

Report on the River Indus, (Sections 1 to 5.) By *Lieut. Wood, Bombay Marine.*

I.—*A General View of the Indus.*

This report is confined to the navigable Indus, or that portion of the river lying between the Sea and Attock.

Throughout the whole of this distance, the river is known as the *Sinde*, sometimes indeed it is called the *Attock*, but this latter designation is local in its application. I have retained both, and apportioned them as follows :—

The Lower *Sinde*, or *Indus*, extends from the Sea to *Bukkur*.

Upper *Sinde*, or *Indus*, extends from *Bukkur* to *Kalabagh*.

Attock from *Kalabagh* to *Attock*.

By dividing the river into these sections, each is made to mark certain important alterations in the navigable character of the stream.

It may here be premised, that of the course of the river North of *Attock*, our knowledge is confessedly superficial. A few miles above that fortress the *Indus* ceases to be navigable ; but not before it has received in the *Cabool* river a tributary, that further extends the advantage of water carriage to the West,—the most important of all directions.

Source.—To what Lieutenants *Burns* and *Macartney* have written on the subject I have nothing to add, unless *Moorcroft's* travels settle the question. The source of the *Indus* is still a problem to be solved.

In the plain above *Attock*, the *Indus* is divided into many branches, but abreast of that fort they all unite. One deep, narrow, clear, blue stream, shoots rapidly past, and at once entering the hills, disappears from sight. Among hilly groups it winds to *Kalabagh*. At *Mukku*d the channel widens, and the expanded river flows quietly forwards with a lessened velocity, and a reduced depth. On escaping from its rocky bed the river enters a level country, through which it winds onward to the sea. Its boundaries are now those of the valley ; the *Soliman* mountains are on one side, and the *Indian* desert on the other.

Length of Course.—From the Sea to *Attock*, the distance in a straight line is 648 miles.

By the River it is increased to 942 miles.

Breadth of the Stream.—The width of the surface water in the dry season, varies from 480 to 1600 yards; the usual width is about 680 yards.

Depth.—When the river is in full freshes twenty-four feet; but in an opposite season of the year, nine, twelve, thirteen, and fifteen feet are the usual maxima of its soundings. The greatest depth of water in the Indus occurs between Kalabagh and Attock; one hundred and eighty-six feet has been here sounded.

Velocity.—Seven knots an hour in the freshes, and three when the river is low. It is scarcely necessary to remark, that the three last items are very inconstant. At no two places are the measurements exactly alike, nor do they continue the same at one place for a single week. A more particular account of these will be found under the next head.

Fall per mile.—From Attock to Kalabagh, 20 inches.

Ditto Kalabagh to Mittun, 8 ditto.

Ditto Mittun to Sea,* 6 ditto.

Discharge per second.—Cubic feet Maximum—

in August, 446,080

Maximum in December, 40,857

Annual Discharge.—5,383,600,934,400—or 150,212,079,642 tons avoirdupois.

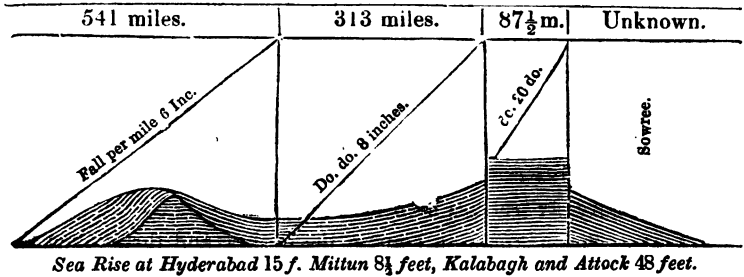
Power of Transport.—Rolled pebbles do not occur in the bed of the Indus below Chandia-ke-kote, a village five miles South of Kalabagh. Above Kote, though not below it, the sand of the Indus is searched for gold. The precious mineral is also found at Dera Ismail Khan; but not in the river.

It is washed down by the rains from the Soliman mountains. Pebbles also occur at a certain spot in the river below Hyderabad, in Lower Sinde; but they can be traced to hills in the neighbourhood.

Height of the River's Banks.—Assuming for the purpose of explanation that the source and the embochure of the Indus are upon the same level, the river in its long course may be said to have two maxima of rise. These are shewn in the following sketch, where the measurements are those of the stream when in full flood.

* The fall of the river from Mittun to the Sea is from Captain Burnes' Memoir of the Indus.

Distance by the River.



The rise between Kalabagh and Attock cannot be called natural ; it is caused by the contracted bed, into which the stream is here thrown among the mountains. The rise at Hyderabad is the result of a carefully kept register daily ; but at the other places, this item has been reduced from an examination of the river's banks, and the best information I could procure.

Colour and Temperature.—To Dera Ismail Khan, the water of the Indus is of a lead colour ; below that town it becomes of a dirty whitish yellow, tinged with red. In the freshes the red tint is heightened ; but the general colour continues the same.

Between Attock and Mittun, all the streamlets that fall into the Indus are of a bright red ; save the Hurroo and Toe, which have pebbly beds and clear water.

Temperature of the River.

Months.	Air.	River.	Remarks.
February,	69° 2'	64° 2'	Noon observations in the parallel of 24° 0' North.
March,	90° 0'	78° 0'	
April,	97° 0'	81° 0'	
May,	100° 0'	84° 0'	
June,	101° 0'	87° 0'	
July,	95° 5'	88° 0'	
August,	95° 7'	88° 0'	
September,	94° 5'	86° 0'	

II.—*Navigable character of the Indus.*

Between the Sea and Attock the facilities for navigation are not everywhere equally great. They vary with the state of the river's bed. As an acquaintance with the one may contribute to a know-

ledge of the other, I shall apportion the river into sections corresponding to its capabilities, and afterwards indicate the character of the present method of navigating the stream.

The Delta.—As high as the influence of the tide extends, there will always be an ample depth of water for even vessels of a greater draft than those elsewhere described as the best and only boats suited to the river under all circumstances.

It reaches to Nooroo-kanand, a village on the left bank of the river below Tatta. But above this navigation is intricate, nor does it materially improve till beyond the *Delta*.

This is owing to the great expansion of the river's bed, where among the numerous channels that present themselves, it is not always an easy matter to select the right one. No great inconvenience is felt on this score by the vessels now upon the river, for whether they ascend it laden, or in ballast, dragged by the track rope, or propelled by the breeze, their progress is so slow that they may be said to feel every inch of the way.*

From the Delta to Sehevan.—This is the best portion of the river, and the *Pulla* fisherman as he floats down the centre of the stream, proclaims the fact. The pole to the lower extremity of which his net is fastened, measures from sixteen to twenty-two feet, and according as this may be in March or August, either eight or fifteen feet of its entire length is immersed in water. Two rocky ledges occur in this section; both project from the right bank of this river, and are found, one under the village of Jeskh, and the other at the north end of the Hilaya reach. Both are under water in the swell.

Sehevan to Roree, or Bukkur.—As the character of the last section was determined by the avocations of the fisherman, so may be that of this one. The fishing pole is no longer in general use; but among the shallows in the middle of the stream, men armed with creels, shaped like inverted cones, may be seen busy at work ensnaring the *pulla* fish. Here then it may be presumed, the depths are too irregular for the employment of the former method. Such is the cause, and thus does the practice of the fisheries on this river become an index to the state of its navigation.

Bukkur to Mittun.—A great change here takes place in the character of the river. The stream at Roree, though at some places it may

* See Appendix, Table V. for the soundings of this and other sectional divisions.

be found in a single bed, is more often divided into two or more parallel branches, from 400 yards to four miles apart. Where the former is the case, (at Mittun-kote and for some distance below it, for example,) the channels are more mazy and intricate than where its volume, as in the latter instance, is apportioned among a number of branches. These changes in the configuration of the river are met by a corresponding alteration in the build of the boats. A new description of vessel, called a *tohruk*, of a less draft than the *doondah*, is now the common cargo boat. Where the other is retained, its size is reduced. *Doondahs*, it will be afterwards shewn, requiring five feet and half an inch to float them, are in use upon the river below Bukkur; but above that fort, I have not met a single boat of a draft exceeding three feet nine inches.

Mittun to Kalabagh.—The Indus in this section, as high as Dera Ismail Khan, is equally well suited to navigation, though not better than that last described. It also in some degree resembles that section in its parallel branches and broad bed. Between Dera Ismail Khan and Kalabagh, the difficulties of the navigation increase.

Kalabagh to Attock.—The downward voyage may be made throughout the year; but from April to October the passage is hazardous, and rarely attempted. Boats at all seasons may ascend as high as Sharkee, a village on the right bank of the river, a few miles above Mukkud, but between that and Attock the upward navigation is restricted to the winter months, and even then a boat must have a double crew, and be of a build that does not obtain below Kalabagh, called a *dug-gah*. For a description of this vessel see the 7th article in this Report.

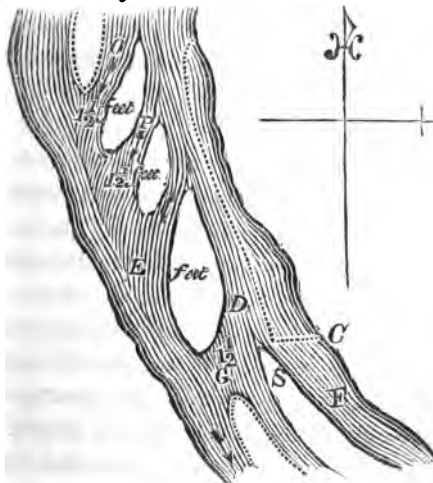
III.—Of the Soundings in Indian Rivers.

