

Robinson's are much below those determined by simultaneous observations with good barometers; and I join with Mr. Prinsep in expressing a hope that every traveller boiling his thermometers will at the same time, if he possess a barometer, make a record of its indications, and thus render essential service to physics by fixing so many points on the scale of the elastic tension of steam at different temperatures.

When the thermometer has been boiled at the foot and at the summit of a mountain, nothing more is necessary than to deduct the number in the column of feet opposite the boiling point below from the same of the boiling point above: this gives an approximate height, to be multiplied by the number opposite the *mean* temperature of the air in Table II., for the correct altitude:—

Boiling point at summit of Hill Fort at Purúndhur,	°	Feet.
near Púna	204·2 =	4027
Boiling point at Hay Cottage, Púna	208·7 =	1690
Approximate height		2337
Temperature of the air above	75°	
Ditto ditto below	83	
Mean	79 = Multiplier.	1·098
Correct altitude		2·566 ft.

When the boiling point at the upper station alone is observed, and for the lower the level of the sea, or the register of a distinct barometer is taken, then the barometric reading had better be converted into feet, by the usual method of subtracting its logarithm from 1·47712 (log. of 30 inches) and multiplying by ·0006, as the differences in the column of "*barometer*" vary more rapidly than those in the "*feet*" column.

<i>Example.</i> —Boiling point at upper station	Feet.	Feet.
Barometer at Calcutta (at 32°) 29 in. 75°	185° =	14,548
Logar. diff. = 1·47712 — 1·43749 = 00363 × 0006 =		218
Approximate height		14,330
Temperature, upper station 76°	} 80 = multiplier .	1·100
Ditto lower 84°		
Correct altitude		15,763

Assuming 30·00 inches as the average height of the barometer at the level of the sea (which is, however, too much), the altitude of the upper station is at once obtained by inspection of Table I., correcting for temperature of the stratum of air traversed by Table II.

[*Note.*—Dr. Hooker finds that the index error of boiling point thermo-

meters is often more than 1° even in instruments supplied by the best makers.—(1854).

According to Mr. Adie, optician, Edinburgh, the index error is liable to change from some hidden cause amounting to nearly a degree in a few months.

See Dr. Buist's paper on the Aneroid, page 43, vol. xxi. Royal Geographical Journal.]

ED.

Letter addressed by Francis Galton, Esq., to the Secretary.

SIR,—When a man, for the first time in his life, proposes to explore a wild country, he is sure to ask, "What astronomical and mapping instruments ought I to take with me, and how should I pack and carry them?" It therefore seems to be a very proper undertaking for persons who have already had to do with these things, to record their experience in answer to the above question. And, further, I am sure it would be of infinite service to young travellers if different lists of instruments, books and stationery, were drawn up; each complete in itself, down to the minutest detail, so that a tyro having selected any one of them might straightway take it down to the different shops and order off-hand his complete outfit. He would then be satisfied that he had omitted to provide himself with no object of real importance, that he had bought nothing superfluous, and that the different items of his store corresponded together in size, in power, and in their several uses.

Half-a-dozen or more different lists might be drawn up; they would vary according to the accuracy of the results aimed at, to the character of the observations intended to be made, and also, to a great extent, according to the fancy of the person who might draw up the list.

But a young traveller would never go far wrong who followed to the letter any one of these lists. His danger lies in following the advice of observers who have little experience of the bush, or else in adopting scattered hints from many sources, and starting with instruments which, though individually good, are, when considered as a set, incongruous and incomplete.

A rough estimate of prices might be added to these lists, and hints on packing and carrying them would be of great importance. It is a desideratum as yet unsupplied, to arrange one or more light strong cases fit for strapping on an animal's back, or on men's shoulders, readily to be opened and unpacked, which shall contain all the books and instruments that a traveller requires for his daily use.

Guided by these views I will proceed to describe an outfit based upon that which I used, which would suit an explorer in any part of the world, who desired the means of bringing back as good

geographical determinations, generally speaking, as explorers over large tracts of land have ever yet succeeded in obtaining. And in the list that I am now about to draw up professedly for an inexperienced observer, simple and well known instruments shall only find a place. I am very far indeed from thinking that instrument makers have yet learned to meet the wants of land travellers, but as we *know* that good results may be obtained from such sextants, &c., as are to be bought at any optician's shop, I would urge a young explorer to make *these* his mainstay; and if he takes other instruments, to do so more for the purpose of testing and reporting on their performances, than of relying in entire confidence upon their suiting him.

