not wish to enter Gibraltar, so we took up our quarters at Macre's Hotel, where we really fared very well, and the rest after our fatiguing ride was most agreeable. We had English friends at Gibraltar, who kindly came to us at San Roque, and we had been so long banished from English newspapers and English friends, that the time passed only too rapidly in the enjoyment they provided for us.

We were to complete our riding tour by riding to Xerez, whence the distance was but trifling to Seville. The valley of the Guadayvo is delightful; thick groves of walnut and chesnut, and extensive orchards of almond-trees, extend everywhere. A most striking sight greeted us on our way, which made a deep impression on some of the party. I have already alluded to the wayside crosses often erected in commemoration of some fearful deed perpetrated on the spot, and I spoke of the deeply tragic character these memorials gave to the scene where they were placed, but I leave my readers to imagine what must have been our feelings when we came in sight of eight of these memorial crosses all clustered in a very small space. Our guides had taken care to tell us that the defile we were entering was a most notorious resort of robbers, and that not so very long ago; but the band had been broken up and the chief executed for a most fearful murder committed on an unfortunate old man and his daughter, wealthy people travelling without sufficient precautions, and it was supposed with a large sum of money, but that never was heard of again. These dreary crosses, looking dark and ominous, seemed to threaten the passer-by with some fearful doom, stretching out their long arms in different directions, as many of them were placed at right angles with each other. These crosses each bear the name of the person who was murdered on that spot, with the date; and it is the custom with the Spaniards when they come within sight of these crosses to halt and offer up prayers for the repose of the victim cut off in so fearful a manner. They make upon the passing traveller an unpleasant impression; but the succession of striking scenes after a time brought brighter and pleasanter thoughts. Nothing can be more mountainous than the route, and often and often we regretted that none of our party were able to carry away sketches: as far as the landscape was concerned, it would have required the genius of Salvator Rosa to do justice to its grandeur and magnificence; but most effective drawings might have been made of many of the women that we saw. Anything more strange and weird than their looks I have never seen; the very sight of civilised human beings, especially ladies, seemed so strange to them, that when we halted they clustered round the horses, coming as near as our guides would allow, and gazing at us with their glittering eyes. Their hair all flowed in tangled locks about their heads, their dress was the oddest mixture of bright colours and strange hues that ever were brought together. They were not so much Eastern as thoroughly African in their appearance, and I could imagine many of them being quite ready to aid brothers or husbands in any daring exploit whatsoever. The pass over the mountain, called San Cristobal, is very steep and lofty, and rarely free from snow on the summit.

We were quite glad after our fatigues and the excitement we had experienced, to find ourselves at the tidy little posada, or inn, where we intended to pass the night, and thought with increasing pleasure of our near approach to Seville. The following day the scenery changed completely. We came to a smiling luxuriant district, where fruits, flowers, and verdure vied with each other in displaying their varied beauties, bright rivers refreshed the thirsty earth and watered the lovely gardens with their welcome streams of ice cold water! Pine woods afforded most delicious shade and coolness, and presently we reached Arcos, situated, as are all these mountain towns or villages, on almost inaccessible heights. The awful precipice that skirted the road nearly took one's breath away, and would have caused even greater fright but for the diversion of the Andalusian costumes here seen in all their graceful beauty—the veritable Majos and Majas; each peasant, male and female, forming a striking object from the singular national costume that they wear. We had, from this strange spot, a farewell and most magnificent view of the Ronda mountains. A short rest and then we made the best of our way to Xerez.

THE ORDNANCE SURVEY.

Surveys, in the land valuator's sense of the term, are no new things. Doomsday book was a record of land, describing with minute accuracy the plots, their value, tenure, crops, and stock. Nor are surveys, in the astronomer's or geographer's sense, marvels, the ancients having left us charts and maps of no mean value. But with the advance of science, settlement, and the arts, refinements became necessary; even the surveys of a few years ago have been deemed insufficient for the requirements of the present day.

Thus it is that the Ordnance Survey has grown into its present form. Its history we would now outline. The immediate origin of the Ordnance Survey may be traced to the desire, in 1783, of connecting the observatories of Paris and Greenwich. In the following year General Roy, R.E., measured a base, and commenced that triangulation which has since extended over the United Kingdom.