After having sketched the greatest capabilities of the Indus from the draft of its boats, it will not be necessary to enlarge in this place on the nature of its soundings. South of Mittun-kote I have inserted, under sectioned heads, specimens enough to shew the characters of the Channels,* referred to. A table marked maximum, minimum, &c. is quite the thing for a thermometrical register; but such a formula for soundings, when applied to an Indian river, mars its own object,

* See Appendix, Table V.

unless indeed it be based on the accumulated experience of years. That I do not therefore crowd these pages with figures, is from a firm conviction of their inutility. They are in fact positively injurious; for when a practical man at a distance casts his eyes over the contents of a table, purporting to give the soundings in a river's channel, and finds the least depth to be two fathoms, he very naturally concludes that a boat constructed to draw only nine feet, will navigate the said river. No conclusion could be more erroneous, the reasoning is suited to the equable streams of the new world; but not applicable to the ever-changing channels of our Indian rivers. To what other causes can we attribute that crude digest of a prospectus for introducing steam upon the Indus for commercial purposes, that lately reached this country from England, authenticated by names of the first rank and respectability in the mercantile world? One of the articles in the proposed Joint Stock Company provided for stationing a ship of one thousand tons, (an old East Indiaman,) as a depôt inside the river. Such a vessel could hardly come in sight of the Sindian coast. Lieutenant Charles' survey of the mouths of the river has made us acquainted with their actual condition, and in another part of this report, what should be the draft of the Indus Steamers;* and this decision is the result of a most careful examination of the river, both in its dry season and during its freshes.

Sketch of a Reach below Sehewan.



* See the 8th Article in this Report.

IV.—Of the mode of Navigating the Indus.

The diagram on the preceding page, represents a reach of the river below Sehewan. The better to illustrate the figure, I shall suppose a boat deeply laden at the village Y is about to start on the downward voyage, and that her "*meerbar*," or man in charge of the boat, is a stranger to the river. Leaving the village, he would doubtless take the large channel indicated by the colored arrows, without regarding, if indeed they had been seen, the numerous offsets on the right hand ; when abreast of the shoal S, a decrease in the depth of water would for the first time apprise him of his having lost the fair channel, and shortly after this intimation had been received, the boat would ground on the bar G. Now by inspecting the sketch, it will be seen that between the villages X and Y, the deep channel has shifted from the left to the right bank of the river. The alteration has been effected by the silent drainage of the lateral channels O, P, E, and D, and by the unperceived departure of a large body of water over the bar extending from S to G into the back water F. E is the passage the boat should have pursued ; but this knowledge could only have been the result of a previous careful examination, appearances at starting being decidedly in favour of channel D. The nature of these changes will be rendered still more evident, by inspecting a section of the river's bed. Take for example the following :—

1st. Channel.

2nd. Channel.

$\overbrace{3.4.4\frac{1}{2}.4\frac{1}{2}.3\frac{1}{2}.2\frac{1}{2}.2.}$
 $\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}$
 $\overbrace{1.1.1.}$
 $\frac{1}{2}.1\frac{1}{2}.2.2\frac{1}{2}.2\frac{1}{2}.2\frac{3}{4}.$
 $1.1.1.1.\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{3}{4}$

3rd. Channel.

$\overbrace{1\frac{1}{4}.1\frac{1}{2}.1\frac{1}{2}.2.2.1.\frac{1}{2}}$ fathoms. Such a line of soundings is not uncommon, though this one differs from the usual section in having an additional channel, two being the more usual number. The junction of these is not effected at a particular spot, but is, on the contrary, the result of a parallel course of many miles, during the whole of which distance the change is gradually being effected. They thus imperceptibly glide into each other ; and should the channel selected by a boat descending the river, be that which the stream is in the act of abandoning, she must be moved into the new formed channel as soon as a decrease of soundings gives warning of the fact. Now it is deserving of remark, that when the necessity of change first becomes apparent,

there is seldom more than three-quarters of a fathom water on the spot separating the channels. Whether alterations in the channels of other large rivers are brought about in a similar manner, I am not aware ; but this peculiarity, if it can be so termed, is familiar to the boatmen on the Indus ; and with a description of the manner of their meeting it, and of the precautionary measures to which it gives rise, I shall conclude this notice of its navigation.

No vessel with cargo on board makes a downward voyage unaided by a pilot boat ; it is called here *sooee*, or guide. These are small cheap skiffs managed by a couple of men, one of whom standing on a platform in the bows gives the depth of water, while the other, with his scull over the stern, steers the boat. Cheap as the services of a pilot may be had, the protracted length of the voyage makes it a burden too weighty for a single cargo to bear, and the custom therefore is, for boats to drop down the river in fleets, or by divisions, when *sooees* become so multiplied, that to every two or three large boats a tender is attached. Grain being the only freight, all shipments are made at a stated season of the year ; and as the quantity of corn produced on the banks of the Indus in autumn far exceeds that cut down in spring, the winter fleet outnumbered in an equal proportion that which takes its departure about midsummer. In February 1837, when the river was at its lowest level, I counted forty-two grain laden boats pass Sehewan on their way to Hyderabad, whither the surplus of the Upper Provinces is yearly exported.

The largest of these boats drew five feet and half an inch of water, and the manner of conducting the fleet was as follows:—When the day's stage has been fixed, a detachment of *sooee* went ahead to sound, into each boat there being, besides her own small complement, two or more of the *doondah's* men. On their arrival all is bustle and noise in the fleet. The fastenings of the boats are cast off, the oars are plied, and the huge hulk, preceded by her guide, shears out into the stream.

If the *meerbars* have confidence in the channels, and the wind be fair, a large square sail is set, and the unwieldy *doondah*, deep though she be, outstrips her tender, and seems to skim the surface of the water ;—such a fleet in motion is worth seeing. First, the large white sail of the headmost boat is discovered at the top of the reach, then another,

and another, until the surface of the river becomes studded with those uncouth, yet really interesting objects. As may be supposed, this mode of navigation is tedious, the daily stages not averaging more than from ten to twenty miles. Delays too are not unfrequent in the dry season; but never exceed fifteen days, and rarely extend to half that number.

When there is a prospect of a long detention, it is customary for large boats to transfer a portion of their cargo into smaller ones, and take it on board again when the shoal water is past. In high wind, the boats remain fast by the bank of the river. The two following Tables are inserted in illustration of the above remarks:—

Tables, shewing the cargo draft of the largest boats upon the Indus, with the least water in the continuous channel, during the dry season of 1837.

Class of Boats.	Draft of Boats.		Gunwale above water line.	Places.	Channel.	
	Ft.	In.			Ft.	In.
1st Class,	5	0½	10 Inches.	Gooloo,	3	8
2nd ditto, ..	4	9	9 ditto.	Lillong, ..	4	4
3rd ditto,	4	3	9 ditto.	Mycotta, ..	4	8
4th ditto,	3	3	7 ditto.	Bulalpoor, .	4	1
5th ditto,	3	0	5½ ditto.	Kaira,	4	8

The places in the above Table are all situated between Sehewan and Roree; but they furnish a good example of the depth in other places.

Boats descending in the freshes, proceed as above described. In this season the length of the voyage is much shortened, though attended with considerably more risk. A pilot is still required; but a previous examination of the channel is not always considered necessary.

The following Table gives a statement of the downward voyage at opposite seasons of the year. It embraces the whole navigable extent of the river, and includes Pilotage where such a custom prevails. The voyages are such as are rarely performed even by Sinde boats, even when the river is clear, and other circumstances favourable.

The Downward Voyage.

Stages.	Dry Season.	Freshes.	Pilotage.
Attock to Kalabagh,	1½ Days	1 Days	—
Kalabagh to Dera Ismail Khan,	7 ditto.	2 do.	6 Rupees
Dera Ismail Khan to Dera Ghazee Khan,	10 ditto.	3½ do.	6 do.
Dera Ghazee Khan to Mittun,	4 ditto.	2 do.	3 do.
Mittun to Roree,	6 ditto.	3½ do.	a boat 18 Rs.
Roree to Sehewan,	7 ditto.	4 do.	do. 16 do.
Sehewan to Hyderabad, ..	3 ditto.	2 do.	do. 12 do.
Hyderabad to Sea,	2½ ditto.	2 do.	do. 12 do.
Total	41 Days.	20 Days.	

The upward voyage is performed by the aid of the wind and track rope. This last mode of procedure is slow, but certain; and averages about eight koss, or thirteen miles, a day. With a strong favourable breeze, the daily progress is increased to twelve and eighteen koss. The prevailing winds during the year, and their consequent influence on the navigation of the river, are given under the next head, and it will there be seen that the freshes, far from presenting any obstacle to the upward voyage, are more favourable to it than otherwise. During their continuance, a south wind blows from the sea to Kalabagh; and though less steady on the Upper Indus than in the lower part of the river, it is a great service to navigation, since the time consumed by an up-river voyage, in the dry season, may be stated as one-half in excess of that required to perform it in the swell. Annexed is a Table, shewing the relative time occupied by the voyage at opposite seasons of the year:—

The Upward Voyage.

Stages.	Dry Season.	Freshes.
Seaport to Hyderabad,	15 Days.	7 Days.
Hyderabad to Sehewan,	8 ditto.	4 ditto.
Sehewan to Roree,	14 ditto.	7 ditto.
Roree to Mittun,	14 ditto.	6½ ditto.
Mittun to Dera Ghazee Khan, ..	10 ditto.	4 ditto.
Dera Ghazee Khan to Dera Ismail Khan,	11 ditto.	10 ditto.
Dera Ismail Khan to Kalabagh, ..	12 ditto.	7 ditto.
Kalabagh to Attock,	15 ditto.	Impracticable.
Total, ..	107 Days.	45½ Days.

Of the foregoing Tables it may be remarked, that under a different management, the number of days occupied in performing the voyages, especially up-river in the dry season, will be much reduced. At present, *time* is no object to the Sindian; and besides, he loads his boats so deep, that the ripple caused by only a moderate breeze, endangers her safety.