Again, it is hazardous for a man hurriedly preparing himself for a journey, to order new apparatus from a maker; he can never be sure that it will be made nicely or punctually, and he may have to set sail in possession of a strangely shaped instrument—very delicate, difficult to pack—whose adjustments he has not had opportunity of mastering, and on which nobody out of England can give information; whilst if he determines on buying a sextant, he may make his selection out of great numbers that are always ready made to hand, and practise himself in its use, under the tuition of the officers of his ship, during the whole of his voyage from England. It will, therefore, be my present object to give a list of instruments which, though confessedly improvable in numerous points, will, all things considered, be what I should advise a traveller of but little experience to provide himself with, and which, beyond all doubt, are thoroughly adequate to do his work.

Outfit for an Explorer.

A Sextant—

A sextant of five-inch radius, light in weight, by a first-rate maker, divided clearly, and on platinum, to quarter degrees. It must have a ground-glass screen fixed in front of the reading-off lens to tone down a glaring light, and a coloured glass to screw on to the telescope for index error purposes, in addition to the coloured shades.

The handle must be adapted for fixing on the telescope stand.

A Sextant—

A sextant of three-inch radius, graduated boldly to half degrees, in a leather case, like that of an azimuth compass, suitable for slipping on to a leather belt and being worn round the waist, if required.—Reserve, a second five-inch sextant, or other angular instrument of whatever kind the traveller may wish to take.

Artificial Horizon—

The trough must not be less than $3\frac{1}{4}$ inches, inside length; it must be of the usual construction for filtering the mercury when it is poured in. The glass screen must be a folding one, and by a first-rate maker.—

Reserve, one spare glass and a strong two-ounce glass bottle full of mercury, wrapped up loosely in a roll of clothes and well tied up and labelled.

Watch—

A common, strong, silver watch, not too heavy, with an open face and a second hand; it must wind up at the back. The hands should be black steel, not gilt, and they and all the divisions should be very clear and distinct. The performance of the watch is really a very secondary matter. 4*l.* is quite enough to give for it.—Reserve, at least two other watches of the same character; these should be rolled up separately, each in a loosely-wrapped parcel of dry clothes, say of old stockings, and they will never come to harm: they should be labelled, and rarely opened. Half a dozen spare watch glasses, fitting easily; two to each watch. Three spare watch-keys; one might be tied to the sextant-case, one wrapped up with each watch.

Compass—

An azimuth compass, graduated from 0° to 360° , and if the maker understands how to do it, have a shield of brass cut out here and there, to admit light, fixed over the glass.—Reserve, two spare glasses and a second azimuth compass.

Three common pocket compasses, from an inch to an inch and a half in diameter. Their needles must carry cards graduated, like those of the azimuth compass, from 0° to 360° , in addition to the points. These compasses should be very light in weight, have plenty of depth, and be furnished with catches. The needles should work steadily and quickly. Avoid one that makes long, slow oscillations.

Telescope—

One of $2\frac{1}{4}$ -inch object-glass, for observing occultations of small stars and eclipses of Jupiter's satellites. The buyer should test it on the satellites, and be himself satisfied of its power, before concluding the bargain.

Stands—

A clamp to screw into a tree or a block of wood for the purpose of holding the telescope or sextant; one with three legs is perfectly useless to a traveller, for he has no table or anything else to put it on.

The ordinary telescope clamp makes a very good rest for a sextant by clamping a rod of wood, one end of which is weighted as a counterpoise, and the other, ending in a neck, is pushed through an auger-hole in the sextant handle, with a lynch-pin stuck through its projecting end. Smooth action is not at all wanted for a sextant-rest.

Thermometers—

Two boiling-point thermometers. (Try them yourself against a good barometer to learn their index errors, at least; and recollect that for all purposes of determining heights, common water does just as well as distilled water.)

Two or three common thermometers, graduated to 160° at least, if for hot climates.

A pot arranged to boil the thermometer in.

Lantern—

I can only suggest a "bull's-eye," which was what I used: I wish I knew of a better. A small ball of spare wick. Oil.

Mapping Instruments—

Protractors—1 large circular brass one, 4 or 5 inches in diameter; 2 semicircular brass ones of $3\frac{1}{2}$; all graduated, like your compasses, from 0° to 360° , and not twice over to 180° .

A station pointer for protracting sextant angles.

Two or three rulers of one foot each in ivory; a small square; a set of scales; small parallel rulers; compasses with pencil and pen; small pair of reserve compasses; fine ruling pen; a dozen artists' pins. Medium size measuring tape, say 12 yards; pocket ditto, 2 yards.

Additional Instruments not necessary, but convenient—

A pedometer of the best construction.

An Adie's sympiesometer.

I cannot recommend an explorer to have anything to do with either a chronometer or a mountain barometer.

Stationery—

A light board of the very best mahogany to rule and draw upon, as large as the writing-case will hold, say 11 inches by 7.