On the accuracy of a base of any survey depends that of the whole work, so that the utmost niceties are resorted to in its measurement, and as a check upon even that base, it is usual to measure other bases at remote distances, and connect them for comparison by a series of triangles. The first base measured in England was that on Hounslow Heath in 1784. For this were tried at first steel chains, then deal rods, twenty-three feet three inches long, tipped with metal, but the hygrometric changes of the atmosphere were found to affect this length sometimes to the extent of one-fifteenth of an inch, which would have made a difference of more than seven feet in the whole length of the five-and-a-half mile base, fatal to the accuracy aimed at. Glass rods were next used with great improvement. Their result against that of the steel chain showed only a small difference.

The operation of measuring this base was watched by the president of the Royal Society, and by many of the leading men of the day, and honoured upon one occasion by the presence of his Majesty George III. Other bases were measured about the same time, including one on Salisbury Plain in 1794.

About 1828 a vast improvement was introduced into measuring apparatus: compensation bars were invented. These are not easy to describe without drawings, but it may be mentioned that, by a self-adjusting process, they avoid showing any variations in length from change of temperature. With these compensation bars a new base, ten miles long, was measured near Lough Foyle, in the north of Ireland, in 1848. These tests upon previous work are as satisfactory as they are instructive.

The results of the measurement of the Salisbury Plain base stood thus :—

Measurement with Ramsden's steel chain, 1794 . . .	36,575·64 feet.
,, with Colby's compensation bars, in 1849	36,577·95 ,,
Computed by calculation from Lough Foyle base . .	36,577·34 ,,

A result equally beautiful and illustrative of the general excellence of the instruments and work of the British triangulation.

Hounslow Heath measured when reduced to the—

Ordnance standard, with glass rods, 1784 . . .	27,405·06 feet.
Ditto ditto with steel chain, 1791 . .	27,405·38 ,,
Deduced by computation from Lough Foyle base .	27,405·83 ,,

A result which may be considered unparalleled in geodesy, when the extent of the triangulation intervening between the two bases is considered.

The delicacy of the operation of measuring a base cannot be here described, but its labour may be inferred from a few details. For instance: The work is carried on under oblong tents, especially on days when the sun would overheat the bars, or possibly heat one end more than another. The starting point each day was a stone pillar having a plug of platina with a silver pin point in it let into its centre. The direction of the line was given by a delicate transit isntrument. At the termination of each day's work a heavy triangular plate with a moveable silver pin point in it was sunk under the end of the last bar laid, and the dot in its centre being brought under the focus of the extreme microscope, served as a starting-point the next day. A sentinel was always placed at night over this mark. The extremities of the bases are invariably marked by similar pins of metal let into heavy guns, or blocks of masonry, and protected from injury by some superstructure, as well as by being placed below the surface of the ground.

But we must dismiss bases, and go on with our triangulation, which is the next operation. The first side of our first triangle is, of course, our base. Points on hills or prominent objects are selected, and other points beyond these, generally increasing in distance from each other as they recede from the comparatively small base. At all these stations as well as at the extremities of the base, the angles between all other visible points are observed; the instruments being placed over the stations with every regard to a continuance of the minute accuracy implied in the use of fine dots at our base points.

The sides of the triangles, *i.e.*, the horizontal distances of the stations on the hilly ground from the ends of the base, are calculated with great care, and form fresh bases from which the distances to other stations can be ascertained in like manner.

The method is continued until the territory to be mapped is spread over with a network of triangles, the sides being in proportion to the extent of the survey and the quality and correctness of the instruments employed; care being taken that the sides of the triangles should rapidly increase from the measured base, and that the angles should be about 60°.

This network of triangles was finished in 1858, and encloses, so to speak, the United Kingdom of Great Britain and Ireland; for the angle of one of the triangles is at the St. Agnes Lighthouse, off the Scilly Isles, the angle of another triangle is at Saxaford, the northern extremity of the Hebrides, and a third on the west coast of Kerry.

The great triangulation being effected, the country has to be cut up into smaller portions for the surveyors of the details, viz., roads, rivers, railways, houses, fences, hedgerows, etc.

The largest instrument made use of for observing angles on the Ordnance Survey is a theodolite three feet in diameter. It has been upwards of seventy years in use, and upon the highest mountains, and at most of the trigonometrical stations in England, Scotland, and Ireland, and was the instrument used in making the necessary trigonometrical observations to determine the longitude between the Observatories of London and Paris. It is on record that a station has been observed with this instrument at a distance of 111 miles, viz., from Sca Fell, in Cumberland, to Slieve Donard, County Down. The distances between Sca Fell and Snowdon, and Snowdon and Slieve Donard, from which observations were also taken, are nearly as great.

Theodolites, eighteen inches diameter, are used for determining the secondary triangles, the length of their sides being about ten or twelve miles. These are subdivided into lesser triangles of sides from one to three miles, the angles being observed by seven-inch theodolites.