V.—*Of the Winds and Weather in the Valley of the Indus.*

The prevailing winds of the Indus conform to the direction of the river, blowing for six months up the stream, and as many down it. From April to September the breeze is southerly, and during the other months of the year it comes from the north. An east wind of twelve hours' continuance is rarely felt. When a change in the prevailing direction takes place, the wind veers by the west from 10 P. M. till noon of the following day; the wind is usually fresh. The evening and afternoon too often oppressive, for want of the usual breeze. This last remark is, however, more especially applicable to the weather on the Upper Indus.

In Lower Sindh it is often just the reverse, the breeze there freshening up about 3 P. M. However warm the day may have been, the nights, with few exceptions, are cool. A more particular account of the prevailing winds will be found in the annexed Table:—

Prevailing Winds.

Months.	North.	South.	Calm and Variable.
January,	29	2	0
February,	22	6	0
March,	17	13	0
April,	7	15	8
May,	1	29	1
June,	0	28	2
July,	0	28	3
August,	6	27	4
September,	0	24	0
October,			
November,			
December,			

The south wind.—It reaches Kalabagh at the entrance of the mountains, and last year was as fresh and steady upon the Upper as on the Lower Indus. This wind is believed by the boatmen of the latter to cease at Sehewan, and in my report on the inundation in 1836 I mentioned the circumstance. Such, however, is not exactly the case. South of Sehewan a spur from the Hala mountains comes down upon the Indus, which intercepts the breeze, and turns it off from the river, so that above the town for many miles calms and sultry weather are characteristic of a season remarkable at other places for the steadiness of the prevailing wind; yet though this peculiarity is thus shown to be local, another circumstance leads me to think, (contrary to my own experience,) that the south wind is less fresh upon the Upper Indus than lower down the river. Above Roree the boats have but a single reef band in their sails, while at Hyderabad it is no uncommon thing to see them scudding before the breeze with their sails double and even triple reefed.

The north wind is not so steady as the south, but is oftener more violent while it lasts; clouds of sand darken the air, and compel the trackers to bring their boat to the bank. This wind is cold in November, December, January, and February; the thermometer at sunrise is often but a few degrees above the freezing point. During the season that northerly winds prevail, gales from the south are not infrequent. These are always scarce, and usually, last three days. The change is marked by cloudy, rainy weather, lightning, and thunder.

Variable Winds.—During those sultry breezes that follow the daily lulling of the prevailing wind, the calm is often agreeably broken by light breezes off the river.

These are seldom sufficiently strong or lasting to benefit navigation, but in tempering the heat of the atmosphere, and conducing to the health of the numerous tribes that dwell on the banks of this river, they serve an important purpose.

Storms.—Plenty of warning is always given, and ample time afforded to secure the boat, which should be done either under the weather bank of the river, or the lee side of an island or sand bank. An unsheltered position in deep water, with the open river to windward, generally settles the fate of an Indus boat. If loaded, she

at once fills and goes down, and if empty, the shaking produced by a short chopping sea soon opens the seams of a vessel that has no beams to hold her frame together.

In a river danger from this cause may appear slight; but when the stream and wind are opposed to each other, a short breaking sea is formed, that will swamp a six-oared cutter at a grappling. Most of the boats that are lost on the Indus, are wrecked in the manner here described. Gales of wind are experienced throughout the whole line of the Indus. They are more frequent near the mountains, than in the neighbourhood of the sea.

VI.—Of the Boats upon the Indus.

The boats upon the Indus are of simple construction, and their figure is perhaps the best that could be given, considering the kind of navigation in which they are employed. They are easily constructed, not very expensive, and for stowage of cargo, no form could be better devised. Their proportions though not elegant, are pleasing, and tracking or under sail, their appearance is pretty.

The employment of the Indus craft is confined to harvesting the crop, serving the ferries, and keeping large towns in fuel. For these purposes, the supply is ample. Second, between the sea and Attock two kinds of vessels are in use, the *zohruk* on the Upper, and the *doondah* upon the Lower Indus. In boats belonging to the latter class, a slight difference in the build gives rise to a further classification, and of this description of vessel the *moohanah*, (boatman,) enumerates more than one variety. But before particularizing each, a description of the *doondah* is necessary. Her good and bad qualities are shared alike by them all, and the following notice of this boat is therefore applicable to every vessel on the river:—

Form and method of construction.—The hull or body of the boat is formed by the junction of three detached pieces, namely, two sides and a bottom—at variance with our ideas of naval architecture; the three parts are first separately completed, and then brought together as a cabinet-maker does the side of a box. The junction is thus effected: when each of the three parts that are to form the whole is completed in itself, the sides are carried to the bottom of the boat, and at

once secured by crooked pieces of timber to the flat future bottom of the *doondah*. To bring the bow and stern up to the corresponding parts of the side is more difficult; and to effect this, many days are necessary. Where the bow and the stern are to rise, the planks are lubricated with a certain composition, which gives them a tendency to curve upwards, and this is further increased by the application of force. The extremes thus risen, a tackle is stretched between them, and by constant application of the heating mixture, and a daily pull upon the purchase, they rise to the required angle, and are secured to the side, while an advantageous curve is imparted by this process to the plank in the boat's bottom. The bow of the *doondah* is a broad inclined plane, making an angle of about 20° with the surface of the water. The stern is of the same figure, but subtends double the angle.

Advantages of this construction.—To the slight curve in her bottom planks she is indebted for the following advantages:—In descending a river, should she strike upon a sand bank the boat turns like a top, and presents no stationary point for the stream to act against. A merely flat-bottomed vessel would probably shew her broadside, and the stronger the current was running, the greater would be the difficulty in getting such a boat again into deep water. Thus in a situation where the *doondah* experiences but a little inconvenience, and occasionally it may be a few hours' detention, a boat of another and but a slightly altered form would be very awkwardly placed, though her safety might not be actually endangered. In passing through eddies, the common or wedged-shaped bow dips considerably, while the form of the *doondah's* prow has a tendency to lighten her draft, and the more rapid the current, or the greater her velocity, the more buoyant she floats. When forced out or against the river's banks—an accident which the defective steerage of the *doondah* renders of frequent occurrence in tracking—the form of her bow, where the bank is not too high, parries the violence of the shock. A greater defect in the common wedged-shaped bow for river navigation, (at least in those of the Indus, where the current is very irregular,) is the surface it presents for currents or cross-currents to act against; these force the boat from its course, and deprive the helm of its power. In tracking this is often seen; and I can remember rather a ludicrous instance which occurred to the *Indus Steamer*,

whilst coming up the river to Hyderabad in 1836. The day to which I allude, it was necessary to second the power of the engine by a tracking party on shore, and a number of Hindoo countrymen were employed for the purpose. All went on well, till the bow of the boat got inclined to the direction of the current, when out she shot like an arrow into the stream, and with her dragged the trackers.

Casting off the drag rope prevented accident; but the situation in which it left the Hindoos, was not a little grotesque. Between the firm ground and the river lay a strip of recently placed alluvium, and in this the Sindees were planted at various depths, from the middle downwards.

The present great defect in the form of the *doondah* is bad steerage. By rounding her quarter, and making other judicious alterations, this could be improved. To fit them for conveying merchandize, they require to be stronger built; and for the convenience of the merchant, to have better accommodation; in fact to be restored to the state in which an early traveller, Captain Hamilton, described them when trade flourished by the Indus, and its arrangements were such as to attract the notice of an intelligent European.

Rig of the Boats.—The masts are poised upon strong beams resting athwart the gunwales. Moving on this *fulcrum* their management is easy, and the masts can be lowered down or placed upright at pleasure.

The sail is hoisted behind in preference to before the mast for several reasons, the principal of which is, that as the boat sails only with a favourable wind, it is never necessary to brace or haul up the yard, and fewer hands suffice to manage the boat.

The *jumptee* is the state barge of the Sinde Ameers, and is used by them and their principal officers on all occasions, whether of business or pleasure. Perhaps the appearance of this boat, as she approaches the capital, is more characteristic of the Indus and of Sinde, than aught else to be seen in the country. On this day her *meerbar* puts on clean clothes, and the national cap received from the Ameers on a recent river excursion. The bright hues of the cap, formed by the gaudiest coloured chintz, vie with those of a Kilmarnock bonnet, or a Paisley tartan. The crew are dressed becoming the occasion, and as they bend to the track rope, the breeze

distends their ample robes, and a further character of stateliness is imparted to the *jumptee*. Large red flags were over her stern, and from the raking mast streams a long party-colored pendant that anon skims the water, as the breeze lulls and freshens. In the bow of the boat is a small crimson pavillion, in which royalty reclines, and in the other extreme of the vessel, a roomy cabin of elaborately carved work, for its numerous attendants.

The steersman on an elevated platform, stands in bold relief, and while he guides the boat, encourages the trackers. The *jumptee's* crew are a noisy set; but for aged men, wonderfully good humoured. They are divided into two gangs or watches, and are as partial to a cup of good *bang*, as sailors are to *grog*. These boats are decked, and of considerable tonnage. One which I saw at Hyderabad, measured one hundred and twenty feet over all, with a beam of $18\frac{1}{2}$ feet; her draft of water was two feet six inches, she pulled six* oars, and had a crew of thirty men. They are built of Malabar teak, chiefly at the ports of Mughribee and Curatchee. *Jumptees* are seldom lost; the only danger to which they are liable is that of having their bottom pierced by sunken trees. Their more substantial build keeps the frame of the boat together in situations where the poor-pieced shell of a *doondah* would fall asunder. The *doondah* is the cargo boat of Sinde; her principal and almost her sole employment being, the transport of grain.

