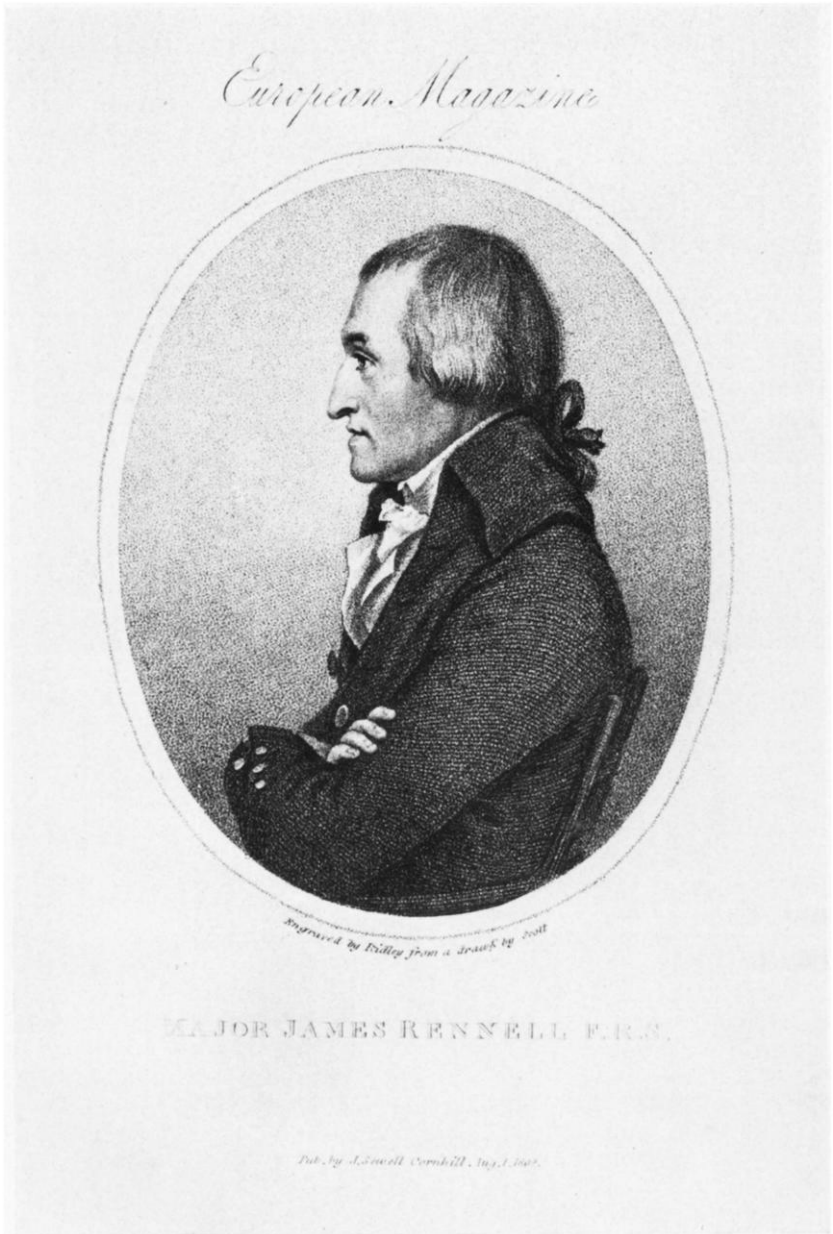
DISCUSSION

Evening Meeting 11 December 1967

THE PRESIDENT (SIR GILBERT LAITHWAITE) in the Chair: On the 1 May of this year the Survey of India celebrate their bi-centenary at their Headquarters at Dehra Dun. This is intended to be only the first instalment of the celebrations, which will end with a ceremony on 14 December 1968 at the conclusion of the International Geographical Congress Meeting in India.

Brigadier Heaney, who is to talk to us tonight, is quite exceptionally well qualified to speak—he served the Survey of India for 30 years, becoming Surveyor General in 1946; he was in fact the last Surveyor General of all India, and, after partition, he stayed on as Surveyor General of Independent India until 1951. His service and his

PLATE I



Major James Rennell (1742–1830): from the collection of The Royal Society

See pp. 318–27

travels have by no means been limited to India; part of his young days was spent in British Columbia, and he saw service in France in the first world war. He was employed for part of the inter-war period in Burma, and in the Second World War he was in charge of the military survey operations in Persia and Iraq and in the South-east Asia Command. Since his retirement he has become, if I may say so, a very successful fruit farmer. I invite Brigadier Heaney to address us.

Brigadier Heaney then gave his lecture

Major-General R. C. A. EDGE: Mr. President, ladies and gentlemen. I am very glad to have this opportunity of adding my thanks to Brigadier Heaney for his most interesting lecture. I am particularly glad, because I started my survey career in the Survey of India, and the years I spent there were very happy years indeed. In fact an almost unbearable sense of nostalgia overcame me this evening as I looked at some of Brigadier Heaney's slides of that beautiful country of which we all became so fond. Now I have finished up in the Ordnance Survey, and so perhaps I can speak with some authority from both angles. I know that both departments continually learned a great deal from each other and that there was a healthy mutual respect tinged at times perhaps with a certain healthy rivalry.

