

HISTORICAL RECORDS OF THE SURVEY OF INDIA

Volume IV
1830 to 1843

GEORGE EVEREST

27831

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CHAPTER XV

MADRAS SURVEYS

Organization — Madura, Trichinopoly & Salem — Ganjam — Nellore — Nizām's Territories — Professional Details — China, 1840-2.

THANKS to the sound organization that Mackenzie had given to the Madras surveys, and the close control maintained by Mountford and Montgomerie, survey was carried steadily forward until every district was furnished with satisfactory maps and valuable memoirs. Those still in hand in 1830 were—Hyderābād, or the Nizām's Territories, under Henry Morland, commenced by Garling in 1816, and only just completed fifty years later.

Madura District, commenced by Benjamin Ward in 1830, the party moving to Trichinopoly in 1832, and to Salem in 1835.

Northern Circārs, commenced in 1815, and from 1820 under Charles Snell. Having completed the coastal area northwards into Ganjam, the party moved to Nellore during season 1832-3.

Since 1824, Montgomerie had held charge as Deputy Surveyor General of the field parties and the drawing office, with the recruitment and training of apprentices [III, 321; IV, 381]. After the closing of the branch offices at Madras and Bombay in 1833, the more important maps and records were transferred to Calcutta, the remainder being deposited with the local Chief Engineers [328].

Though the Madras parties now came under the direct professional control of the Surveyor General, appointments of officers and establishment remained with the local government, who were also responsible for discipline, pay, and equipment, and, except for Hyderābād, for all expenses. Everest was so deeply engaged in the work of the Great Arc that he could exercise little control over these parties, and in 1840 deputed their charge to his deputy at Calcutta [317, 325].

The Hyderābād Survey had worked under the political control of the Resident who corresponded with the Supreme Government in Bengal, so that except for personnel this survey had little to do with Madras. In 1831 Everest asked that it should come under his direct control as he knew the country so well¹ [III, 442-5].

The transfer was approved, and from July 1831 till April 1840 reports were sent direct to the Surveyor General, being thereafter sent to the Deputy Surveyor General at Calcutta. Morland held charge from 1829, with frequent intervals, till his promotion to Major in 1848, when the survey was still far from complete.

By 1840 the Nellore and Salem surveys were drawing to a close. Campbell, in charge at Salem, was ambitious and energetic, and most anxious to turn the energies of his staff to geodetic, geological, or revenue surveys, but the Surveyor General would not hear of such misuse of a topographical party [258-9]. A long discussion then followed as to whether to employ these parties on the resurvey either of "the Jawaddy Hills" in North Arcot, or of north Coimbatore, or whether they should take up work in the Nizām's territories.

With...three parties kept efficient and actively employed, Captain Morland states that the remaining portion of the Nizām's Territories would probably be surveyed in about five years. ...

I...suggest...that Captain Morland...be placed in general charge, and that his salary (now 350 per mensem only) be raised from the 1st January 1841 to 526 per mensem, or the average of a full surveyor's established allowance [365]².

¹ DDn. 265 (118), 10-1-31. ² DSG. to Mil Dept., 28-11-40; DDn. 408 (97-9).

Government was doubtful as to the wisdom of surveying the Nizām's territories at all; "Mr. Prinsep, who leads the Council in geographical matters [101], is asking the 'cui bono' of such extensive work in a half-independent State, when so much country under our own immediate jurisdiction requires to be better known"¹. The Surveyor General was asked to make a full report on the work of the Hyderābād party, with reasons for maintaining it in that particular area, and whether its work was good enough for the Atlas of India [20, 298].

The Resident at Hyderābād has furnished a statement of the sums issued from his treasury on account of this survey, and though the account does not include payment made at Madras, and the issues of near six years from 1822 to 1828 are altogether omitted, the amount expended... is...Company's rupees 3,37,688 [256]. ...

The Survey party having been organized by the Madras Government, ... the charges were for some time after the appointment of one Surveyor General for all India borne in the accounts of that Presidency. The bills and monthly abstracts seem still to be rendered to Madras, but the charge is there transferred in account to the Government of India. ...

Although the responsibility for the institution of this survey attaches to a period when the system...was different, the control...has been vested in the office which you have filled for the past ten years. The Government had therefore a right to expect that the survey would have been put under such efficient regulation by your direction, not only to ensure a full equivalent of work for the money expended, ... but to provide also that it should be conducted according to the system best adapted to the end in view. ...

If the formation of a general map of India is to be attempted by survey parties of this description, their work should be laid out annually by the Surveyor General, and the result reported to the Government of India at the end of each season, ... and although some of the parties may with advantage be composed of...officers borrowed from other Presidencies, ... the appointments to the survey should be made by...the Governor General in Council, the correspondence passing through your office.

In the case of the Hyderābād surveys this rule has only been partially followed, and the Government of India has had no periodical reports. ... Although, too, the expense has for some time been charged to this Government ultimately, ... the bills and abstracts seem to have been passed by the Government of Fort St. George, ... all of which is objectionable, and should not have continued after the survey was placed under your control².

It took Everest a full year to collect material for his reply. He then pointed out that the survey had been started under the directions of the Madras Government as a contribution to the general geography of India. It had been strongly supported by the Resident at a time when there was profound ignorance of the geography of the greater part of the territories, and when maps were urgently required for military defence against *pinḍāri* incursions [III, 114-5]. There was on the other hand no demand for survey from the Nizām's government. Though the cost of survey fell on the Supreme Government, its necessity had not hitherto been questioned, and had been accepted by the Court of Directors. It served no purpose except to furnish materials for the...Atlas, nor can I divine any other. ... I have never received any intimation...[of] what might be the real causes of this minutely detailed process in a foreign territory. ... As the field for survey...it had been covered over with a net of principal triangles between 1813 and 1822 [II, 249; III, 227-32; pl. 18]. ...

The Sirkars of Kummummett, Warungul, and others to the eastward of the Great Arc Series, include perhaps some of the most deadly tracts in India. They have been a grave to the members of the Survey Department and seriously injured the health of all engaged in them [III, 231-2]. Moreover those tracts, though exhibiting remains of former populousness in the days perhaps when Tellingana flourished under its native princes, consist now of forests almost interminable, and would not seem to be worth the cost of an accurate detailed survey. ...