The great trigonometrical work may be said to have been conducted and brought to a close under the successive directors of the survey, Generals Roy, Mudge, and Colby, men who had all worked unceasingly in the wild life of their mountain labours—labours of which little has been written, but much might be said—on lone mountain tops in all weathers, and far on into winter when travelling was laborious (for there were no railways in those days and few roads)—often with but poor fare—at times, too, reft by storm of even the shelter of their tents. Let me record an incident in point.

The tents of a surveying party being liable to be blown down the mountain side, the occupants were in the habit of sleeping with their working garments under their pillows. This custom, however, was not approved of by a young Irishman, who lacked the experience of mountain tempests, and in spite of the warning of his comrades, usually suspended his attire from the tent pole. One night, however, a violent gale swept away the encampment to the bottom of the valley, and in consequence Paddy not only presented a deplorable appearance, but became a conspicuous object in the midnight search for the debris of the camp, every new comer illuminating him by turning his lantern upon him, to ascertain whether he really belonged to the camp, and then generally greeting the unhappy surveyor with a loud laugh. History is silent as to the length of time Paddy "stood in the cold."

To observe a distant object it must be visible, and to observe it well, that is often, so as to obtain a mean or average of a number of observations, you may wait weeks, even months. The haze of the atmosphere, even in fine weather, being an enemy to the telescope, the sun's rays in the early days of the survey were, with the assistance of mirrors or tin plates, made available for rendering distant stations visible from each other. As the sun's rays could not, however, be borrowed in sufficient quantity from the moon to be of service at night, Bengal lights, argand lamps, parabolic reflectors, and plano-convex lenses have been used with more or less success to produce lights sufficiently brilliant.

The light invented by Captain Drummond, R.E., in 1826, far surpassed previous contrivances. It consists of a ball of lime, placed in the focus of a parabolic reflector, and raised to an intense heat by a stream of oxygen gas directed through a flame of alcohol. The brightness was so intense, that a station at Slieve Snacht, in Donegal, which it was of great importance to view from Mount Divis, near Belfast, sixty-six miles distant, was, in spite of hazy weather, rendered distinctly visible. The experiment, however, was conducted under con-

siderable difficulties, for the season was inclement, and as Mount Divis and the surveying camp were enveloped in snow, with a keen cold wind continually blowing, the situation was more romantic than agreeable. More than once a storm carried away the few worldly possessions of the party; and the occupants of the camp at Slieve Snacht, at an altitude of 2,000 feet, were not better off, for their tents were so shattered that they had to obtain shelter by building rude stone cabins. At last, however, the light was directed on Mount Divis, and, notwithstanding the keen blasts, it was at once seen by the Sapper sentry there, and burnt for the required time with great brilliancy. Thus years and years were saved in time that otherwise would have been lost waiting for excessively clear weather.

In flat countries or about large towns the trigonometrical stations were necessarily upon buildings, and on curious ones too. On Norwich spire the great theodolite was 299 feet from the ground. Some of the stations above church spires rocked in even gentle breezes in a manner by no means agreeable. But the station which attracted most public attention was that on St. Paul's, London.

A survey of London, with the primary object of improving its sanitary condition, was commenced in 1848, and terminated in 1850. The City was covered with a network of triangles, the summits of Primrose Hill, the tops of towers, steeples, roofs of churches, etc., etc., having been made available as trigonometrical stations. By their aid the relative position of every street, square, and alley, with their relative levels, was gradually ascertained and mapped. The survey extended eight miles from St. Paul's Cathedral, and above its cross was one of the principal stations. The account of the construction of the station or "crow's-nest" round St. Paul's Cross is so interesting that I have extracted it from the "History of the Royal Sappers and Miners," by Quartermaster (now Captain) Connolly, R.E.:—

"The scaffolding was of rough poles. The stage, ten feet square, formed of planks, which supported the observatory, rested on the gallery on the top of the great cone. The four lower posts, twenty-nine feet long, stood upon short planks, bedded on the stone footway, and the top supported the angles of four horizontal planks, each twenty-three feet long, bolted together at the angles. From these planks rose a screen, to prevent materials, etc., from falling. The base of the four upper posts, fifty-three feet long, rested on the angles of the above planks, and the scaffold, in addition to these posts, consisted of four sets of horizontal and four sets of transverse braces on each side, the whole being fastened together with spikes and ropes. Fifty-six of the uprights were double poles, placed base and point, and bound together with hoop-iron and wedges, and with bolts and hoop-iron at the splices. The height from base to floor was eighty-two feet, and to the extreme top of the observatory, ninety-two feet. A railing surrounded the 'crow's-nest.' The ascent was made by the inside of the tower or lantern to the circular openings, then to the outside of the foot ladders set at the north-east corner, parallel to the north-east principal post inside the scaffold. The whole of the materials were drawn up from the floor by a permanent windlass erected in the tower, to the Golden Gallery, and thence passed to the outside through an aperture thirty-two inches wide, and finally were drawn up and put into position by an apparatus erected for the purpose. The whole construction weighed about five tons, and the time occupied in going up the ladder was only seven minutes, the descent requiring only five. In the hazardous and intricate operations of building and dismantling the 'crow's-nest' not the slightest accident to human life or limb—not even the breaking of a single pane of glass—occurred."