Plenty of metallic note-books, with spare pencils, all of one size, say 5 inches by $3\frac{1}{2}$, or larger, with a leather pouch, having a flap buttoning easily over, to hold the one in use.

Two (or three) ledgers of strong ruled paper, 11 inches by 7, each with a leather binding; the pages should be numbered, and journal observations, agreements, sketches, and every single thing that is written, written in them.

Plenty of spare paper; it should be smooth, sufficiently thick, and fold up into 11 inches by 7.

A sheet of blotting-paper cut up and put here and there in the ledgers.

Tracing-paper, both black and transparent.

Blank map ruled for latitude and longitude.

Two dozen steel pens and holders; half a dozen fine drawing and holder; half a dozen FH pencils; half a dozen HB ditto.

Two penknives; India-rubber cut up in 5 or 6 bits.

Ink in abundance (ink-powders require vinegar). Red ink.

Paints, one cake or half a cake of each, viz. Indian ink, lake, cobalt, gamboge, oxgall, in a small tin case.

Half a dozen common paint brushes, one or two of which are kept in the case.

Books—

Raper's Navigation.

Nautical Almanack for current and future years, well bound.

Tables of Logarithms of Society of Useful Knowledge, well bound.

Tables for boiling-point thermometers.

Celestial Maps (uncoloured) pasted on canvas (and learn how to use them).

Three or four small 6d. or 1s. almanacks of any kind (the Nautical is far too cumbrous and on too bad paper for daily use; Hannay and Dietrichsen give a vast deal of information; the Seaman's Almanack, White's Ephemeris, &c.: they are useful to select and cut tables out of).

The best maps of the country you are going to visit that are to be obtained.

Notes on the above Outfit.

With these instruments, latitudes can easily be found to 300 yards; the sextant, mounted as it may be on a stand, will give nearly as accurate longitude as a sextant can be expected to give. When observing lunars with the larger one, the small sextant will take time at the end of each set as a check upon the watch. The telescope will give the traveller an opportunity of observing occultations of small stars, (not only those given in the Nautical Almanack, but also of others,) which is the most accurate way of finding longitude and the eclipses of Jupiter's satellites, which is the readiest way, and by no means so inaccurate a one as to be altogether worthless. For rapid reconnoitering expeditions on horseback the little sextant would be carried by a belt round the waist, and would give latitudes easily to 500 yards.

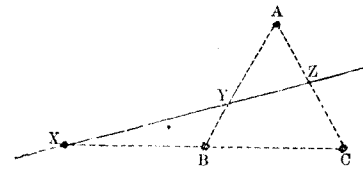
It may save trouble to others if I mention here the way which, after many trials, I adopted of observing with a sextant. During the day time I made out a list of the stars that culminated at convenient hours, and their expected altitudes. I set my watch by sunset, if it was very wrong, and spread my rug north and south in an open spot of ground, trampling down the bushes and long grass round it. Then, when the time of observing approached, I lighted my lantern and set it on the ground in front of my rug; to this I brought all my instruments, and first spreading a small cloth to the right of the lantern, I set my horizon on it, filled it with mercury, and covered it with a glass. The cloth was to catch any mercury that might be spilled. I then propped up my watch to the left of the lantern, laid down my note-book, with the leaves tied open, and taking out my sextant, adjusted it to the expected altitude, and screwing on the telescope, which always was kept at my focus, I laid myself flat down on the rug, and taking off the roof from the horizon if there happened to be no wind, and turning the glare of the lantern away from my eyes, and upon the watch, I made accurate contact of the star; then looking quickly round, I observed the watch. I now turned the lantern towards me, changed hands with the sextant, read off and wrote down, turned the lantern back on the watch and recommenced. For a meridian altitude I read off and wrote down about ten observations, both time and altitude, beginning a little before the star reached the meridian, and continuing after it had perceptibly sunk; it was thus easy to tell with accuracy what the meridian altitude really was. For lunars my sextant was always on a stand. I took time with another sextant before beginning, also two or three times during the progress of the lunar, and finally at the close of all. I was thus very independent of the good going of my watch, for by observing every half hour, no watch that went at all could

be many seconds wrong. It is of very little consequence that the movements of a stand should be smooth and steady; its object is to so hold the sextant as to retain the moon and star in its field, while the observer is reading off and writing down. Neither of my instruments were fitted to a stand, but by very rough carpentering I made two which proved of infinite service and comfort to me, and which I have alluded to under the head telescope stand. The figures upon the face of a common watch are inconvenient in reading off minutes: therefore, in the first place open the glass, and with a pen and ink make a good conspicuous dot upon each five-minute division, and should you happen to make a blot, it does not in the least matter, for a wet finger entirely removes it. Next stitch together a watch-pocket, to be used when observing; it should be padded soft behind, and expose the face of the watch after the usual way, through a round hole cut out of the middle of a cardboard front. Now draw radiating lines on the outside of this cardboard opposite to each five-minute division, never mind if they are not very accurate, and write legibly on them in italics, the numbers 5, 10, 15, &c., up to 60. Many a mistake will be avoided by doing this, for after long observing the eye becomes sorely puzzled and all kinds of misreadings are put down. If the figures on the watch dial be faint, the numbers may be written over them, or the hour hand may be shortened and a paper ring pasted on to receive the new numbers; the observer can suit his fancy in this.