There is abundance of territory belonging to the H.E.I. Company yielding an ample revenue, which would seem much more worthy of the cost and toil than the dominions of his Highness the Nizām. But...it is much easier to destroy than create efficiency. A vast deal of time, cost, and labour, are always expended in training a new establishment, and the parties employed in...the Nizam's Dominions have already undergone that course.

He discussed the wisdom of closing down the survey, and moving the party up to Bengal to survey the country now being covered by the subordinate meridional

¹SG. to Morland, 15-12-40, DDn. 389 (21). ²from Mil Dept., 30-12-40; DDn. 407 (175-86).

series to the east of the Great Arc, but it was decided to leave this area to the Revenue Surveyors [210-34, 261-2], and to carry on the survey of the Nizâm's Territories¹. It was not, however, until 1842 and 1844 that orders were issued for the disbandment of the Nellore and Salem parties, the military officers being reverted to their units, and the civil staff distributed to other survey parties [253, 255, 259].

The Ganjam survey was a different matter. About a year after the withdrawal of Snell's party [253, 255], Thorold Hill was recalled for a military survey into the hills, and from 1836 was continuously employed on survey of the hill tracts of Goomsur. A large area of this difficult unhealthy country was still unsurveyed when he had to take sick leave early in 1842. His survey was not based on regular triangulation and was later entirely superseded. It was, writes Bedford, neither under myself or the Surveyor General. On receiving charge lately from Captain Hill, his successor applied to me for instructions. ... I forwarded his letter to the Surveyor General, and in reply was told that he could issue no orders as the survey had been got up by the Madras Government quite independent of him. Captain Hill is said to be embarking for Europe. ... The Ganjam survey appears a perfect amateur affair² [255].

When Everest left India all field survey in the Madras Presidency had come to a close [10].

MADURA, TRICHINOPOLY, & SALEM

In April 1830 Benjamin Ward moved his party, with Du Vernet as assistant³, to Madura, where survey was completed in 1832. Trichinopoly was taken up after the monsoon, and field work there was completed by about April 1834, and the final maps submitted by May 1835⁴.

Having been promoted to the rank of major, Ward was ordered to rejoin his military unit [III, 512], and handed over to Thorold Hill at Trichinopoly on 1st November 1834. Ward was the last of Mackenzie's officers, and a very fine topographical surveyor, with long experience of work in heavily wooded hills. Since 1816 he had held charge of the surveys of Travancore, Dindigul, the Nilgiri Hills, Malabar, Madura and Trichinopoly. His senior assistant, Charles MacMahon, had been with him all through [III, 105-14].

The party started field work in Salem District in March 1835⁵, Hill taking up the triangulation in May. In the few months left that season about 850 square miles were completed covering "the course of the Cavery for about 41 miles, and the whole of the Colleemullay Range, commonly known as the Shandamungalum Hills, and of which little has hitherto been known"⁶.

In January 1836 Hill was called to military duty in Goomsur [*sup.*, 253], being joined by Howard six months later. John Campbell took charge in April, but after two months was himself recalled. MacMahon then carried on field work right through the year, reporting that during field-season 1835-6

upwards of 2,000 square miles...has been defined with great minutia with the planetable, ... founded on...the Great Trigonometrical Survey. The terrace land called the Cullery and Jädagoundum mountains, rising to an elevation of about 4,000 feet above...the sea, hitherto so very little known, has been explored and surveyed in detail, together with portions of the...talooks in the plains, and of...the Baramahl; the whole...between the latitudes of 11° 15' and 12° 40' North, and 77° 50' and 78° 50' of east longitude. ...

The...mountains...are densely peopled by a class of hill tribe called Malayalers, who are permanent residents confined to agricultural pursuits. ... The rich and beautiful production of dry grain vegetation on this interesting table-land is of an insular character. ... About the locality of Salem, the hills are intersected by veins of magnesite, a mineral which has of late years attracted attention with naturalists. ...

¹DDn. 402 (197-207), 13-12-41. ²from DSG. to Morland, 13-1-42; DDn. 389 (69-70). ³tr. to Hydrâbâd Dec. 1832. ⁴trig. chart, *Bes. Repr.* 594 (64); maps, MRO. 147 (35-6), submitted in March 1833. *IO Cat.* (400); triangles, village regrs., road svys., Trichinopoly, MRO. M 9, 10, 94; maps, ib. 147 (28-9); 137 (26); DDn. 337 (19), 26-5-34. ⁵MacMahon, Howard, Boyne, Brunton, Allen. ⁶DDn. 286 (2 28-35); 31-10-35. *Journal*, MRO. M 100, 1-9-35; maps, MRO. 135 (12-21), completed 1840-2.

The unconnected state of the survey...was caused by the ill-health of some of the party, which rendered it necessary to employ their services for a time in the Baramahl to avoid the inhospitable hot season below the Ghauts¹.

Campbell resumed charge during 1837 reporting 1,840 square miles for 1836-7;

The Shevary mountain is...most conspicuous and extended, throwing out in almost every direction minor branches and ridges, particularly to the north, where it emerges into the prolongation of the Tappoor Ghauts. ... The elevation of this terrace is nowhere above 5,260 feet from the plains, and the...smooth almond-shaped hills, with the over-grown...thickets, ... densely covered with permanent foliage as if artificially produced, characterize the appearance of hills very similar to that of the Neilgherry².

He reported 2,218 square miles for 1837-8,

the work of only nine month in the field, as the Survey went into quarters on the 9th October 1837 for shelter during the monsoon, which fell very heavily³, ... and did not take the field again until the 9th of January, during which time the sub-assistants were...finishing the colouring of their respective plane-table draughts, and entering the names, ... as the draughts had been set aside unfinished from the commencement of the survey four years ago, to allow the work to be got on with quicker.

The northern border with Mysore followed broken rugged country, elevated about 2,500 feet above the sea. ... From it rise abruptly high naked gneiss rocks... of a rounded mammillary form, ... crowned with numerous hill forts of considerable strength, constructed by the former independent Poligars [II, 181], but which are now in ruins.