The Cowtell.—This again is the ferry boat of Sinde; her construction adapts her for this service, and for conveying houses up and down the river. From her great beam and high draft of water, she is a faster boat than the *doondah*. In all their excursions on the river, the Ameeris are accompanied by many boats of this description. The class is not numerous, and most of the boats are the property of government.

The *doondee* is common from the sea to Mittun, and the boat most generally used in the fisheries, both upon the river and its *dunds*, (small lakes). It is the smallest description of vessel upon the Indus, and at the same time one of the most useful. Two men are ample to its management; but a man and wife are its usual crew.

The Zohruk.—What the *doondah* is in Sinde, the *zohruk* is upon the Upper Indus, namely, the common cargo boat of the country. The

* So in MS. ? 16 oars ?

planks of this vessel are held together by clamps instead of nails, and the junction is often neatly enough executed. This class of boats is not so strong as the *doondah*, but they sail faster and draw less water. They are more roomy than the *doondah*, and though less adapted for the conveyance of goods, are much superior for transporting troops.

The Duggah.—This is the clumsiest, and at the same time, the strongest built boat upon the Indus. She is confined to that rocky and dangerous part of the coast, between Kalabagh and Attock. The form of the boat differs but slightly from that of the *doondah*. The *duggah* has neither mast nor sail. Her name is the Sindean word for cow, and the awkward sluggish motion of this boat shews that it has not been misapplied. If the *duggah* drops down the river to Mittun, there she must remain, and be sold for whatever sum she will bring; for to drag her up against the stream to Kalabagh, would cost more money in the hire of men, than the boat is worth.

Management of the Boats.—Under sail the very best of them will not be within eight or nine points of the wind. Dropping down the river with a contrary wind, the mast is unshipped, as also the rudder, and the latter is replaced by two sculls. Should the wind blow strong, a boat without cargo can make no progress, and the safety of one laden, is endangered by the chopping sea it raises.

Tracking is performed as follows:—the boat is provided with a track rope at least a hundred fathoms long; it is rove through the uppermost sheave-hole at the mast head, and the inner end fastened to the rail or platform on which the steersman is standing. On the hauling post before the mast, is a guy, called a "*lagh*," the lower end of which passes through a ring bolt in the bow of the boat. This guy is of as much utility as the helm itself. Before the boat starts the track rope is middled, and the inner half coiled down under the feet of the steersman: one man is stationed by the guy, and the remainder of the crew toggle on to the shore part of the line. Thus yoked they march at the rate of two miles an hour up to the knees, often higher, in water or in mud. Whilst thus advancing the foremost walker calls out "*shoal water*," on which the inner end of the clog rope is let go, the guy eased off, the helm put to one side or the other, as the case may be, and the boat thus relieved, avoids taking the ground by shooting out into the stream. The shoal passed, the guy

is shortened, the line again middled, and the crew advance at the same slow pace as before. Boats should have two track ropes, and when turning the bends of the reaches, both should be on shore. They should also be provided with a heavy grapnel to drop, in the event of accident to the track ropes.

The steep banks in bends of the river should be avoided, for under it circles a current in a contrary direction to that of the main stream, the quick gyratory motion of which is constantly exerted to the destruction of the bank, and that of such boats as frequent it.*

Boat Building, Materials, Suggestions.—Boats are constructed according to established usage, which has fixed a proportion between the beam and length of each boat. The tonnage is calculated on the boat's bottom, from the point where the stem and stern rise. The angle at which it takes place is matter of taste, a high projecting stern improves the steerage, and a low bow gives speed. The banks of the *Indus* are deficient in almost every article used in constructing the boats on the river. The Lower Sinde is supplied with plank and spars from the Malabar coast, and with coir and cordage from the same quarter. The Ameers of Hyderabad, are, however, the chief, almost the sole purchasers. The *Moohana*, unable to give the high price asked by Cutch boatmen for teak plank, exhibit both skill and ingenuity in building boats of timber of their own country's growth; for this the orchard is robbed, and the country for miles round laid under contribution. In the bottom of a single boat, teak, baire, fir, babool, and the curreet tree are sometimes seen together, and in the same extent of workmanship, six hundred and seventy three patches have been counted.

The Upper *Indus* is principally supplied from the banks of the Chenaub, where the talee tree, the sissoo of Hindostan, is seen with a trunk measuring twelve feet in circumference. Three such trees furnish plank enough to build a large sized *zohruk*.

The Attock boats are built of good fir, brought down the Cabool river, and from the forest of the Lower Himalaya.

Iron Work.—The Lower Indus is supplied from Bombay, and the upper portion of the river from the mines of Bunnoo and Badjour.

* See an example of this in Table VI. of the Appendix, headed Irregularities in the bed of the *Indus*.

It is customary to purchase the latter in the matrix, and to allow a per centage to the blacksmith who smelts the ore, and works it up into nails.

Cordage.—Upon the Upper Indus the rope is either of hemp, or formed from the culm of certain tall reedy grasses, very plentiful on the banks of this river.

The tools of the Sinde carpenter are as little diversified in form as those used by the same class of artificers in India. The absence of good material to work upon sharpens his inventive powers, and gives a manual dexterity that improves the execution of whatever he may have to do, when really good timber comes before him. If a curve is to be imparted to one or a dozen planks united, chaff moistened with water is the Sinde carpenter's store; or what answers the purpose still better, the dung of animals, and more especially that of sheep.

Teak-built boats are much prized by the *Moohana*, as are those of cedar and fir construction, which come from Pind Dadun Khan, on the Jalum. Such boats, when well put together, will run forty years; but from seven to ten is the duration of those patched up with the jungle wood of the country; and if care has not been used to see that the wood employed in her construction was originally well seasoned and selected, a less number of years brings on the decrepitude of age, when to delay a thorough repair, is to lose the boat.

Adaption of the Indus Boats, for the transport of military stores.
—They are not calculated to bear the weight of ordnance, such as a battering train; and at the present moment there is not a boat upon the river, which a Committee would declare efficient for the transport of these heavy guns. For this purpose, the boat should have a perfectly flat bottom, that the weight of metal may be equally distributed over the immersed portion of the hull. The sides too require to be fixed to the bottom in a more secure manner than is at present customary. The knees which connect them should be formed of iron, in preference to wood. If shot is to be carried, the bottom of the boat should be planked over the beams, as well as under them. The latter is all that is done at present; but if this is not guarded against, the nails will draw, and the shot fall through.

Should it become desirable to increase the amount of tonnage upon the *Indus*, boats could be built at Bombay, Hyderabad in Sinde, or

Pind Dadun Khan in the Punjab. If at the former place, it would be desirable there only to prepare the frame; but to build the boat, that is, to put her together in the river, good artificers are to be had in the country; but the introduction of a few superior workmen from the dockyard, with a clever native foreman or overseer would be necessary. A smith is an indispensable accompaniment, and when steamers are introduced, this establishment should, to be efficient, be possessed of science, material, and skill. If Hyderabad were to be selected for building boats, still all the material must come from Bombay. If Pind Dadun Khan had the preference, a small supply of cedar plank might be there calculated upon, and the services of better workmen than are to be procured in Sinde.

Boat Hire.—In this charge there is some incongruity; yet it does not appear to exceed the rate of hire that prevails upon the Ganges.*

VII.—Of Steam Vessels for the Indus.

Naturally solicitous to be acquainted with the present state of internal steam navigation upon the Ganges, on presenting Government with the result of my experience on this river, I addressed a letter, forwarding a list of queries on the subject, to Mr. C. B. Greenlaw of Calcutta, and through the kindness of that gentleman, I have been favoured with the accompanying valuable report from the pen of Captain Johnston, controller of Government steam vessels,—an officer more conversant with these matters than any man in India. In submitting this document to his Lordship the Governor General in Council, I will only remark, that in every essential point the class of vessels described by Captain Johnston, seems well suited to the Indus, and the economy that pervades the steam establishment upon the Ganges, is worthy of imitation here.

Towards the close of the year 1835, when the *Indus* steamer arrived off Hyderabad, one of the Sinde Ameers expressed a wish to be possessed of a similar, but a more powerful vessel. Captain Burnes, who was then at that court, requested my opinion on the description of vessel best suited

* See Appendix, Tables IV, VII, VIII, for the tonnage, price, and hire of Indus boats.

for the Indus, and from the reply to his communication, the following paragraph is an extract, from which it will be observed, that I had then fixed for the draft of an Indus steamer, the exact number of inches, which boats upon the Ganges draw.

Paragraph 11th.—"In a preceding paragraph, I stated that powerful vessels were required on the Indus; the reason is this: In some parts of the stream, the current has a velocity of five and six knots an hour.* It will, therefore, be wise to possess a sufficient power, since steam is now so under controul, that in the downward voyage, where accidents are more liable to occur, it can be reduced at pleasure; but if the engines be originally too weak, a new boat is a costly remedy. Two feet six inches is a good draft of water, and ought not to be exceeded, the boat to have great beam, not much length, and no keel."

Remarks on the Steam Boats of the Ganges, furnished by their Controller, Lieut. Johnston, R. N.