It will be most in place here for me to add what remarks I would make about sextant and other observations. If you commence to observe for longitude at all, make a regular night of it, working hard and steadily, and accumulating masses of observations at one station. Taking a few observations at many stations is time thrown away. Endeavour with much forethought to balance your observations. If you have to take a star's altitude for time east, select and wait for another star as nearly as may be of the same altitude west, and use the same telescope, horizon roof, &c. If a meridian altitude be taken north, choose another star and take it south, and so with lunars. In this way your observations will be in pairs, and the mean of each pair will be independent of all instrumental and refraction errors; and by comparing the means of these pairs, one with another, you will know your skill as an observer, and estimate with great certainty the accuracy that your results have reached. Never rest satisfied with your observations, unless you feel sure that you have gained means of ascertaining the limit beyond which you certainly are not wrong. Weight all your observations; that is, when you write them down, put good, very good, doubtful, &c., by their sides. When taking occultations, if the star be not down in the Nautical

Almanack list, do all you can to identify it by drawing diagrams of adjacent stars, and indicating the point of the moon's limb that occults it. Before observing, see that the minute hand and second hand of your watch go together, that is to say, that the minute hand is truly over a division when the second hand points 0 seconds; if it be not, move it till it is.

The azimuth compass is one of a traveller's most useful instruments. To use it, it is best to make a pile of stones and lay the cover of the compass on the top, with its bottom upwards; this makes a smooth table for the azimuth compass itself to be moved about on. Be on guard against magnetic rocks; it may happen that the bare peaks of high hills, which are the best of places for observing from, and which a traveller often makes great sacrifices to reach, are found so magnetic as to make compass observations worthless. The little sextant should always be taken up on these excursions. It is of little use in a wild country to devote much time to getting accurate bearings, as the landmarks themselves are rarely well defined: the main endeavour should be not to mistake one hill for another, to judiciously select good angles, and to carry on more than one independent scheme of triangulations at the same time, by comparison of which the accuracy of the whole may be tested. It is surprising how much work may be thrown away by want of judgment; and also how much may be done, with very little trouble, by a person who has acquired a good eye and memory of country. The daily difficulty of an explorer is to triangulate without leaving his caravan: to do this he must note the bearings of hills when they are in conjunction, and also when he happens to be in a straight line between them.



Thus, in travelling along XYZ, the hills ABC can be mapped; for at X, or thereabouts, the bearing of B from C can be determined; at Y that of A from B; and at Z that of A from C; and so on for any number of hills. And it is very important to recollect that it is not necessary to catch these lines of sight precisely; for by taking bearings twice, and the intermediate course approximately, there are sufficient data for protracting out upon paper the required bearing. Thus, as soon as the peak of a distant hill is about to be occulted by the shoulder of a nearer one, a bearing should be taken; and again another one as soon as it has reappeared on the other side, and the intermediate course noted.

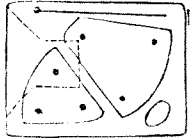
Suggestions for carrying the above Instruments.

Wear a leather belt $1\frac{3}{4}$ inches broad round the loins, to the outside of which, besides any other pouches that you may wish to carry, the leather case of the azimuth compass and the leather pouch of the note-book are sewn. The place for the compass is against the small of the back; for the note-book, behind the right hip. The other instruments must be carried in cases. I have tried many ways myself, and if I were to start again on a journey I should adopt the following. First, I should divide the instruments into three groups, A, B, and C., of which I give the average weights:—

A.	Weight in lbs.
Five-inch sextant	2
Three-inch sextant	$1\frac{1}{2}$
Horizon trough, bottle, and roof	$2\frac{1}{2}$
Thermometers and watch	$\frac{3}{4}$
Loose sheets of tables, a ruler, protractor, compass, and pencil, spare watch glass	$\frac{1}{2}$
	7
B.	Weight in lbs.
Telescope (about)	4
Lantern	$1\frac{1}{2}$
Light stand and counterpoise	2
Spare oil	$\frac{3}{4}$
Pot for boiling thermometers	$\frac{1}{2}$
	8 $\frac{1}{4}$