Others of these gneiss hills are formed of huge masses of rocks piled on one another, or shooting up into fantastic spires, while the bases of all are surrounded with jungle growing among the debris of the softer portions which have disintegrated and fallen from the summits. In some parts the diluvial soil contains so large a portion of quartz and felspar as to make it unprofitable for culture. ...

The portion surveyed...between the town of Denkecottah and the Cavery River⁴ is a mountainous tract, almost a neglected jungle, in which elephants, bison, and tigers roam unmolested. Some of the mountain summits rise 4,000 feet directly from their base, and to about 5,000 feet above the sea. They are mostly of sienite granite and trap rocks, and the upper part of some is flat, and is covered with arable land.

Among these mountains are...fine fertile and highly cultivated lands, and also deep glens, many of considerable beauty, in which under the Moslem rule⁵ many flourishing villages once existed, but which now, in consequence of the high assessment, have been deserted to the ravages of the elephants.

The villages on the table-land on the summits of the hills have been held from time immemorial by a peculiar race of men, who smelt the iron found in the hills, and cultivate their fields in peace, where the elephants do not ascend.

While carrying on my trigonometrical observations along the Cavery, I have had frequent occasion to remark how incorrect the topography of the hills of Coimbatore is, as represented in the 61st sheet of the Atlas [pl. 23]. These hills, ... instead of being, as represented, a succession of low ranges, are a highly elevated tract of enormous mountains with table-lands little inferior to the Neilgherries, and, like them, should have been shaded up in strong relief.

They are in many places very unhealthy, and are infested with elephants and tigers, from which cause the survey was probably neglected which was made as far back as the year 1809, under the then Collector of the district [II, 148, 214]⁶.

As already pointed out, the surveyors of 1800 to 1812 were not trained in the survey of hills, which were regarded as unprofitable and of no interest for revenue purposes [II, 145-6]. Also, as Bedford and Blacker before him pointed out, the representation of hills was bound to suffer when engravers worked from reduced maps, without knowledge of the real nature of the country [III, 297-8].

At the end of 1838 Campbell reported completion of the field survey;

The survey was commenced in...March 1835, and...[the party] remained in the field without intermission until October 1837, when it went into quarters for three months. The whole extent...including a small portion of South Arcot is about 7,500 square miles, of which about 2,500 are a wild and mountainous country covered with jungle and infested by...elephants. ...

The Baramahl lays...in an elevated tract of 2,000 feet above the sea, having in its northern portions, which are the highest, a cool and salubrious climate. ... The Salem...District...to the

¹Krishnagiri, 7-3-36; MRO. 100 (1). ²MRO. M 100, 6-9-37. ³the NE. monsoon of Oct.-Dec.

⁴about 35 miles S. of Bangalore. ⁵under Haidar Ali & Tipu, 1761-99. ⁶DDn. 387 (161), 12-9-38.

south...is not more than 1,000 feet above the sea, and the climate is hot, damp, and generally insalubrious. ... The rocks are trappean, and minerals, particularly iron, magnesia, and corundum, are in great abundance. A geological map of the district and a set of illustrative specimens are preparing. ... The fair plan on the scale of 4 miles to an inch is on hand¹.

The only acknowledgement Campbell received for his very interesting report was a note from Bontein to the effect that "the Surveyor General has not at present time to give the necessary attention to this subject, but will refer to it when he is at leisure"². Combining the administrative functions of Surveyor General with the exacting work of the Trigonometrical Survey, Everest was at this time engaged in the enthralling task of testing his astronomical circles at Kaliāna [133-4, 381].

Campbell spent the next nine months on his maps, and had then to wait for names of villages from the Collector. ... I..go through the whole of the names myself to correct the spelling of them, to which the native Tamul names form no guide, and I thereby hope to avoid the incorrectness...which I see in some of the published sheets of the Atlas, in which spelling is sometime so preposterous as to be totally unlike the real ones.

The sub-assistants, when not immediately employed on the fair plan, have been...finishing the drawing, and entering the names on the plane-table draughts—in preparing the statistical papers...—and in carrying on their studies in mathematics and astronomy. ... I have also employed them...in studying mineralogy and geology [121, 259]. ...

My own time has been principally taken up in the collection of materials for the geological map of the district. ... Besides examining the geology of...700 square miles, I..found it necessary to...chemically examine many minerals totally unknown before, or quite misnamed.

He enlarged on his scheme for a geological survey and map, and asked for the Surveyor General's approval. Again Bontein replied that the Surveyor General hoped to have time to attend to the matter later, perhaps in March 1840 [99-100]³. Being thus left to his own devices, Campbell took the field on 1st January 1840, Mr. Howard having been detached to complete the survey of...Congoondy⁴—Mr. McMahon and Mr. Allan to make a fresh survey of the tableland on the Kholly Mally and Shervaroy Mally—and Mr. Boyne of the tableland of the Culry Mally⁵.

I have considered it necessary to make a fresh survey...on account of the former being on the scale of 1 inch to a mile and not sufficient to shew the...arable land, which lays in strips of about a quarter of a mile in width between the ridges of granite. ... This soil generally...well adapted for the cultivation of coffee. It is very scarce in the plains of the Salem District, and these hills are...the only part on which coffee is, or can be, raised to any extent. ...

The cultivation of coffee in this district may be considerably increased, and [I] am preparing a report to the Madras Government of the subject, to accompany which I have directed the fresh survey to be made on the scale of 2 inches to a mile. ...

The sub-assistants have been employed...in finishing...their plane-table draughts...and...statistical papers. ... The field work will probably be completed about the month of May, and the survey will then return into quarters at Royacottah. To complete the survey we shall have to finish the drawing...and the writing of the names, ... to finish the statistical accounts, and to make a copy...for...the Chief Engineer's office at Madras, and...a copy...for the Collector. This work will probably occupy the rest of the current year⁶.

In his final narrative Campbell points out that the whole of the topography of this extensive district was completed in nearly 3 years, notwithstanding I was absent in Goomsoor for 16 months, during which time Mr. MacMahon was taken away...to conduct the necessary triangulation. Mr. Howard was also employed in Goomsoor for 18 months. Mr. Boyne had been sick for nearly 12 months, and my two youngest sub-assistants were for some time...inexperienced in hill...sketching, and...never able to do more than half the work of the other sub-assistants. ...