"Four iron steam boats are now employed in inland communication; each steam boat is 125 feet long over all, 22 feet broad, and tows an accommodation boat of the same length, and 20 feet broad, with a hold of five feet deep, capable of towing 4000 feet of cargo, weighing 40 tons, the boat's draft when so loaded, not exceeding 30 inches. The iron sides of the boat are 5 feet deep, above that is a light superstruction of wood in the accommodation boat; between the deck, which forms the hold and the deck on which the crew and passengers walk, the height is nearly 7 feet, and the included space from one end of the vessel to within 20 of the other, or fore end, is divided into cabins and dining rooms, &c. Fourteen cabins are available to passengers; four of 12 feet by 9; four of 9 by $8\frac{1}{2}$; and six of $8\frac{1}{2}$ by $6\frac{1}{4}$; a dining room 20 by 12; two bathing rooms; two pantry or store-rooms, a butler's room; guard room, and two cabins for officers. Each cabin has a water closet; the windows or venetians are 4 feet deep by $2\frac{1}{2}$ wide. In the steam boat, the iron side is continued up in the centre to the height of the beams, which carry the paddle shafts, and the light paddle boxes

* I had not, when this was written, seen the Indus during its freshes.

are of wood. The engines are double, of 60 horse power, oscillating; they consume of Burdwan coal about 10 pounds per horse power per hour, and carry at a draft of 30 inches, about 450 maunds. In the steamer there is a large cabin abaft the boiler, not habitable by Europeans in the warm weather; but very comfortable in the cold. Before the engines, there are two cabins on each side, 8 feet by 5, with a space between that forms a mess room. There is also a very light cabin on the deck of $\frac{3}{4}$ inch board 8 feet by 10; the engines are before the boiler; the steamers have one mast and top-mast, on which they set square sails when the wind is fair. The boat, (a good stout cutter,) is always towed close up to the stern of the accommodation boat. The anchors are 4 and 5 cwt., besides stream and kedge anchors, grappels, &c. They are well furnished with ground tackle; chain cables are alone used. The diameter of the paddle wheel is 16 feet, the breadth 6, the board 6 feet long, 8 inches deep, and 18 on each wheel: they are preferred of fir, and are 2 inches thick. The centre board, when the vessel has her coal on board, is 3 inches below the water surface. The greatest speed of the steamer when alone, is 9 statute miles an hour; with the accommodation boat in tow, 7 miles.

“The contractors have their coal in depôts on shore, and send it in boats to the steamers when they cannot lay along-side the bank. Coal is taken by weight, and one hour allowed for the delivery of one hundred maunds.

“In the bow of the accommodation boat and in the stern of the steamer, are fixed strong posts well secured, and at the same height a saddle is bolted on each, and protected by an iron plate. An iron hoop 6 inches deep is on the post also above the saddle, in contact with it; a beam of 18 feet long, 14 inches broad, and 5 inches thick, with jaws at each end, connects the boats by resting with its two ends on the saddles, and is secured round the posts with a chain with a hook and lever, so as by letting go the end of the lever, to detach the chain in an instant, and allow the boats to separate. There are also hawsers from each bow of the accommodation boat to the paddle boxes of the steamer, which serve to guide the boats, and assist the steering; the following boat acting as a powerful rudder to the preceding one.

“Progress is more easy and safe up the Ganges during the dry season. There is little danger at any time in ascending the streams, but much in coming down; most during the dry season, when the channels are all defined, and the commanders are instructed to come with great caution, dropping through the difficult reaches with the head of the boats up the stream. They are instructed to consider the preservation of the boats the first consideration; speed a secondary one. In the dry season, the voyage downwards frequently occupies sixteen or seventeen days; in the swell five, six, seven, and ten; the upward voyage during the greatest strength of the current occupies from twenty-five to thirty days; at other times nineteen to twenty-three, and twenty-five in the swell. The current of the Ganges is seven miles in the dry season.

“The boats in the swell can generally evade the strength of the current by running over, or on the edge of sands; in the dry season they must generally encounter it in full force.

“There is an establishment of Pilots, (native fishermen.) The distances vary from eighteen to twenty-six miles, through which they are required to be acquainted with the channels; nevertheless, a boat seldom makes a voyage without grounding, and the principal injury the boats sustain, is coming in contact; under these circumstances, it is nearly confined to the superstructure. On one occasion only a pair of boats suffered under water, being thrown against rocks by a strong eddy when descending under steam; each boat had a hole forced through the bottom; they were easily stopped, the injury being confined to the portion of metal actually in contact with the rock. A wooden boat would have been shattered by the concussion.

“It would not be possible to construct wooden boats to retain their form as the light draft the iron boats do; and I can conceive no means of improving on the boats we have, limited, as by the nature of the rivers we are, to length and draft of water. I believe, that for the Ganges above Allahabad it will be in my power to fix a steam boat not to draw more than 22 inches, with 24 hours' fuel, the economy of weight will be confined to the superstructure, the iron hull being the same in point of form and dimensions as those now plying, the metal a little higher.”

(Signed) JAMES H. JOHNSTON.

There is one point in the above report, where I conceive a different arrangement must be made upon the Indus to what prevails on the Ganges. Most of the fuel *depôts* on the Indus must be afloat. If wood firing is used, there is no alternative, for otherwise the time lost taking it on board will cancel all the other advantages of steam.

The banks of the Ganges are high, substantial, and compared to the banks of this river—permanent. Towns overlook the river ghauts, or landing places are constructed on the banks, and the steam boat at most of the stations has only to shore alongside the ghaut and receive her fuel.

It is very different with the Indus. Towns stand within two miles of the river, and the banks are ever varying their outline. I would therefore recommend that large manageable flats be used for this purpose, and anchored at such distances apart as subsequent experience may suggest; their draft should be restricted to 3 feet 6 inches, and each should have a small boat attached, by which means the crew of the flat would be able to keep the floating well supplied from the shore store.

I am further of opinion, that were the *zohauk's* defective steerage overcome, steamers built upon her model will prove efficient boats.

VIII.—Of Fuel for Steam Boats.

The jungle on the banks of the Indus contains the following trees:—

1. *Mangrove*.—Found in the Delta, is plentiful, and burns well. Though it attains no great height, it has sometimes a circumference of 12 feet.

2. *Kundie*.—Rarely exceeds 9 feet in height, and is found, though not confined to the locality under the Lukkee mountains, between Chandkote and Sehewan. In Lower Sindh, this wood is scarce; but twelve miles south of Mittun, on the west bank of the river, is an extensive jungle, in which this is the most common tree; the hardness of its fibre and the crookedness of its grain, make it in great request among the boat-builders.

3. *Bawn*.—Little of this wood is seen below Hyderabad; but between that capital and Sehewan the tree is common. As a fuel, it is useless.

4. *Jall* or *Pello*.—This tree is found in every part of the river's course. Between the river and Desert, two descriptions of trees prevail. Tama-

risk fringes the river, Jall or Pelloo the desert ; the latter as a fuel is not superior to Baun.

5. *Tamarisk*.—From the sea to Kalabagh, this wood is more or less plentiful ; almost any quantity of it is procurable ; but the large wood is distant from one to twelve miles from the Indus, and considerable expence and delay must necessarily be incurred in transporting it to the river. Tamarisk is the common firewood of this country.

6. *Kurreel*.—It is plentiful in Sinde ; but makes an indifferent fuel ; it gives out volumes of smoke, but emits no flame. This wood is generally crooked, and its fibre being hard, it is advantageously used for knees of boats, and wherever curved lines, strength, and durability are sought to be combined.

7. *Loohera*.—Between lake Munchur and the mountains, grows a tree of this name, of a dwarfish size, and very common ; as a fuel it is even worse than the last described.

8. *Tallee*.—This tree is not common on the banks of the Indus, and the few that do occur, are found near villages, in single trees. It attains a large size, and is much in request amongst the boat-builders. It burns well ; but the tree is too valuable to be cut down solely for firewood.

9. *Babool* or *Bubber*.—This tree is plentiful in Sinde ; but becomes less as we ascend the river. It makes an excellent fuel.

Shikargahs or *Hunting Forests*.—They are numerous below Sehevan ; but above that town, they are not found. The trees they contain are mostly Tamarisk and Babool. These forests at some places fringe the river for three and four miles ; but their medium width seldom exceeds one. In a few of them are trees of a large size ; but far the greater number are merely extensive thickets, containing saplings of sorts, tall grass, and reeds, the spontaneous offspring of a rank inundated soil.

In December 1835, I made several experiments with the *Indus* steamer to ascertain the relative strength of wood and coal fuel. The result was as follows :—Tamarisk, when newly cut down, would not generate enough steam to keep the engine, though working only one-half power. If the billets were large and thoroughly dry, it answered the purpose better ; though I consider this wood at best but a very indifferent fuel. Mangrove and the Babool trees are much superior ; burning equal proportions of the two last, the furnaces were, reple-

nished once in seven minutes : with coal, (not however of a very good quality,) every fifteen. Coal has thus an advantage over wood fuel in something more than the proportion of two to one, and when the superior performance of machinery driven by the former is taken into account, it is doubtful which is the more economical plan to navigate the Indus, with coal from England, or the jungle now growing upon its banks.* The question resolves itself simply into one of expence, for there is wood enough on the banks of the Indus, to keep two or more steamers constantly plying for years to come.

On this subject, Captain Johnston, the Controller of Government Steam Vessels, has made several experiments with steam boats on the Ganges. The result is already before Government ; but having obtained, through the kindness of that officer, a copy of his report, the nature and value of its contents is my apology for introducing it here.

Report on the relative value of Wood and Coal, by Captain Johnston, the Controller of Government Steam Vessels.

On Friday the 27th instant, I ordered the steam to be got up on board the *Experiment Flat*, and ran for two hours on the ebb tide between Fort William and the Reach below Budgebudge, and consumed nine and half maunds of coal, making on an average 29 revolutions. I then returned with a flood tide, and in two hours consumed $11\frac{1}{4}$ maunds of wood, making on an average 21 revolutions. I also noted the time we were running the same distances under coal and wood steam ; the periods were 90 minutes with coal, and 112 with wood ; great care and persevering attention were required in the stocking with wood to keep the steam up, and twice the engines were nearly at rest from the steam failing. Admitting that the revolutions of the wheel on the strokes of the piston in the cylinder measure the steam expanded in any given time, the coal would have supplied the cylinder 6960 times.