The history of the scale of the survey maps may be regarded as a history of the advance of wealth in the kingdom. When General Roy commenced England, it was deemed sufficient to engrave the maps upon the scale of one inch on the paper to a mile on the ground. These maps, engraved for all the South of England and Wales, show roads, parks, rivers, and (by shading) the hills and valleys. When the survey in 1824 was to be extended to Ireland, a committee reported that nothing under six inches to a mile would suffice. Upon this scale, which shows every fence, field, and house, maps of Ireland have been published. The North of England perceived the improvement, and for many years after the Irish maps had shown the way, maps of the Northern Counties, and subsequently of part of the South of Scotland, were published on this scale. The value of these maps, and the possibility of making them of still further value if on a larger scale, became so apparent, that after deep consideration by a Parliamentary committee and scientific commissions in 1853, it was resolved to do the cultivated lands on a scale of about twenty-five inches to a mile. Maps of towns and cities according to their size and character have also been published on scales of sixty and 120 inches to the mile. In these every lamp-post and doorstep can be correctly made visible.

Had England and Wales been originally surveyed on the twenty-five inch scale, the country would have been saved the expense of the survey made some years ago (at a cost of about £4,000,000) by the Tithe Commissioners.

Some of the northern counties of England, and many of those towards the south of Scotland, also the isles of Arran, Rothsay, etc., etc., have been surveyed upon this scale. Its value is almost incalculable; and for want of a similar one in the neighbourhood of Portsmouth, Plymouth, Dover, Pembroke, Sheerness, and other localities where certain fortifications (now either in progress or completed) were proposed to be constructed, a special survey of those districts had to be made at some considerable expense.

In the early maps hills were shown by shading, and for small scale maps this method of delineating ground still holds its place and retains its admirers. On six-inch maps shading would be confusing and lack artistic effect. Numbers of actual instrumental levels have therefore been introduced referable to marks on houses, milestones, etc. etc., and to these, contours, or level lines at equally distant *vertical* heights, have been added. These render a map so perfect, that civil engineers have given evidence that they could with a sufficiency of contours, sit at home and trace a railway within any narrow limits of its proper position.

Up to 1842, the datum level for the altitudes of the principal mountains and hills of Ireland was low-water spring tide, but in England the datum was the mean level of ordinary tides. A series of observations having determined that the latter level was the most constant, it has been adopted in the survey of Scotland and the North of England. During its progress, as opportunity offered, the altitudes of the chief mountain ranges and hills were ascertained, by which it appears that Ben Nevis, in Aberdeenshire, is the highest mountain of the United Kingdom, being 4,406 feet above the sea.

Before parting from our subject it is but fair to say that the Ordnance Survey has been one of the best conducted public institutions in the kingdom. To the late

General Colby is this chiefly due. His officers were invariably selected by merit; and if found not equal to expectations, were soon changed for abler. The names of Drummond, Portlock, Sir Thomas Larcom, and Captain Ross Clark, all engineer officers, are household words in the homes of science. Under General Colby the officers were trained to disregard all personal consideration and to give all their attention to the work in hand. The annals of the survey tell how General Colby has walked many miles over mountains before breakfast; and the twenty or thirty mile journeys he made day after day with his subalterns at almost racing pace over the roughest country, evidence how he infused energy by example. Not content with example, he carried with him the highest feelings of his officers by embracing every opportunity to publicly acknowledge any improvements suggested by them, however junior their rank; and perhaps in this was the secret of his success in rearing zealous men. Had he lived until Lieut.-Colonel W. D. Gosset, R.E., initiated the application of photography as an economical method of reducing plans from a large to a smaller scale, and until Captain De Courcy Scott, R.E., by his chemical researches developed this into photo-zincography, whereby thousands a year have been saved, he would have gloried in making known the authors of the improvement. The solicitude of his officers for their work was as remarkable as it was sincere. Their observing instruments they regarded almost as mothers do their children; and there are yet a few living whose eyes brighten as they talk of "Ramsden's" (the familiar name of the great three feet theodolite), and the old days of the trigonometrical survey. The pastimes of these gentlemen in hazy weather on the mountain tops were not many; but a favourite one with officers and men, was to dig about some huge rock, often several days' work, and at last by powerful levers to detach the mass, and send it hurling down the mountain side, crashing, and dashing, and bounding away, a great Leviathan in its disportings.