Part of the field work was gone through in a hurried manner, ... particularly...in the tablelands on the summits of our mountains, when the...fogs and frequent rains prevented the sub-assistants doing their work quickly, and, although generally correct, yet the scale was too small to admit of the work being done sufficiently neat and exact, ... whence the necessity of the revision of some portion during the present year, ... completed by Mr. MacMahon⁷.

¹ DDn. 410 (54-61), 14-12-38. ² ib. 16-2-39. ³ from Campbell, 1-9-39; reply from Bontein, 29-11-39; DDn. 387 (175). ⁴ resurvey of Kongoondy, 1841-2, MRO. 262, 3 sheets. ⁵ MRO. 135 (12-21). ⁶ Bāramahāl & Salem, MRO. 285, 288; DDn. 387 (191), 1-3-40. ⁷ original field sections, 4-inch, 2-inch, & 1-inch to a mile; MRO. 133 (17 *et seq.*); 136 (47-52); $\frac{1}{2}$ -inch, 136 (47); 147 (21); 8-m. to inch; 148 (17-20); Memoirs, MRO. M 100; *Bo Geo Soc.* III (198).

After submitting the reports and maps in September 1841, many of the latter being beautifully drawn, Campbell kept his party busy on extra-departmental work for two and a half more years, when the Surveyor General at last arranged for his return to military duty [259]¹. Orders for the break up of the party and dispersal of the assistants were issued in April 1844. Records of the survey were finally completed by MacMahon and reached Calcutta before the end of the year².

GANJAM

After many changes and casualties Snell had brought the Northern Circārs survey northwards from the Kistna to enter Ganjam by the end of 1828. In eight seasons he had brought his party triangulation some 300 miles from Lambton's triangles in the neighbourhood of Guntūr, the survey being largely confined to the coastal strip [III, 99-101, 104]. By 1832 the survey of Ganjam had so far advanced that his military assistant, Thorold Hill, was detached to start triangulation in Nellore District and Snell joined him with the remainder of the party early in 1833³ [255, 361].

Except for the coastal plain Ganjam had been hardly explored. The interior was wild, hilly, and most unhealthy, and the tribesmen, some addicted to human sacrifices, were giving a great deal of trouble. To pacify the country it was occupied by a military force, and shortly after Snell's departure, the Commissioner, George Russell, asked that the survey might be resumed.

The survey conducted by Captain Snell was confined...to the more open part, ... the state of the country not then admitting of his assistants being sent into the difficult...hill tracts. As the uncertainty...respecting roads and distances has been the cause of much unnecessary fatigue and many failures in the operations of the troops, I...recommend that the survey may be resumed...as soon as the rains are over, ... to commence...in Purlah Kimedy. A correct map showing all the different passes in the range which separates the zemindary from the Vizagapatam District would give a complete command over that tract⁴.

Hill was accordingly sent up in December 1833 to survey the Kimedi *zamindari* "during the presence of the troops". Being appointed to succeed Ward in charge of the Trichinopoly Survey [250], he left Kimedi in October 1834, but on disturbances again breaking out he was recalled a year later for "the survey of the districts of Polkondah, Kemidy, Goomsur, and generally such parts of the Ganjam and Vizagapatam districts as have not yet been surveyed"⁵.

He wrote at once to Calcutta for Snell's maps and triangles, at the same time informing the Surveyor General, who replied that such a call for documents from the Surveyor General's office excepting through the Surveyor General is...at variance with the orders both of the Supreme Government and the Hon'ble the Court of Directors. In consideration of the urgency of the present case, however, I am not disposed to lay much stress upon this departure. ... Lest Mr. De Penning should demur, ... which I think is...unlikely, I have written him...authorizing despatch of the surveys you have called for⁶.

Hill was later joined by Howard from the Salem survey, and by Macpherson and Barnett from Nellore. He also had the assistance of Campbell who had rejoined his battalion from Salem [255, 361]. He records that until the resumption of the Goomsur Zemindari by Government [in 1836] no portion of the hilly country...was under the immediate control of the civil authorities, but was distributed among the zemindaries. ... Goomsur and Purla Kimmedy...I was enabled to survey during the campaign of 1834. ... On my arrival...in January 1836, ... from the unsettled state of the country and the want of an adequate establishment, I found it impracticable to do more than complete a series of route surveys [and]...the...hills north of Kolada. ...

This season [1836-7], having had a large establishment placed under my control, the country has been fully explored. The roads hastily sketched last year have been resurveyed. ... On the force taking the field in November...Lieut. Macpherson, ... after triangulating across

¹GO. GO. in c. 22-3-44. ²Mil Dept. 19-4-44; DDn. 471 (89-92), DSG's report, 23-1-45. ³MAPS MRO. 138 (48), 146 (16-22). ⁴from Russell, 28-9-33; DDn. 282 (412-3). ⁵MRC. 22-12-35; DDn. 341 (7). ⁶from Hill, 19-1-36, reply from SG. 29-2-36.

...to the frontier, was sent to explore and report on the road through the Chokapad country to Boad, which is more direct towards Nagpoor than the one usually traversed¹. ...

Lieut Campbell proceeded into the hills to the west, and was employed in...Bodamah and the Deoghar valley till the cessation of hostilities enabled the Commissioner to send a party through...the Khond country to Sohnpoor, and thence southerly from the Mahanuddy to...Purla Kimeddy, which Lieut. Campbell accompanied. ...

The party of sub-assistant surveyors from Nellore did not arrive till the later end of January and were, therefore, too late to be employed in advance of the Ghauts. ... I employed myself in the survey...from Durga Prasad to Patlinga...and then from Bybully to the Corada Zemindary...and the hills to the s.w. of Soorada. The Beeracot Motah and the country below the ghauts west of Kodunda was surveyed during...March by Sub-Assistant Barnett.

The road from D—to S—and thence to K—was surveyed by me last year in a hasty manner while accompanying a party of troops, and generally by night, but from bearings I then got by day at the halting places, and what I have since seen, I have every reason to suppose is not far from the truth².

The height of one of the principal hills in the Khond Maliahs above the sea, as determined by the boiling point of water, was about 4,200 ft., but as the thermometer used was a small one this can only be taken as an approximation. ... By trigonometrical measurement I find the height of Seetamoonda Hill, one of the highest peaks above Bybally, to be about 3,487 ft. above the level of the plain near Nowgam³.