C.
Almanacks, maps, tables, mapping instruments, &c.

I should next fit up a common deal box, as a model, for group A., and would follow the general arrangement of the sketch, differing from it only so far as peculiarities, in the particular instruments bought, might render necessary. The horizon apparatus would slip into a separate compartment which did not communicate with the interior of the box, for fear of any mercury getting loose upon the instruments; its position is dotted out. The dark lines show the sizes of sextant boxes as usually made, so that plenty of room is allowed in the sketch for horse-hair stuffing. The small sextant I should pack in its leather case; for the larger one I should take no case at all. The thermometers, thrust into a thin tin case, would go along the upper part of the box, and a watch in the right hand lower corner: the size of the whole inside measurement is 11 inches by $7\frac{1}{2}$, and about 4 deep. Having satisfied myself that the fittings of the box were secure and convenient, I would have a light one made of painted tin after its model; it should lock, and also have hooks to secure the lid, even when it was not locked. Places should be made for leather handles, one to go at each end of the box, and two, crossways, on the top. Its weight would be in all 4 lbs.—the box a little less than 3 lbs. and the stuffing rather more than 1 lb. This accomplished, I would order two more boxes of the same length and breadth, one of them of 4 inches deep to hold group B, which might be arranged with the telescope along one side, the lantern and thermometer pot end to end along the other, and the stand and counterpoise between them, while a flat oil-can an inch deep extending the whole breadth and depth of the box, or 7 inches by 4, would fit in a narrow compartment at one end. The third box should be a kind of writing-desk, and of a depth sufficient to hold group C, say 6 inches. The fitting up of this would be entirely a matter of fancy. Lastly, I would have



a couple of thickly-quilted canvass bags, in which the boxes A and B might be slipped endways. Each bag should have a flap to button down, be painted some light colour, and have strong loops sewn at the four corners of its back. The weight of each bag would be $1\frac{1}{2}$ lbs. Thus, A, box, bag, and all, would weigh $12\frac{1}{2}$ lbs.; B, 14 lbs. These weights are certainly heavy, but they are practicable, and each package is very convenient for carrying as a knapsack or in any other way. For ship, boat, or waggon travelling, a light wooden chest should be procured which would just hold the three boxes, and then putting the quilted bags at the bottom, the boxes would lie one above another as the trays in a canteen. As a protection against the fearful jolting of a waggon, it would be advisable to inclose the chest in a large pannier and loosely to stuff up the interval between them with sacking, clothes, or anything else at hand. The outside measurement of the chest would be 13 inches long, 9 broad, and 15 inches deep; those of the pannier 5 inches larger every way.

Hints for Collecting Geographical Information.

1. *Aspect.*

1. What is the general aspect of the country?
2. Mountainous or hilly?—Sharp peaks or rounded outlines?
3. Of the coast? Abrupt or shelving? Rocky or in cliffs?
4. Downs of Sand? Low or flat?
5. Any active volcanoes? or traces of extinct ones? or their probable forms in the outline of the mountains?

2. *Surface.*

1. Is the surface level or undulating?
2. Has it a tendency to table lands, or steppes?
3. Is the soil rich or poor? loamy—sandy—boggy?
4. Are the plains fertile or barren? wooded or cultivated?
5. What its general capabilities?

3. *Physical Divisions.*

1. Note the chief divisions of the country.
2. Mark especially the line of separation of waters.
3. Trace the outlines of the principal basins of the chief rivers.
4. Group the country into basins as far as practicable; it will be found the simplest mode of describing it.
5. Trace also the limits of the secondary valleys comprising the tributaries to the main stream.
6. May they from position be called upper and lower basins?
7. Do distinct traces of mountainous—hilly—flat—wooded jungle—cultivated—sandy—marshy, or barren, country exist? if so, note their limits generally.

4. *Mountains.*

1. What the direction of the chief range, or ranges?
2. What the general form of outline? (Describe while in sight, *not* from memory.)
3. What is the *estimated* height (if no measurement can be had) of the chief points; and also of the general range?
4. Are any of them snow-capped? (State the season.)
5. How far down does the snow extend? (Note north or south side.)
6. Are they wooded?—At what height does the wood finish?

7. At what height does vegetation cease?
8. Are the mountains in groups or masses? or detached?
9. Obtain bearings, by compass, of the limits of the range, and of all remarkable points, masses, gaps, &c.
10. Mark the chief mountain-passes, and note if they might be easily defended against an enemy.
11. What their general structure?