The wood,...	5040
--------------	-----	-----	-----	-----	-----	------

Making a difference of	1920
------------------------	-----	-----	-----	-----	------

* Coal has been discovered on both banks of the Indus ; the locality is the salt range, in the parallel of 32° North, deposits extending in a longitudinal direction ; but not in a North and South one. Ten specimens from the West bank procured by Captain Burnes have been analyzed by Mr. Prinsep, and four of them pronounced to be the purest form of mineral coal. Those forwarded by me, and discovered on the East bank, have not yet been examined.

measures, which at 42 per minute, would have required $45\frac{1}{2}$ minutes longer of the consumption of wood to have completed, which at the rate of $11\frac{1}{2}$ maunds in 240 minutes, would have required $4\frac{1}{2}$ maunds nearly, which added to $11\frac{1}{2}$ would make $15\frac{1}{2}$ maunds of wood to produce the same quantity of steam as $9\frac{1}{2}$ maunds of coal; but it has been seen, that owing to the weakness of the steam provided by the consumption of wood to perform the same distance, required $\frac{22}{120}$, or one-sixth more time nearly, a detention most injurious to the interest of Internal Steam Navigation.

30th. October, 1837. (Signed) J. H. JOHNSTON, *Controller.*

IX.—*Of the Inundation.*

Like all other large rivers, the Indus is subject to a periodical increase of its water; during the continuation of which, it inundates a large tract of country. The river rises in March, and falls in September. From Mittun upwards, I have delineated the flooded district upon the chart; but in tracing their boundaries between that district and the sea, I labour under the disadvantage of having to draw my material as much from hearsay as personal observation.

It may in this place be observed, that the valley of the Lower Indus owes its crops entirely to the yearly swell of its river.

The soil of Sinde is naturally poor, producing spontaneously the products of the desert; but save within the belt of inundation, neither grain for man or grass for cattle. Even here grass is scanty and coarse; a turf is a thing unknown on the banks of the Indus, and the Islands in the stream below Bukkur are nothing more than naked sand banks. Two consecutive crops exhaust the soil, unless manured. The natives it is true liken it to gold; but the comparison would be more just if applied to the river, the cause of all its fertility. On the banks of the Upper Indus the soil improves, and were such subject not irrelevant to this report, I might proceed to adduce the proof of this assertion, and to investigate the cause of so apparent an anomaly.

In some respects, the annual swelling of the Indus is attended with peculiar phenomena. One year the country on its right bank is so deluged, that towns and villages, though protected by strong dams,

are threatened with inundation; while on the opposite side of the river, there may be found, during the same season, a difficulty of irrigation. In thus distributing its favour, the stream exhibits more of constancy than caprice, for when once it has taken to either of the banks, it adheres for a series of years to the favoured side. Another circumstance merits notice. The Mississippi when in flood, as we learn from Audubon, the talented American ornithologist, inundates the valley to a large extent; at that season the Squatter and a Lumber river canoe pierce the thickest depths of the forest, while flat boats of great burden, and steamers of noble dimensions, are seen moored to stately trees overhanging its banks. The Ganges in the lower part of its course, overflows its banks in a similar manner to the Mississippi. During the S. W., or rainy monsoon, when the former river is in flood, the whole of its Sunderbunds, or Delta lands are, according to Rennel, submerged. With the Indus it is different. Inundation here is more often partial than general, and at the height of its freshes, the Persian wheel may be seen watering fields on the verge of its banks. The *Kurreef* and *Rubbee* (Autumn and Spring) harvest affords the most conclusive evidence in this case. The crops of the first are produced from an irrigated, and those of the latter from an inundated, soil; while the weight of the *Kurreef* harvest is to that of the *Rubbee* nearly as two to one.

On inspecting the accompanying chart of the Upper Indus, it will be seen that the river has double banks, or inner and outer ones. The first of these is as changeable as the navigable channels of the Indus, the latter as permanent as the river's course; the inner banks from its bed in the cold season, when the water is low and permanent, hem in the floods and freshes of an opposite season. The following Table will further illustrate this interesting feature of the Indus, though I believe it is one common to all rivers flowing through plains:—

Outer and inner Banks of the Indus.

<i>Parallel of Latitude.</i>	<i>Dry season Surface Water.</i>	<i>Width of the Dry flat.</i>	<i>River's Bed. Surface Water in the freshes.</i>
26° 28' N.	1456 yards.	788 yards.	2244 yards.
26° 44'	658 do	1560 do	2218 do
27° 18'	850 do	3004 do	3854 do

The double banks accompany the Indus after it has left the mountains at Kalabagh for the remainder of its course. Were the permanent continuous, the inundation would be restricted to narrow and defined limits; but as this is not the case, I will endeavour to point where this barrier is broken or wanting.

From Attock to Kalabagh.—No inundation.

From Kalabagh to Mittun.—It may be generally remarked, that in the northern part of the Upper Indus, there is no inundation, while in the south, or lower part of its course, the flooded districts are of a considerable extent, as a reference to the chart will shew.

Mittun to Bukkur.—Neither on the east or west banks of this division is there an outer bank, and the consequence is, that the country here is largely inundated. In the Mozarry districts, the floods of 1837 fell twenty miles back from the river; but in ordinary seasons twelve is the more usual measure of their width. On the opposite bank, the inundation about Subzalkote reaches to the edge of the desert.

Bukkur to Sehewan.—Though the permanent banks may be traced in this section, their outline is broken, and the low districts behind them overflowed in the freshes. South of Sehewan inundation of the west bank is general, though the quantity of uncovered land exceeds that submerged. Chandkote, the most valuable province in Sinde, is situated here, and its exuberant crops are to be attributed to its great command of water. Upon the opposite bank, between the river and the desert, is a strip of alluvium, the medial width of which is four miles. This belt marks the extent of the flooded districts; but for some years past, there has been scarce any inundation upon this side of the river.

Sehewan to efflux of Fulailee.—The Tela mountains for some distance below Sehewan prevent the river from expending in a westerly direction, and a creeping hilly ridge serves the same purpose further South. On this side of the river, the inundation is confined to a very narrow belt; on the opposite side the desert opposes any outlet to the East, and here, though the inundated belt be wider than that upon the West bank, its breadth cannot be estimated at more than three miles.

Efflux of Fulailee to the Sea.—The Delta of the Indus may be said to commence from the efflux of Fulailee. The lower portion

of it only is under water, and the inundation here as in the upper course of the river is partial; the submerged part is a belt fringing the sea, measuring in width about twenty miles.*

X.—*Fords of the Indus.*

There are properly speaking no fords on the Indus below Attock, that is, there is no spot in its course where their annual occurrence is so certain as to warrant a dependence on their existence in any subsequent military operations, of which the banks of this river may become the scene.

But that the Indus is at times fordable is certain, and in the course of my inquiries on the subject, I have met with many individuals who assured me of having done it. What may be done once, may be performed a second time, and when a solitary unassisted *Moohead* can cross, it is just as possible that a regiment of infantry may follow. A ford open to a foot soldier, would prevent no difficulty to horse. The practicability of fording the river being once admitted, becomes a subject of importance, and viewing it in this light, I shall devote more space than I otherwise should to its consideration.

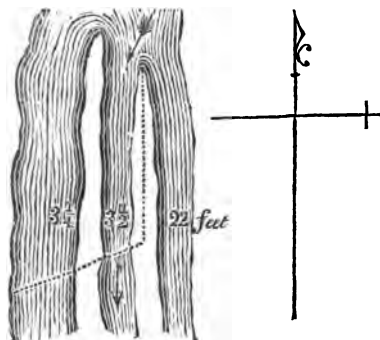
The months in which the river is fordable, are December, January, February, and March. No instance is on record of its having been done either north of Mittun, or south of Hyderabad in Sindh. The Indus does not within the excluded track run deeper than in that portion of its course where the river is known to be fordable; but being less frequented by the boatmen, its capabilities are not so generally known.

The fords are discovered by the annual fleet of grain boats, which descend in the cold weather from the Upper Provinces to Lower Sindh. Some boats in this fleet are of so large a draft, that their safe navigation calls for the most minute survey of the river's channels, and it is whilst so employed that the boatmen sometimes find they have crossed, almost unknown to themselves, from one bank of the river to the opposite, without once having had to swim.

* These observations on the inundation of the Indus south of Mittun are given with much deference, as I have not had proper opportunity of inquiry. This does not apply to any remarks on this subject above Mittun.

During the dry season of 1836-37, I had frequent intimation of fords ; but was not fortunate enough personally to discover one, for it so happened, that by the time I had got to the spot, they had always disappeared. The following sketch is taken from a trust-worthy person, whom I had sent to report on a suspected locality :—

Ford in the neighbourhood of Halá.



The centre channel is here the continuous one ; that on the east side was however the deepest, and discharged the most water ; but its mouths were closed up by shoals. Forty-two boats were lying above the ford, waiting for the channel to open ; this was on the 27th February. The dotted line shews the ford. On this subject I am glad to have the testimony of Dr. Gordon, the officer who went from Loodiana to Bombay with the Maharajah's (Runjeet Sing) mercantile speculation. He tells me, that some distance north of Hyderabad, he came upon a shoal stretching completely across the river, when many grain boats unable to pass over it, were lightening their draft by transporting a portion of their cargo into smaller boats. Dr. Gordon finding more water above the shoal than the boats in his charge drew, held on his course.

The custom of bridging the Indus by boats at Attock, has prevailed since the days of the Greek invasion, and it appears to me, that the same might be used with equal success to cross an army much lower down the river.

The place most adapted for this purpose, whether viewed merely with reference to the river itself, or to the Afghan Passes that lead down upon it, and which have not be unaptly termed the gates of Khorassan, is Bukkur fort. Here we have a permanent channel, both

banks of the river being faced with hard flint hillocks, while in the middle of the stream are some islets of the same material, on one of which is the ford, and contiguous to it, or rather adjoining it, another, containing the tomb of Peer Khaja Khizr. At no other spot below the mountains, does the Indus present similar facilities for bridging. The channel here is as follows :—

Above the fortress the river widens to.....	1244	yards.
In a line with the fort it is less, say	1000	do.
The channel between the fort and the west	98	do.
bank of the river, is by measurement.....		
Ditto ditto on the opposite side of the fortress,	400	do.
estimated		
Width of fortress and Isle of Khaja Khizr,	502	do.
	1000	do.