The Directors appreciated the value of the survey;

The protracted campaigns in Goomsur, Palconda, and Purlakemedy which caused so great an expenditure of blood and treasure were mainly owing to our ignorance of the localities, and the want of practicable roads on which to move our troops to the required points⁴.

About March 1837, on the close of military operations, Campbell and Macpherson returned to Salem and Nellore, whilst Hill kept Charles and John Summers [381-3] for...the survey of the unexplored parts between this district and the Nagpoor Territory as opportunities may offer. It is said a regiment will march through Goomsur to Nagpoor via Boad etc. next season⁵, in which case I hope to be allowed to penetrate through the heart of the Khond country...to the Nagpoor frontier. ...

The...survey having hitherto been carried on...by snatches, as the troops penetrated the country, I have not made any regular report. ... Now, however, that the country appears quiet, I am...completing some details in the low country⁶.

Survey was interrupted by efforts to put down the horrible practice of human sacrifice, though warnings were issued against "any unnecessary display of force".

The zemindary...bordering on Parlakemidy and the Hill Mootahs of Ganjam may be explored under the protection of an armed escort of 50 men. I should not deem it prudent to visit the mootahs of Ganjam Hills...with so small a display of force, until the excitement occasioned by interference with the Meriah sacrifices be in some degree diminished⁷.

In 1841 Hill applied for furlough;

Since January 1834 I have been constantly employed in the hilly tracts and have suffered repeatedly from fever. ... Rheumatism succeeded the fever about two years ago, and although I was then advised to return home, I had hopes that my naturally good constitution would enable me to carry out the survey. ... In this, however, I have been disappointed, and am now so nearly crippled that I find it impossible to carry on. ... I have the surveys of my last route through the very heart of hills, from north to south, in an advanced state⁸.

Early in 1842 he handed over at Madras to an officer who was not a surveyor⁹, and never had been. As there were now no assistants left with the party, and this officer had other employment in Madras, it was impossible to take the field; there was just one clerk left in charge of records and instruments¹⁰. After one more transfer, the survey was taken over by John Halpin under an order dated Fort St. George, 18th October 1842, and he restarted field work in 1843.

Waugh made the following review of the Ganjam surveys in 1860;

The...survey of...Ganjam was commenced...by the late Captain Snell, who was...well trained in the system of plane-tabling [II, 321]. The work, however, was not founded on

¹ MRIO. 59 (23), Boad, by Macpherson. ² Maps, MRIO. 88, 89, 93; MRIO. 133 (33). sd. Hill, Ganjam, 10-10-37. ³ Memoir, MRIO. M 35. ⁴ CD to B. Rev. 21-11-38 (20). ⁵ cf. Van Heythuysen, 1822 [III, 410, 508]. ⁶ from Hill, 30-3-37; DDn. 387 (99). ⁷ from Hill, 5-8-39; MMC. 18-10-42 (71). ⁸ to SG., DDn. 403 (499-502), 10-10-41. Routes (by Hill); MRIO. 73 (31-40); 72 (43-52); 133 (33); 149 (9-11); 135 (24); IO Cat. (275, 326); MRIO. 150 (12, 23-4). ⁹ John Carne Boulderson (1806?-1868/70), Mad. Inf. ¹⁰ DDn. 405 (48-9), 12-4-42.

the Great Trigonometrical Survey, but on an independent triangulation and separate base. ... It was, therefore, of desultory character, and the precautions, ... especially in the marking of stations, were not rigidly attended to, which makes a union... beset with great difficulty. ... Still, as the work was founded on a triangulation, and Captain Snell was an able surveyor in details, his survey of Ganjam is very complete and valuable.

He was succeeded by Captain Thorold Hill, a very talented officer, who was employed in the Goomsoor war, and under local orders, and... detached on explorations... as far as Nagpoore. These were desultory route surveys in which, ... triangulation being neglected, the results were next door to useless, and... no complete or accurate map could be expected.

With great difficulty I incorporated these discordant materials in 1844, but the map thus produced can only be considered a rough preliminary reconnaissance. ... Captain Hill retired in 1841 on account of ill health occasioned by exposure¹ [250, 361].

Part of Hill's map of 1837, including part of Snell's survey of 1830-2, is reproduced as plate 15.

NELLORE, 1732-42

On 11th December 1832 Thorold Hill from the Ganjam Survey left Madras for Nellore, taking with him Chatelier and Charles Snell, junr. He spent the month instructing the two apprentices, laying down secondary points to facilitate the operations with the plane-table, and surveying with the plane-table; about 40 square miles completed. ...

This year having passed without any rain during the monsoon months [251 n.3], I have been enabled to take the field early. ... I have two apprentices here from the school at Madras; they promise well, but will not be of any effectual service this season. This is a very fine country, and our having Colonel Lambton's points, etc., will render it a comparatively simple work².

Snell followed with the rest of the party during 1833, starting field work in earnest in December. About 1,400 square miles were surveyed during season 1833-4 and another 1,680 during 1834-5. Triangulation was based on Lambton's triangles and Garling's work of 1810 [II, 399]. Survey was on the one-inch scale, fair maps on the half inch, and triangulation charts on the quarter-inch scale³.

On 30th June 1835 Snell handed over to Samuel Macpherson and withdrew from the survey. Macpherson and his assistants took part in the survey of Goomsur during 1836 and 1837 [253], and Nellore District, with part of North Arcot, was not completed till 1840, by which time 4,850 square miles had been surveyed at a cost of Rs. 39,330. Very neat detailed surveys of the roads with descriptive reports were a feature of the survey⁴.

From March 1839 Macpherson took two years leave to New South Wales, leaving the party under Barnett's charge until it was taken over by Thomas Ryves in November 1840. With field work drawing to a close Ryves proposed to revise the work of the old Military Institution [III, 96], but this was not sanctioned. In September 1842 orders were issued for the party to be broken up and Ryves surrendered charge to Barnett at the end of February 1843, but it was not until 21st December that the final papers of the survey were submitted, "finished" writes the Surveyor General "with that degree of style and completeness of detail for which the Madras Surveyors are eminently distinguished"⁵ [362, 383].