5. Rivers.

1. What are the native names of the chief rivers?
2. Trace the general course of each; with its windings, if possible.
3. Does it receive many tributaries? note their names in order, from its sources, distinguishing on which side they join.
4. Is it navigable for large or small craft? and to what extent?
5. How far up does the tide reach? Is the current rapid? What its rate?
6. Does it flow by several outlets, or by one grand mouth to the sea?
7. Does it form a bar, or banks, or islands at its mouth?
8. What the width of the river at its outlet? and at various points?
9. Is the river ever fordable? Name the chief fords.
10. Does it form cascades, or rapids, or occasionally inundations?
11. Does it at any season lose itself in sand, or otherwise not reach the sea?
12. Does it flow from a lake, or from other sources or springs?
13. What may be the probable elevation of its source above the sea? measured or estimated?
14. Is the bed of the river gravel, sand, or mud? Does it bring down much detritus?
15. What the colour of the water? Does it retain it at any distance from land?
16. Is the river obstructed by islands, shoals, rocks, snags, or any obstacle to steam navigation?
17. Are its banks wooded? Is fuel easily procured?
18. Does it abound in fish? and in what species?
19. Is it navigated by native boats? and how far up?
20. Describe each affluent as a main stream, with its tributaries, marking the position of junction, and the angle at which it joins its recipient.

6. Lakes.

1. What the native names of the lakes?
2. What is the situation and extent of each?
3. What its level, above and below the sea? How ascertained?
4. Is it formed by rivers or springs? or does it feed any river?
5. Is it of salt or fresh water? Is it said to rise periodically?
6. What its general depth of water?
7. Are there any vessels or boats upon it? and of what size?
8. Are its banks rocky or steep, or low? Are they wooded or barren?
9. Could fuel be readily procured? Does it offer facilities, or the contrary, to steam navigation?
10. Are its shores thickly inhabited? Are birds, fish, shell-fish, &c., plentiful, and of what sort?
11. Are any marshes or ponds known, and where? Are they constant or periodical?

7. Sea Coasts and Ports.

1. Does the coast form gulfs, bays?
2. Promontories, peninsulas, capes, low points, &c.?
3. Is it abrupt, bold, rocky? or low, flat, and shoal?
4. Are there currents along the coast? Note their force and direction.

5. Name the chief *ports*. Are they secure harbours, or only open bays, or roadsteads for anchoring?
6. What the depth of water, and what bottom for anchoring?
7. Is the port capable of containing many vessels? Does it offer facilities for repairs?
8. Can water, provisions, and fuel be easily procured?
9. Note the time of high-water at full and change of moon, and rise and fall of tide; and direction and velocity of stream.

8. Volcanoes and Mineral Springs, &c.

1. Are any now active? or, are there traces of extinct volcanoes?
2. Give their position—height above the sea—and native names.
3. Does tradition or history record any eruption? at what date?
4. Was the eruption of fire, lava, scoræ, water, or mud?
5. Are earthquakes frequent? Are there records of any having occurred?
6. What were their effects? how far did they extend? any up-heaving or depression of land recorded?
7. Are many *mineral springs* known? Hot, tepid, or cold? (Note the temperature if possible.) Are their waters used medicinally?
8. Do they form deposits? Siliceous or calcareous?

9. Maps, Charts, &c.

1. Do any charts of the coast, or maps of the country, or partial surveys exist? Native or otherwise? What their respective dates?
2. Are they believed to be accurate? Upon what scale?
3. Endeavour to map the country, starting, if possible, from a fixed point; if exact observations cannot be obtained, give compass bearings, and estimated heights and distances. (N.B. Heights may often be obtained by length of shadow, &c.; distance by velocity of sound, &c.) The scale of one inch to a geographical mile is recommended.
4. Take bearings of all remarkable objects in sight from any known station, as mountain-peaks, masses, gaps, towns, villages, forests, &c. &c., and transfer all to paper immediately; trust nothing to memory.
5. Preserve all original observations and documents relating to surveys; and make two or three copies of observations.
6. Obtain correct *native* names if possible, and keep to one standard of orthography. Mark all hearsay information with the initials of the informant. If a journey is made by night, or in foggy weather, trace it with coloured ink.

10. Astronomical Observations.

1. Are any positions astronomically determined? What reliance may be placed on them?
2. It is very important to obtain observations for the position of all capes, headlands, points, towns, villages, &c.; mountain-peaks, passes, limits of range, &c.; lakes, sources, confluence, and outlets of rivers; in short, of every remarkable object.
3. Endeavour to obtain the *latitude* by meridian altitude of the sun, or of a planet, or of a star, or of the moon.
4. *Longitude*—by eclipses of Jupiter's satellites, especially by eclipses of the third and fourth satellite, when both immersion and emersion can be observed,—or by any other eclipse; by moon culminating stars; by occultations of fixed stars by the moon; by lunar distances from the sun, or a planet, or a star, always East and West when possible; by an altitude of the moon in the prime vertical; or by chronometers:

state always by which method obtained, and what reliance may be placed on it.