Depth of the Channels.

West Channel 98 yards measurement.
Current 2.9 knots.
5,6,7,9,12,15,9,3 feet.



East Channel 400 yards ; estimated
Current 3.7 knots.
7,7,9,9,9,12,12,13,15,18,30,24,12ft.

A spit projects from the north-west end of the fortress, and extends to within fifty yards of the west bank. In this gut the current is four knots an hour, the depths were 6 6 7 7 6 6 6 5 5 feet ; at the time these measurements were made, the river had 12 feet more to rise. In fact it was when at its lowest level.

Last June I had an opportunity of examining this bridge of boats at Attock, it contained thirty-six boats, and the river, when they were moored, had a width of 540 feet, its depth by measurement taken the preceding year was 10 fathoms, and the current about 6 knots an hour. By comparing this account of the Attock bridge, with the details of the river at Bukkur, it is evident that circumstances are greatly in favour of the former ; but surely, if a few untutored boatmen succeed so well at one place, we ought not to despair of our success at Bukkur.

The chief, in fact the only difficulty is, mooring the boats, and to effect this, the Seiks use an anchor of a form the very worst that could be imagined, and which has no other recommendation than its antiquity, and perhaps the ease with which it can be dropped from the boats. The figure is pyramidal, a skeleton of wood filled with stones. These uncouth things, when once let go, cannot be recovered, and as the strength of the bridge is not proof against that of the current in June, July, August, and September, a new set has to be made as often as the bridge is required to be constructed. Now were a line of mooring anchors once laid down in place of these wooden baskets, and beyond chain bridles attached to them, a bridge of boats could be put together in about as many hours, as days and weeks are now consume in preparations.

The number of boats required to form a bridge, would be built of a form the best that science could propose, and always kept in a state of readiness to haul out to their several berths, numbered as the buoys would be, 1, 2, 3, &c. A bridge so formed, would be a very solid construction, and able to brave, under proper superintendence, the strongest freshes in the Indus, whether abreast of Attock or under the fort at Bukkur. Should it become necessary to destroy it, one end of the bridle chain has only to be slipped and the mooring anchors are useless to an enemy. But little weight is due to the opinion of men, who not conversant with military affairs, cannot be expected to have clear ideas on such a subject. But still I venture to hold the opinion, that bridging the Indus at Bukkur, is a practicable question.*

The difficulty would be to moor boats in the eastern channel; but this once accomplished, the bridge might be made permanent, as the small western channel might serve for the navigation of the river.

XI.—Of a Site for a Fair.

While Government has it in contemplation to establish an *entrepôt* for trade on the banks of the Indus, it will not be irrelative

* I need not observe that this was written before Capt. Thompson (Bengal Engineers) threw his noble bridge across the river, by which the British army crossed in 1838, with their baggage and battering train.



to the subject of this report, briefly to say a few words on the locality of those towns where the mart is likely to be fixed.

This question will perhaps be ultimately decided more by the existing foreign relations of the different towns, at the time when this selection is made, than with reference to their geographical position, or their local site. Shikarpoor has hitherto been excluded from the list of places best adapted, to answer the purpose of Government; but in the turn which current events may give to the political relations of Afghanistan, that town may yet become one of the *entrepôts* for the trade of Central Asia.*

Shikarpoor is not destitute of collateral advantages. The large money transactions of its bankers; the extent and skilfully organized agency which they have diffused, are known to all interested in these matters; though the advantages of such an establishment can be duly appreciated by merchants themselves. With steamers upon the Indus, the proximity of the town to Bombay, the market for Europe goods is favourable to its site as a mart; and were Bukkur fort in our possessions, the British flag upon that fortress would win confidence by guaranteeing security.

The *Zeearat* of Khaja Khizr, a *peer*, alike worshipped by Mahomedan and Hindóo, adjoins the fort of Bukkur, and on the anniversary of a certain day in April, multitudes of both creeds flock to this shrine. Opposite, in the town of Roree, is a place of pilgrimage of still greater sanctity; for here, say the faithful, is preserved a lock of the prophet's hair.

The distance of Shikarpoor from the river, operates unfavorably to its becoming a commercial mart; it lies eighteen koss inland of its port of Shukur. From May to September inclusive, boats can come up to the town by means of a fine canal, called the Sinde, and were this work deepened and connected with the Larkhana canal or the Noroab canal of the Indus, we should have an inland navigation throughout the year, between Sehewan and Shikarpoor. It would traverse the richest portion of the Sindian territories, and evade an intricate passage of 100 coss upon the main river. So admirably is the country adapted for this means of transit, that

* It is a proof of Lieut. Wood's judgment and sagacity, that his supposition is now in course of fulfilment.

throughout the entire line, not a single loch is necessary, save for occasionally cleaning the canal. The returns would be great, and the outlay very moderate compared to that of similar work in countries where natural obstacles have to be surmounted, and labour is a more valuable commodity than in Sinde.

The country around Shikarpoor is subject to inundation; but west of the town, and contiguous to the suburbs, is a dry plain, where buildings to any extent could be erected.

I do not believe there is a healthy spot on the banks of the Indus; in this respect there is little choice; some towns have ailments peculiar to themselves; but from the day the river begins to fall in September to the end of November, asthma and fever are common, from the mountains at Kalabagh to the sea.

Bukkur fort and Roree are built upon hillocks of flint, which though not high, render both these places more healthy than towns in the plains. The first is a fortified islet amid channel, and Roree overhangs the left bank of the river, with a depth of four fathoms water under the walls. As a *depôt* for military purposes or an *entrepôt* for commerce, much could be written in favour of both these places.

Mittun.—The geographical position of Mittun is superior to that of any town upon the Indus. In addition to commanding of both the Indus and Punjaub streams, it stands midway between the gates (as the natives term them) of Khorassan, namely, the passes of Bolan and Sakhi Surwar, while immediately behind it are the entrances of the former pass by the auxiliary routes of Assui and Hunnund. The town is built upon a small artificial mound, and when the freshes are in the river it is surrounded on three sides by water; it is two miles distant from the Indus, but from the middle of June to the 22d of September, boats can discharge or take in cargo immediately under the town, by means of a fine natural water-course, navigable down the Bangalah and Omerkote. South of Mittun, is a dry plain that fringes the above nullah; and should this town be preferred for the site of a fair,* it is on the bank of this stream that booths and other buildings should be erected. During the inundated months, camels cannot travel north or west of Mittun. The inhabitants prefer well-water to that of the Indus. When

* Since selected for the purpose.



the river has been falling for four or five successive days, to drink the nullah water is almost certain to bring on an attack of illness; this the natives attribute, and I think very properly, to the vegetable matter which must be brought into the water-course, by the drainings of the inundated districts. Mittun, and the village of Chatchur upon the opposite bank can, taken together, supply forty boats of from one hundred maunds burden to one thousand.

I ought before to have said that cutaneous eruptions trouble the inhabitants of Mittun; the sores frequently become ulcered, but though difficult to heal, the disease does not appear to affect the general health.

Dera Ghazee Khan.—This town has been more than once endangered by the inundation when Nawab Jubber Khan, the brother of Dost Mahomed Khan of Cabool, was governor of the province; a wall that surrounded the town had to be thrown down to keep the water out, nor is there within a circle of many miles a spot exempt from its effects. Dera Ghazee Khan is situated about four miles from the river; but in the swell, like most of the other towns upon the Indus, it has a large navigable canal, by which it may be approached by boats for some months. Dera Ghazee Khan has, however, advantages that it will be difficult to set aside; the town lies at the foot of a pass in the Soliman mountains, that leads both to Cabool and Candahar, while it is equally central with respect to the Indian routes. It is the largest town upon the Indus, and even under the Sikh rule, it wears an appearance of increasing prosperity. Its merchants, though they do not speculate largely, have an extensive agency, and a considerable command of money. The country around yields heavy crops of grain, and the staples of cotton and indigo, while its home manufactures of silken stuffs, such as gool buddens, timorees, &c. is only equalled by the manufacturing marts of Bhawalpoor and Moultan. When to the above recommendations are added, the fairs at Peer Adul and Sakhi Surwar, I believe that every thing considered, Dera Ghazee Khan, or rather some spot in its vicinity, will at once be considered the most eligible place to lay the foundation-stone of an Indian St. Macrera. By a reference to the map it will be seen, that Sakhi Surwar and Peer Adul, are towns in the district of Dera Ghazee Khan; at each of these places, a large *Mela*, or fair, is annually kept; that of Sakhi Surwar

occurs in the Indian month Visukh, answering to our March. It is held in honour of the *peer*, after whom the place is named; the fair lasts five days, and pilgrims from India's furthest shores come to prostrate themselves at the tomb of Sakhi Surwar. Few come from the countries west of the Suliman range; and the followers of Brama out-number those of Mahomed; the aggregate of both cannot be much under 100,000 souls. Though commerce is not neglected, there is but little business done.

A Khorassan or Afghan horse-dealer may now and then exchange an animal of his stud for the productions of India, or the manufacture of Europe; but this *Mela* is essentially an assemblage for devotional and pleasurable purposes; but with such a material, and the example of the holy Mecca, it is easy to fortel that (when the fair is established,) many individuals in this annual concourse of devotees will become as enterprizing merchants as they are now zealous and bigotted *fakers*. Sakhi Surwar is twenty-four koss nearly direct west of Deera Ghazee Khan; it is a considerable town situated in the mouth of the pass. Firewood is abundant, and a mountain rivulet supplies the town with water. At Peer Adul Zeearat, seven koss in a N. W. direction from Dera Ghazee Khan, a fair is held in February, similar to that of Sakhi Surwar.