As might be supposed, many of General Colby's lieutenants have been called upon to fill important situations in other departments of the State, both at home and in the colonies, and with advantage to the public service.

The head-quarter-office of the Ordnance Survey is at Southampton, to which station it was transferred after the destruction of the Map-office at the Tower by fire; and there are branch offices in London, Edinburgh, Dublin, and at other stations, when required. In addition to the general business, the engraving and printing the maps is carried on at Southampton; also the reduction of maps from a large to a small scale, by the aid of photography. The force consists of four companies of the Royal Engineers and a number of civil assistants, every branch being under the direction and control of the Royal Engineers, who are responsible that the work is carried out accurately, and in accordance with prescribed instructions.

The Ordnance Survey has long been in existence, but it began by a travelling map of England. It is progressing as a work which will subserve every known purpose of valuation, agricultural statistics, and taxation, that can be worked from accurate detail plans. It is to be hoped that it will not conclude until it forms the basis and index for a complete registration of deeds, connected with the sale, lease, mortgage, or demise of property, whereby the transfer of, and all transactions relating to, landed property might be as easily effected as a transfer of stock in the funds.

Although the Ordnance Survey appears to occupy a long period, it must be remembered that every year the face of the country in many districts undergoes considerable change. Cities and villages spring up; railways, bridges, and roads are constructed with marvellous rapidity; woods are cut down, or arable land converted into plantations; so that new measurements and maps are often required to keep pace with the modern architect and engineer. At the same time every bleak mountain, forest, moor, river, plain, is gradually brought under the power of the Ordnance Survey.

The latest official report of the Director-General of the Ordnance Survey and Topographical Department to 31st of December, 1867, states that in England the survey is proceeding in the counties of Kent, Surrey and Hants; and we are completing the survey of the interior of London. The general progress of the survey has been greatly retarded by the excessive amount of work required to make a perfect survey of London and its environs, but except the central sheets, the plans are now well advanced and many of them published. The parish of Aberdare in South Wales is now being surveyed, and drawn on the scales of 1—500, and 1—2—500, the inhabitants having undertaken to pay £2,200, two-thirds of the actual cost, in consideration of their having the survey of their town made immediately. In Scotland the survey is proceeding in the counties of Aberdeenshire, three-quarters of which is surveyed, Banff, which is nearly finished, Elgin, Inverness, and Argyle. The small county of Nairn has been finished. In Ireland the county of Dublin and the township of Bray in the county of Wicklow, have been revised and redrawn on the scale of 1—25,000, for the purpose of the valuation, as Sir R. Griffith, the chief valuator, did not consider the valuation of so closely inhabited a county could be properly valued with plans on a lesser scale. The survey of the Isle of Man is finished, and the plans are in progress. The cost of this survey will be defrayed out of the revenue of the island.

MY FIRST CURACY.

CHAPTER XII.—VEXATIONS AND DISAPPOINTMENTS

THERE are vexations and disappointments in every class of life. Yet perhaps a clergyman is exposed to a greater number of vexations and "worries" than fall to the lot of others. I am not speaking now of personal and private troubles, but of trials in the work of the ministry. Nor am I speaking morbidly, nor despondingly, though the frightful scenes of disease, distress, and poverty combined are quite sufficient to cause a man to despond. Still it is very hard to see one's hopes blighted and desires frustrated, when all has been done that is in our power for the benefit of some individual in whom a great and warm interest had been taken. Yet a clergyman, knowing that these trials will not fail to come, should be prepared to meet them. He should remember the text, a very favourite one of mine, and one which has often brought light in darkness, "All things work together for good to them that love God."

I will relate a case or two of bitter disappointment.

A young man in whom I wished to take an interest, but to whom I could not readily obtain access, he being rather wild and careless in conduct, was one day thrown from a waggon when half tipsy, and broke his leg in the fall. It was a bad fracture, and he was confined to his bed for six weeks. I cannot say truly that I was altogether sorry for this accident, for I was thereby enabled to get near him, and try what influence I could exercise over him for the future. I went to see him at