5. Observations on the variation of the compass, and dip of the needle, are very important.

Instruments.

A repeating circle, or sextant of five-inch radius; a pocket sextant; an artificial horizon; Kater's compass; two mountain barometers; and two thermometers, with a good pocket chronometer; are sufficient for all common purposes.

Meteorology.

1. Keep an exact register of the barometer and thermometer.
2. What are the prevalent winds? What the periodical?
3. What the average fall of rain?
4. What the amount of evaporation, &c.

Natural History.

1. Note the geographical distribution of man, animals, birds, fishes, insects, plants, &c.
2. Obtain information on all branches of Natural History, bearing in mind that the useful and practical is of more importance than the merely curious.

For detailed instructions, under each head, recourse should be had to the respective sources.

Ethnography.

1. Obtain vocabularies of the native language—phrases rather than single words. Keep to a fixed standard of orthography in writing them down: the sounds of the vowels in *father—there—ravine—mole—lunar*, are recommended as the most simple, and as being both English and European.
2. Note the habits, manners, customs, and amusement of the natives.
3. What notion have they of a supreme being? what of a future life? what, if any, their religious ceremonies?
4. What their treatment of the aged, of the sick, and of children?
5. What seems to be the form of government? Is division of property recognised? Do they buy and sell land?
6. Do they trade or barter with each other, or with strangers?
7. Note the number of natives seen from day to day, distinguishing the sex, and children.
8. Are there many lunatics or idiots?
9. What the usual form of feature? the shape of the skull? hair? colour? stature? bodily constitution?
10. Is plurality of wives common? are women without husbands frequent?
11. Have they any marriage ceremonies? how do they treat their wives?
12. Do they give proof of capacity for civilization?
13. May the natives be trusted as guides—as messengers—or to procure food?
14. What presents please them best?
15. What words or signs do they use when hostile? or when friendly?
16. What are their dwellings? What their chief articles of food?
17. What their disposition—savage or gentle; rash, hasty, or inoffensive? Are they disposed to receive instruction?
18. Are any cases of cannibalism reported? N.B. To investigate strictly under what circumstances they occurred.
19. Are the people said to be increasing or decreasing?
20. Does slavery exist? What is the condition of a slave?

21. What are their diseases? What their medical treatment?
22. Can the traveller point out the most probable mode of civilizing and benefiting the natives?
23. What traditions are current respecting the origin of the people?
24. Collect all information that can throw light on the migration of nations.

N.B. The greatest forbearance and discretion are strongly recommended in all intercourse with the natives—never to allow an imaginary insult to provoke retaliation which may lead to bloodshed. It must be borne in mind their's is the right of soil—we are the aggressors.

DESCRIPTIVE GEOGRAPHY.

Names of Country.

Boundaries.

Configuration of Surface—

General Character; Mountains; Plains; Valleys.

Names, Passes, Culminating Points, Snow-level, Altitudes, Peculiar Phenomena, Outline of Base and on given Contours, Sections, Latitudes and Longitudes, Bearings and Distances.

Hydrography—

Rivers and Tributaries.

Course and Windings, Length, Section of Fall, Navigable Extent, Tidal Extent, Soundings, Velocity of Current, Banks, Fords, Inundations.

Lakes.

Outline, Sections of Depth, Feeders, Outfall, &c.

Marshes; Seas; Coasts; Harbours; Drainage Areas.

Topography and Itineraries.

Meteorology—

Winds; Rainfall; Temperature; Atmospheric Pressure; Evaporation; Meteoric and Magnetic Phenomena; Methods of Observation and Registration.

Zoology—

Species found in Country; Distribution of Animals; Useful Animal Products, Wild and Domesticated; Directions for Collecting, &c.

Botany—

Species found in Country; Distribution of Plants, &c.; Useful Vegetable Products, Wild and Cultivated; Directions for Collecting, &c.

Geology—

Geological Formations; Mineral Products; Soils; Directions for Collecting, &c.

Physical Divisions—

High and Low Lands; Drainage Areas; Forests; Heaths; Barren and Cultivated Ground; Pastures; and other divisions based on Geographical Distribution.

Cartography—

Examination of Existing Maps, Contributions to Cartography, Construction of New Maps, the Methods of Geodesical and Astronomical Observation.

ETHNOLOGY AND STATISTICS.

Population—

Names of Nation, Tribe, &c.; Geographical Distribution; Total Number; Number of families, &c., Males, Females, Children; Characteristic Form,—dimensions, weight, colour, odour free from uncleanness, hair, features; Unnatural modifications of form,—by pressure, mutilation, incision, &c.; Moral and Intellectual Character; Diseases,—corporeal and mental; the Generation, Development, and Vitality of the Population; Classifications of Population; Condition of various classes.