NIZĀM'S TERRITORIES

Garling had started the regular survey of the Nizām's Territories, or Hyderābād State, in the south-west, and work had been gradually extended to the north and east until, when Henry Morland took over charge in 1829, most of the country south of parallel 18° had been surveyed. Much of the country was most unhealthy, and, writes Montgomerie, in reporting the death of James Dardell [III, 436],

¹ SG.'s report DDn. 491 (68-9), 25-7-44; and DDn. 6-10-60; MRO. 133 (47). ² DDn. 330 (17-8); 388 (3-4), 15-12-32. ³ Barnett; Chas & John Summers; C. Snell junr., Chatelier; me moir, DDn. 329 M 82 (119). ⁴ DDn. 396 (193), 22-9-40; IO. Cat. (363-371); GSO. Lib. Aa 46. ⁵ Maps of N. Arcot, Nellore, MRO. 136 (4, 5); 147 (2-8); MRO. Map 247; DDn. 452 (70-3), 13-1-44.

Not only have all the members...been attacked with severe jungle fevers, but numbers also of the guard and followers, ... so that surveying operations...are nearly at a stand. The Superintendent and some of the assistants¹ were obliged to return to Secunderabad for medical aid not long after taking the field. As the field operations...are now carried on at a considerable distance from Secunderabad, and as many of the tracts yet to be surveyed are of a most unhealthy nature, I...solicit that...an efficient Assistant Apothecary, with a proper supply of medicines, be attached from...the Hyderabad Subsidiary Force².

During 1831 the survey was transferred to the immediate control of the Surveyor General, as Hyderābād had for a long time dealt direct with the Supreme Government and was no longer any concern of Madras [248]. Morland took sick leave in February 1832, and Du Vernet assumed charge from Macpherson who had been posted as assistant after Dardell's death. During the next two seasons work progressed at the rate of between 3,000 and 4,000 square miles in the western *circārs*.

In January 1836 Du Vernet took leave to Europe, and Chamarett, the senior civil assistant, held charge till Morland rejoined in July. Being asked how long it would take to complete the survey, Morland replied that

the work would be very greatly accelerated by the appointment of one or more additional officers as Assistant Surveyors, it being next to impossible for one officer to carry on the triangulation and at the same time exert strict and efficient superintendence over the large party of sub-assistants, scattered, as they are, over a very considerable tract³.

No military assistant was available, and when Morland went on leave in October 1838, Chamarett again took charge. Thomas Ryves was appointed to charge in July 1840, but after Morland's return was transferred to Nellore [361-2].

The general sequence of the survey ran from Raichur in the south-west, the whole of the Tungabhadra-Kistna *doāb* being surveyed between 1816 and 1819. Survey then proceeded through the districts to the north of the Kistna, Pangul, Devarkonda, Nalgoonda, Hyderābād, and Khammammett *Circārs* being surveyed by 1824. Nilkonda and Gulbarga followed by 1825; Medak by 1828; Warangal and Kowlass by 1831; Bidar, Kalyani, Naldrug, and Osmanābād, by 1833; Eilgundel, 1834; Bhir, to the west, in 1835⁴.

In 1837 the party was split between Nander on the Godavari and Khammammett to the far east, to complete practically the whole area south of parallel 18° 30' [III, pl. 18]. Chamarett now estimated that quite 15 years work remained to the north-west, "considering the unhealthiness of the eastern portion, and Colonel Lambton not having triangulated it"⁵.

There had been so much sickness during the rains of 1837 that Morland found it was useless to take the field with only two assistants fit for work;

Mr. Britain...is at this moment in a very dangerous state, and Messrs. Ignatio and Turnbull are, I fear, very seriously indisposed. The arrears of work, even supposing the whole party to be available, ... will occupy at least three months. When all is brought up, I propose...to employ the party in laying down the detail in the neighbourhood of this station [Jālāna] so far as the weather will permit of, until the conclusion of the monsoon when the survey of the Nandeir *Circar* will be resumed⁶.

At the end of 1840 he reported the work done since he first took charge;

From August 1829 to February 1832...*Circars* Maiduck and Worungul, with portions of Cummmummett, Beeder, and Kowlass, ... an area of 10,370 square miles, were surveyed, and the expenses...were Rs. 50,170-11-7. Severe and repeated attacks of jungle fever compelled me to resign...and proceed to England...in June 1832. Lieut. Macpherson...assumed temporary charge, and completed the unfinished portion of the Beeder and Kowlass *Circars*, ... 2,550 square miles.

In January 1833 Lieut. Du Vernet was directed to assume charge...and continued...until January 1836. ... The area surveyed by this officer was 9,526 square miles, the expenses... Rs. 64,940-5-9. Mr. Chamarett held temporary charge...until I was reappointed...in July 1836. ... He had surveyed the small *Circar* of Darroor, ... 3,098 square miles⁷.

¹ Chamarett; Long; Britain; Wm. Ignatio; Wm. Turnbull; Pariby. ² DDn. 328 (27-9), 12-5-31. ³ Bangalore, DDn. 353 (38-41), 5-8-37. ⁴ Mrio. 67 (32); 68 (15 *et seq.*); 69 (11-22); 70 (1-107) Memoir, Bhir *Circar*, DDn. 327, M 151. ⁵ Index Map, Mrio. 67 (31), submitted by Chamarett, Jālāna 7-8-37; DDn. 353 (41-2). ⁶ DDn. 326 (335-6), 16-12-37. ⁷ progress index, Mrio. 66 (3); area 1829 to 1840 was 37,434 sq. m. costing Rs. 2,27,586 [249].

I continued in charge...until October 1838. While on survey during the monsoon, ... a severe inflammation and affection of the right eye¹ compelled me to proceed to Secunderabad, and subsequently to Madras for medical assistance. ... 28th September [1840]...I rejoined... at Jaulnah. ... During my absence Mr. Chammarett continued the survey of the Nandair Circar, and finished about 3,900 square miles. ... At present the highest parallel...to which the survey has reached is 19° 30', about 24 miles north of the town of Nirmul, on the high road from Hyderabad to Nagpore².

He suggested that it would take at least eight years to complete the survey, including the districts of Berār³. Proposals to speed up the work by sending up the two parties from Salem and Nellore were dropped after a long correspondence, and after Morland had visited Calcutta [248].