I think I must be the last member of the Survey of India to have finished up as Director General of the Ordnance Survey but I am not the first. In fact there have been two before me. General McLeod who was Director General from 1935 to 1943, and Sir Charles Close, who was Director General from 1911 to 1922. The connections between the two departments go back a very long way indeed. You have heard how in 1905 Kitchener was instrumental in making the Survey of India bring its maps up to date. Kitchener had not actually served in the Ordnance Survey, but his well known surveys in the Near East had been conducted under what we should now describe as its technical control. I believe also I am right in saying that the 1905 Commission had the Director General of the Ordnance Survey as its chairman. Going even further back the founder of the Ordnance Survey, General Roy, was well acquainted with Rennell, and in many ways they had careers which were curiously similar. They neither of them started in the Army. General Roy started in the Post Office, Rennell, as you have heard, started in the Navy. But they both bettered themselves by going into the Sappers, the Bengal Engineers in the case of Rennell. They both ended up as Fellows of the Royal Society and they both were awarded its Copley Medal. Roy's map of the Highlands, started in 1747, marked the beginning of extensive national map making in this country, and I cannot but think that Rennell must have had Roy's map of Scotland very much in mind when he embarked some years later on his surveys of Bengal. Then again they were both keen antiquarians, and it is to this that we owe the fact that both in India and in this country the national surveys have always shown archaeological sites, and I think thereby greatly benefited. Roy wrote an important antiquarian work *The military antiquities of the Romans in North Britain*, and Rennell wrote his *Geography of Herodotus*, and finally Roy founded the Ordnance Survey and Rennell, as you have heard, founded the Survey of India. At the latter end of their lives they both lived in London, Roy in Argyll Street, and Rennell close by in Cavendish Square. Professionally they collaborated and Roy, in fact, shortly before his death, submitted to the H.E.I.C. with Rennell's support proposals for the trigonometrical survey of India.

So you can see how through the years right back to the time of the foundation of the Ordnance Survey and the Survey of India, there has been a continuous interchange of knowledge between them, to the enormous advantage, I am quite sure, of both Britain and India. It is good to know that, although with independence there is no longer just the Survey of India we knew, but two departments, the Survey of India and the Survey of Pakistan, they are both flourishing and in fact expanding. And it was particularly appropriate that in this the bi-centenary year of the Survey of India, we recently had the Surveyors General of both India and Pakistan in this country at the Commonwealth Survey Officers conference at Cambridge. They told us what

they were doing and it was clear that both departments were in very good shape. We were able to exchange views, as we have done for so many generations, and we knew that in spite of everything, this two-way traffic of knowledge, experience and tradition still continues.

Judge WARIS AMEER ALI: You have heard generous tributes to the Indian staffs of the Survey of India, and I need not add much more, only one thing that Brigadier Heaney left out, namely that those very enterprising Indian explorers who were sent up into unknown and often hostile Central Asia, were trained to pace by a British Sergeant-Major with a drum and a pace stick at the headquarters of the Survey of India. They counted their paces on their journeys to mark the distances, the while they looked like pious pilgrims telling their beads on their way to Kumbum, Lhasa, or some other holy place. They also carried prismatic compasses in their prayer wheels or Buddhist charm boxes. Anything more was dangerously conspicuous. One of these men, Babu Sarat Chandra Das, the original of Kipling's Hurree Babu in *Kim*, paced the whole way to Lhasa and back, in 1879. He was about in later years in Darjeeling when I heard of him as a small boy, but cannot recollect seeing him personally. Another explorer I had the privilege of knowing, was the great A. K. Rai Bahadur Kishan Singh of Milam. He was one of my parishioners, you might say, when I was a junior and obscure Assistant Commissioner of Kumaon, more than 50 years ago. He was very spry in retirement in his 70's, and I used to go and see him when I was on tour. He had a number of large deodar wood chests in the fine stone tea-plantation house, 50 miles over a bridle road from anywhere, that he had bought from a European. The chests were full of maps, blue books and gold medals from many of the world's geographical societies. He was most unassuming for all that, but we had great fun. He kept handy a large map of central Asia. I used to pinpoint X or Y or Z and ask if he had ever been there. 'Oh, yes, I was there in 1874'. That was when Forsythe's diplomatic mission was sent to Yarkand or Kashgar to get on terms with the local ruler Yaqub Beg then in revolt against the Chinese.' 'A.K.s.' great journey into Tibet as far as Kumbum, the Koko Nor and other remote spots, took him about 3 years in the late 70's.

Another great explorer was Kintup, a Lepcha from Sikkim. He was sent up in the 80's to try and get absolute proof that the Tsangpo and Brahmaputra were the same river. He was to throw marked logs into the Tsangpo in Tibet, and men were set to watch for them on the Brahmaputra in Assam. However, he ran out of cash, couldn't pay his debts, and was sold a slave. It was so long before he could escape, that the 'look-outs' for the logs in Assam had been withdrawn.

However, in 1912 or 1913, our old friend and gold medallist, Lieut.-Colonel F. M. Bailey who died this spring, and Colonel Morshead, murdered in Burma in the 30's, made a venturesome reconnaissance flouting Government of India orders, and proved that the bend of the Tsangpo was indeed the top of the Brahmaputra. Somebody then said 'What about Kintup, he ought to get some recognition?' He was found to be working as a tailor in the Darjeeling bazaar. He was a very old man, and all that a generous Government had allowed him, was his back pay after his escape from slavery! Sir Henry Burrard, Bart., then Surveyor General of India, got Kintup over to Simla, and pressed for an appropriate reward for him. The Accounts Department, with the praiseworthy care of finance of those days, said 'No, he is too old for a pension, we will give him a thousand rupees.' He and his family scored over the deal, because poor Kintup died soon after, and would have had a very small sum from a pension of 8 rupees a month! His photograph was taken at Simla by Gerald Burrard, the Surveyor General's son, who had himself just returned from a sporting journey into Tibet.

The CHAIRMAN thanked the speakers, and the meeting closed.