Habitations—

Distribution, Character, Number.

Communications—

By Land and by Water.

Occupations—

Pastoral, Agricultural; Maritime, Arts, Manufactures, Trades, Commerce, &c.; Ceremonies, Amusements, &c.

*Food; Costume; Utensils; Weapons and Warfare; Weights, Measures, Division of Time.**Language—*

Literature, Books, MSS., Inscriptions, Picture Writings, Songs, Tales, &c.; Vocabularies of natural objects, qualities, action, relationship, numerals, pronouns, positionals, &c.; Grammatical Variation of Words; Construction of Sentences; Dialectic Variations; Intonation and peculiar Utterances; Geographical Distribution of the Language.

Music—

Vocal and Instrumental.

*Religion; Traditions.**History—*

Origin, Migrations, Increase and Decrease of Territory.

Government—

Territorial Divisions, Laws, Functionaries.

Foreign Relations.

INDEX

TO

VOLUME THE TWENTY-FOURTH.

- Abdallah Aga, 43, 44, 45.
 Abdallah-bnu-Huweishid, 129.
 'Abeih, 1.
 'Abil, 24.
 Abila, 29.
 'Abilin, 8.
 Abimelech, 19.
 Aboo Alfedà, 128.
 — Hanifà, 125.
 — Mansoor, 172.
 — Sa'd, 153.
 — 'Ubeidà, 153.
 — Zeid, 166.
 Abu Sa'ud, 13.
 Abyssinia, 145.
 Abyssinian shore, 231.
 Achioli, 51.
 Acrabattene, 18.
 Aculfus, 22.
 Aden, 225, 226, 228, 229, 232, 233, 237.
 Adonis, 34.
 Adrianople, 36, 40, 46, 62, 70, 73.
 Adrob, 128.
 'Aduân, 141, 158, 192.
 Aeng, or Kyuk-phu, 86.
 Ænus, 45.
 Afka, 34.
 Africa, 116, 117, 227, 234, 300, 340.
 Agà, 167, 168, 171, 173, 174, 175, 176,
 181, 190, 193, 198, 207.
 Aga chain, 142, 159, 200, 201, 205, 206.
 Agrianes, 45.
 Agrippa's kingdom, 30.
 Agrood, 115, 116, 117.
 Ahdung-dÿn, 114.
 Ahi Heit, 131.
 — Sha'r, 131.
 Ahlyic, 70.
 Ahmad Alkubbà, 127.
 Ahmed Effendi, 48.
 Ai, 18.
 Aianus, 52.
 Aiasma, 77.
 Aidos, 36, 46, 48, 49, 50, 51, 55, 56, 57,
 63, 69, 82.
 'Aiha, 27, 28.
 'Ain el-Tin, 23.
 — Haniyeh (St. Philip's), 17.
 'Ain Jürfa, 27.
 — Karim, 17.
 — Künyeh, 26.
 — Yälo, 17.
 Aivachik, 52, 55, 80.
 Ajalon, 11.
 Ajanus, 52.
 'Ajeltân, 35.
 'Akabà, 129, 213, 232. See Al'akabà.
 Akäre, 287.
 Akdéré, 52.
 Akeli, 58.
 — Kamehik, 76, 78.
 Akhli, 49, 50, 51, 53, 54, 55.
 Akhlioli, 56, 63, 69.
 Akhoung, 102, 112.
 'Akka, 5, 6, 7, 8, 9, 34.
 Akra, 14.
 'Akrabeh, 18.
 'Akür, 17.
 'Aküra, 34.
 Akyah, 86, 87, 88, 90, 91, 98, 101, 104,
 105, 107, 113, 114.
 Al'abdé, 190.
 Alablak, 146.
 Alahkáf, 173.
 Alahsä, 135, 173, 180, 186.
 Al'akabà, 115, 123, 125, 129, 203.
 Al'aläg, 143.
 Al'aleim, 160.
 Al'amälik, 176.
 'Alam Alsa'd, 160.
 Al'arabà, 118, 119, 130.
 Al'ärid, 204.
 Al'aroods, 143.
 Al'awärid, 129.
 Al'awgà, 190.
 Al'awig, 151.
 'Aläwîn, 117, 132.
 Albasrà, 169, 170, 172, 174, 188, 192.
 Albatin, 138, 170, 175, 176.
 Aldahnà, 169, 170, 173, 187.
 Aldähanc, 171.
 Aldalhamiyé, 143, 144, 146.
 Aldarräg, 177.
 Alder, 141, 142, 146.
 Aldrich, Col., 13.
 'Aleimá, 128.