Work was now proceeding more slowly to the west, beyond Lambton's triangles, and the party had to carry out its own principal triangulation. By 1843 they had completed Nānder and Pāthri *circārs* north of the Godāvāri, and part of Aurangābād District round Jālāna.

PROFESSIONAL DETAILS

In both the Salem and Nellore surveys it was the practice to carry on field survey continuously through the year, leaving no time for tidying up the field sections after the season's work; they were just stripped from the planetable [250-1]. The writing up of names and preparation of fair maps were left to the close of the survey, and took at least twelve months—a most unsatisfactory arrangement.

In the Hyderābād survey a few months of the rains were spent in recess every year. Montgomerie had criticised the maps that Morland sent in during 1830;

Many inaccuracies are to be discovered in the reduced map on the most cursory inspection. The hilly and high ground is very imperfectly delineated—the...latter feature, indeed, ... nearly wholly omitted—and the whole is too much obliterated by trees and dark jungle.

The points trigonometrically determined by you last season were not...nearly numerous enough to ensure perfect accuracy in taking up the topographical detail, and such a triangulation should, if possible, have been conducted so that three or more points...should have fallen within the limits of each section. ...

By the...original...instructions to Captain Garling [III, 114-5, 209]...a diary...was directed to be kept, to be transmitted...with the other records. ... This practice appears not to have been attended to of late years. ... It may be observed in future, and which you will require from all those under your orders, in as concise a form as possible.

In preparing progress sketches in future, be pleased to insert the high roads passing through the tracts surveyed⁴.

In December 1831 Morland submitted the maps of Warangal Circār about six months after completion of the field survey [III, 119-20]. The documents included—

Geographical Memoir of the Warangal Circār. Register of villages and plan of triangles. ... Measured high roads. Map of the Warangal Circār on the scale of 1 mile to an inch. Reduction...on scale of 4 miles to an inch. ...

Triangles 43 to 62 were executed by the late Lieut. Dardel after I had been compelled to return to Secunderabad by severe illness. The distances marked by dotted lines must have been determined by that officer, as he himself laid down the points...on the plane-table of the sub-assistant surveyor, ... but I have not been able to discover amongst his papers the data from whence they were derived, and fear they were inadvertently mixed up with other papers, which his servant informs me he destroyed the day before his death⁵.

The Surveyor General questioned the data shewn on the triangulation chart;

I do not understand how you have filled up from the 43rd to the 62nd triangles, inclusive, to the nearest second, without the necessary data, ... missing at the death of the late Lieut. Dardel. ... Oblige me by a detailed...explanation, ... for I know of none other but either computing the angles from the sides, or going over the work again⁶.

¹ *herpes ophthalmica*? ² map, 4 m. to inch, MRIO. 67 (34-7); 1-inch, ib. Misc. 8-O-41. ³ DDn. 343 (377), Jālāna, 2-11-40; districts "assigned" to British by Nizām, Amraoti, Buldāna, Akola, Yeotmal [II, 133 n.1]. ⁴ DDn. 328 (24-5), 29-10-30. ⁵ DDn. 272 (98), 20-12-31. ⁶ DDn. 267 (99-101), 16-1-32.

In forwarding these maps and papers to Government Everest repeated this criticism, and remembering the confusion after Lambton's death [III, 464-9] pointed out that

public documents of consequence being mixed up and confounded with private papers, and so liable to be destroyed or lost by casualties, shows strongly how necessary it is to keep the office establishment entirely distinct from the personal affairs of the individual. ... The most effectual way of obviating this is to supply an office tent for conducting business in camp¹.

When in December 1841 Everest recommended that the Hyderābād survey should be continued [249-50], he expressed himself fully satisfied with the use of the planetable, provided that it was sufficiently controlled by triangulated points and constantly inspected by a competent officer [II, 216 ; III, 208].

I have always supposed it to be the object...to fill up the...triangles of this vast skeleton... by means of a planetable, small theodolites, and other ordinary means. That is the plan pursued on the continent of Europe. ... It is that...alluded to in my Lord William Bentinck's able minute [III, 195-6 ; IV, 19, 262], and, when the limiting points...are sufficiently...close to each other, unquestionably delineates the features of a country adequately for...the atlas sheets.

It has the recommendation of being cheaper than that pursued by Colonel Colby in... Ireland, ... more expeditious, and needing little or no computation, the indoor work being chiefly that of the draftsman on whose expertness...the value of the performance mainly depends.

But though...the use of the planetable is...highly desirable, yet, ... had there been no triangulation to precede it and place limits to the accumulation of errors, I should on no account be its advocate, because...of itself this simple instrument cannot be employed in any area of any extent without generating serious discrepancies. Even the hygrometric nature of the paper must be an inseparable obstacle [III, 109, 195].

For the eastern districts a net of secondary triangles had been thrown over the whole of the Kummummett Sirkar as far east as the Godavery [III, pl. 18]. This secondary triangulation seems to have been very creditably performed, and though the method does not seem to me precisely that calculated to give the greatest degree of accuracy, because of the smallness of the base², ... yet it is sufficiently so for the purposes of topography.

In spite of the advantages of the planetable...its operations are merely linear ; ... no numerical values either of distances or angles are registered. It is, in fact, a pencil sketch, ... and the sheet on which the drawing is traced in the field contains the sole record. ... The means of checking results...are all but wanting. ... We must depend entirely on the confidence to be reposed in the party by whom it is effected. ...

Hence...the control...of the Surveyor General or his Deputy...needs to be maintained... in the fullest vigour. ... No officers unless recommended by him should be appointed to the charge of such operations. ... An occasional inspection, not only of the records, but of the actual working, should take place. ... Not only the officer in charge, but all...subordinate to him, should be persons of whose character and qualifications the head of the department is intimately cognizant.

The Superintendent of the Trigonometrical Survey of Ireland makes two tours of inspection annually to visit all his parties in the field, and thereby only exerts what he deems a sufficient supervision that is, perhaps, not to be accomplished in India, because the circumstances...such as want of roads and inns are so totally different.

We must either conclude that such periodical visits of inspection are necessary for the maintenance of...accuracy, or that they are a work of supererogation. ... In the former light, they point to the expediency of concentrating all operations...as much as possible, and making such provision as will enable the Surveyor General, either personally or by means of qualified deputies, to undertake similar tours without fear of his office business falling into arrears³. The practice of leaving all triangulation to the officer in charge of a party prevented his making that constant examination of his planetablers' work in the field that is now regarded as essential.

There have been many survey officers who have found that the regular work of the department along methodical lines was not sufficient to occupy all their time ; whose vigorous and inventive genius called them to break away from established methods, and who not only tended to neglect their humdrum routine duties, but worried their senior officers with bright suggestions for new methods that may have been proved impracticable a generation or two before. None was more

¹DDn. 283 (11-3), 16-1-32. ²Punchpandal-Chitapully, 8,292 ft. ³to Mil. Dept. 13-12-41 ; DDn. 402 (197-207).

fertile in imagination, more persistent, more self-confident, and more of a trial to his seniors, than John Campbell, who, when officially employed on straightforward topographical survey, spent a great part of his time on geology and astronomy, and plans for revenue and astronomical surveys, and pestered the Surveyor General with his proposals. Everest rebuked his demand for astronomical instruments ;

Captain Campbell is conducting a topographical survey, and can have no claim to instruments which are not allowed on all like occasions. The system which Captain Campbell proposes to employ...is precisely the very one which...the Court of Directors have decided to be unsuitable. ... It would be rather late in the day now to set about revising a system which has by general consent long since been exploded [III, 185-6; IV, 261]. ...

An officer conducting a topographical survey ought to have sufficient work to employ his whole time. ... Astronomical or other pursuits...can only tend to distract him from his more important duties, and create confusion¹. ...

I have little time for discussion, ... particularly for those questions which have over and over again been sifted, examined, and settled [t-page]. The principles of accurate topography are sufficiently well understood and laid down, and, as it is like searching for the philosopher's stone to seek to devise a new system, the best way for all parties to do their work is to abide by the old and universally approved methods².

With supreme confidence Campbell offered to re-observe Lambton's southern triangles of the Great Arc with instruments made up locally ;

Being perfectly conversant with the labours and investigations of the French geodesists, I do not anticipate any difficulty...which I shall not be prepared to meet, and, although I do not anticipate any better result...than Colonel Lambton was able to produce, ... I shall be able at least to produce a gratifying and useful proof of Colonel Lambton's correctness. ...

I have put to the test the...native workmen under my tuition by constructing by their hands philosophical instruments equal in appearance, and superior in...power, to the best which have ever been constructed in Europe, for less than 1/10th of the cost in London³.

He offered to make a four-inch revenue survey of Salem District shewing, each field of dry cultivation. ... 4 sub-assistant surveyors could complete in about 4 years...the Salem District, the cultivated portion of which is about 3,000 square miles in extent. By employing...6 intelligent natives under each sub-assistant surveyor, the whole...might be finished in 12 months at an expense of...about 1/100th part of the revenue of the district⁴.

Two years later he reported that he had been making experiments in surveying "by the method of offsets from rectangular co-ordinate lines", and that the Madras Government proposed to take up the revenue survey of Tinnevely on these lines.

He reported that though there was a triangle of the Salem survey that remained for revision, he had not been able to spare MacMahon to do the work because he had been engaged "upon a set of nineteen hundred repetitions of an angle" with a small repeating theodolite, by which experiments he had proved that the theodolite was not capable of high accuracy by this process⁵.

Waugh could stand this no longer, and pointed out to Government that he had received no progress reports on the Salem survey for 18 months, by which the publication of sheet No. 79 of the...Atlas has been unnecessarily delayed. ... Captain Campbell appears to have employed himself and establishments...in making experiments...altogether extra-official and unauthorized. ... They tend to revive exploded theories which have long ago been set at rest. ... With regard to the repeating instrument, ... any practical man...can satisfy himself of its capabilities by few hours trial⁶.

A week later he reported yet another long letter from Campbell, this time putting up proposals for "the manufacture of iron from the country ores" [121]. Waugh showed that there was no need whatever for the revision of the particular triangle suggested by Campbell, and orders were at last issued for the disbandment of the Salem survey, and Campbell's reversion to military duty⁷. It is indeed extraordinary that a field party should have been allowed to linger on for more than two years after the completion of its official programme. It was obviously impossible for the Surveyor General to control his large department without an efficient Deputy. There was no Deputy Surveyor General between Bedford's departure in January 1843 and Wroughton's appointment in March 1844 [323, 326].

¹ DDn. 410 (122-5), 1-7-40.
26-2-42. ⁵ ib. (423), 14-2-44.

² ib. (152-6), 4-9-40.

³ DDn. 387 (361), 26-2-42.

⁴ ib. (369),

⁶ DDn. 452 (104-7), 1-3-44.

⁷ ib. (114-5), 1-4-44.

CHINA

During the war with China of 1840 to 1842, which resulted in the British occupation of Hongkong, two companies of Madras Sappers and Miners formed a notable part of the small Indian contingent. The exhausting campaigns in the neighbourhood of Canton and Ningpo were brought to an end by the treaty of Nanking, signed on 7th August 1842¹.

The companies were commanded by Thomas Pears, and had among their officers Lieutenants John Rundall and James Johnston. Amongst the many maps of China preserved at Dehra Dūn² are a

Reconnaissance sketch of the attack on the defences at Amoy on the 26th August 1841 by a combined Naval and Military force under Lt. General Sir Hugh Gough and Rear Admiral Sir William Parker, by Lts. Rundall and Johnston, Madras Engineers. Scale 1 inch to 400 yards. Map. sd. by Captn. Thos. Pears, Commanding Engineer, Eastern Expedition³. ...

Field sketch of the attack on the Chinese positions on the Singpo at Chingai, Oct. 1841, ... by Lt. Rundall⁴. ...

Military sketch of the country about Jinghae showing the attack on the Chinese defences... on the 1st Oct. 1841. ... Enlarged from an original survey of Captn. Anstruther by the Madras Engineering Department, Eastern Expedition. Scale 8 inches to 1 mile⁵.

¹Sandes, I (279-82). ²See also *IO Cat.* (507-9). ³MRO. 87 (1). ⁴ib. (16). ⁵ib. (38).