Dera Ismail Khan is never inundated from the river, but is yearly flooded by mountain torrents. The present town lies about a mile back from the river, and was built about eight years ago, when the old Dera was washed into the Indus. Dera Ismail Khan is well planned, and when its skeleton streets are filled with occupants, they, for width and cleanness, will match with those of most eastern towns. The houses are of mud or sun-dried brick, terrace roofed, and rise from a ground platform of from one to two feet high. Few are of more than one story. When I passed through it in the middle of summer, the bazar was well frequented; but in the winter months it is much more thronged. The town is a sort of nucleus or rallying point for those pastoral tribes of Afghanistan, who prefer a clement winter in the valley of the Indus, to the security of that which characterizes that of the mountain districts of their own land. Carriage is thus almost unlimited, as some of the tribes rear camels for no other purpose than to put them out to hire. The *Lohanas*, who from before the time of Baber

have been the great carriers and traffickers of these countries, still frequent Dera Ismail Khan. The transit trade of India and Afghanistan is already fixed here, and if the routes radiating from the town are considered merely in reference to Cabool, then is Dera Ismail Khan better situated for a commercial mart than towns lower down the river.

These are all the places that present themselves as eligible spots for the establishment of commercial *depôts* west of the Indus; but should it ever become an object to Government to have the mart within their own frontier, then Leia, upon the Indian bank of the river, lying between the two Deras, is its proper site.

But to give full effect to these fairs, it is desirable that two be established, one for the lower Indus and one for the upper; the latter will supply, besides the markets of Afghanistan, those of Central Asia beyond the Parapamisan chain. The other, by the roads of Kandahar* and Kelat,* will draw from Beloochistan, the districts around Herat, and the southern provinces of Persia, their staples of wool, assafoetida, and madder; while in return, it can supply the whole of this extensive region with the growth of India and manufactures of the British Isles, at a cheaper rate than can be done by any other route. Thus, should a general war in Europe exclude England from the Black Sea, an outlet equally good for the staples of her trade is offered by the Indus, with an *entrepôt* at Bukkur and another in the Derajat.

XII.—Indus and Punjab Rivers.

Travelling over the Punjab, in a westerly direction, when its rivers are in flood a little above the parallel of Kalabagh, no less than five streams are crossed, each occupying a larger bed, and seeming to the eye, a more important river than the Indus.

The Punjab rivers, as are well known, fall into the Indus in one stream, and if we call our attention to the confluence of the united volume with the latter, the result is strikingly at variance with appearances and pre-formed opinions.

* The port of Sommeanee seems by recent accounts to be most favoured by importers, and I understand that merchants are only awaiting the pacification of the country, to commence carrying thence, *via* Biela and Kelat.



About the middle of May, I examined both when the relative size of the Indus and its Indian feeds stood as follows:—

<i>Indus, or Sindé.</i>	<i>Chenaub, or Punjaub.</i>
Width 608 yards, max. current 4.8 knots, $\frac{3}{4}$. 1. 1. 1. 1. 1. $\frac{1}{4}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{3}{4}$. 2. 2. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{4}$. 2. $2\frac{1}{2}$. 2. $1\frac{1}{4}$. $1\frac{3}{4}$. $\frac{1}{2}$. $\frac{1}{2}$ fathoms. Discharge per second 91.719 cubic feet.	Width 1766 yards, current 1.8 knots, $2\frac{1}{2}$. 2.2 . $1\frac{3}{4}$. $1\frac{1}{2}$. $1\frac{3}{4}$. $1\frac{1}{2}$. 2.1 . 2.1 . $2\frac{1}{2}$. 1. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{3}{4}$. 2.2 . $2\frac{1}{4}$. 2.1 . 2.2 . 2.1 . 2.1 . 2.1 . $2\frac{1}{4}$. $2\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{3}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$ fathoms. Dis- charge per second 68.955 cubic feet.

Here the principal cause of the disproportionate size of the Indus is the early commencement of its freshes. Indebted for its periodical rise principally, if not solely, to snow-clad mountains, an increase is first perceived in its stream when the sun comes into our northern latitudes at the vernal equinox in March; but the Punjaub rivers depending upon theirs upon another and less constant source, namely, the rainy season of Hindostan, have their freshes later. At the time of my examination in May, the Sutlej, the most eastern of the Punjab rivers, was at its lowest level; while the Jalum, the most western of the five rivers, and the one which has its source nearest to that of the Indus, had already shewn signs of rising; from which I am inclined to think, that measurements made in July would give, if not an entirely different, a less disproportionate result in the amount of water discharged by the Indus and its Punjaub auxiliaries.

But that the Indus is a superior river to the Punjaub, seems very clear; and amongst the collateral proofs of this which may be urged, is the direct nature of its course, compared with those of the Punjaub streams. Also the dread in which the river is viewed by the *Mohanas*, who, were the choice left to themselves, would prefer dragging their boats twenty coss up the Chenaub, to half that distance upon the Sindé.

Another circumstance connected with these two rivers is worthy of notice; in the Doab, or country lying between them, all canals are cut from the Sindé, in the month of July, when both rivers are in the flood, the surplus water of the Sindé pours down into the Chenaub, proving that though their beds for a distance of sixty miles are not more than ten miles asunder, yet that in their relative level, there is a considerable difference.

It appears to me, that Captain Burnes must have erred in giving so large a fall as twelve inches a mile to the Punjaub streams, and but half that quantity to the Indus. In the dry weather, the latter river has most decidedly a much stronger current, than any of these streams, and even in the freshes, their current as far as I have been able to observe the Punjaub rivers, is not so strong as that of the Indus. On the 27th of June this year, the current of the Roree at Lahore was not more than three knots an hour, and neither that of the Jalum or Chenaub exceed four.

XIII.—*Concluding Remarks.*

It has been matter of regret, that so noble a river as the Indus, should have no port accessible to vessels of burden.

The disappointment is, however, more imaginary than real. If indeed the merchant is necessitated to employ ships of 4 and 500 tons burden, such a class of vessels cannot enter the river, and he must land his goods at Curachee, the only port in Sinde open to vessels of this description; but if, on the contrary, he prefer water carriage to land portage, why not avail himself of tonnage? In the fair season, hundreds of boats frequent the mouths of the Indus; they are the common coasting vessels of Cutch, and none of them exceed, when laden, a draft of nine feet. The average draft is six and seven. I believe that the principal mouth, namely, one that discharges the greatest body of water, will even be found the least navigable, and that the port of the Indus, though it may fluctuate between the Luckput creek and Curachee, will always be situated in a secondary branch, discharging little or no fresh water, but connected with the main stream by a creek or navigable channel, open only to the flat boats of the river. But even admitting that a vessel drawing seven feet water could get upon the main trunk, nothing would be gained, as no other description of vessel but the light drafted steamer already noticed, will be found to answer upon the Indus, and such vessels will be able also to keep up the communication between the sea-going craft and the main river. If then a portage is thus shewn to be unnecessary merely to give free access to the river, it is equally useless by way of avoiding the difficulties of navigation in any

particular part of its course. In my former report, I did indeed advocate the plan, but I did so then from hearsay. Now I give the result of my own observation. The navigation of the Delta is certainly intricate; but the difficulties are not so insurmountable to render a portage desirable, nor does the river improve so much above it, as I was at the time given to understand.

In one respect, the authorities on the river have it in their power to confer a considerable boon on the navigation of the Lower Indus. The only obstacle in the river, from which danger is to be apprehended, and which no attention can effectually guard against, is sunken trees. Now the river brings down none of these from the mountains. All come from the *shikargah*, or hunting preserves of the Sinde Ameers. The supply might be cut off without material injury to these forests, or interfering with their Highnesses' amusements. Let the Ameers but give an order, that between the *shikargah* and the river, a clear belt of twelve yards wide be left, and in a few weeks their numerous foresters will have cut down a twelve months' fuel for our steamers, and insure a path for the trackers.

As these forests do not extend north of Sehewan, the operation would not require to be carried above that town, the jungle wood there being too small to affect the channels of the river.

TABLE No. I.

Comparison of Chronometers.

Date.	Chronometers.		Differences.	
	No. 256.	No. 257.	1st.	2nd.
1836.				
Dec. 27th	4 18 00	4 31 05	13 "05	2·0
28th	4 13 30	4 26 37	13 "07	2·0
29th	4 26 50	4 39 58·5	13 "08·5	1·5
30th	4 11 15	4 24 25·5	13 10·5	2·0
1837.				
Jan. 1st	4 12 35	4 25 49	13 14	1·7
2nd	4 36 05	4 49 21	13 16	2·0
10th	4 45 35	4 58 06·5	13 31·5	1·9
11th	4 42 35	4 56 08·5	13 33·5	2·0
12th	4 48 20	5 01 55·5	13 35·5	2·0
Feb. 15th	11 51 35	12 06 23·5	14 48·5	2·0
20th	11 18 30	11 34 31·0	15 01·0	2·5
26th	10 49 15	11 04 28·5	15 13·5	2·1
March. 1st	10 48 00	11 03 19	15 19	1·8
5th	11 09 50	11 25 16	15 26·0	1·9
9th	4 38 00	4 53 32·5	15 32·5	1·8
April 9th	4 18 30	4 34 59	16 29	0
14th	4 02 21·5	4 19 00	16 38·5	1·9
17th	4 24 14·5	4 41 00	16 45·5	2·3
18th	4 00 12	4 17 00	16 48	2·5
19th	3 49 10	4 06 00	16 50	2·0
20th	3 54 37·5	4 11 30	16 52·5	2·5
27th	3 34 49	3 52 00	17 11·0	2·6
29th	4 00 14	4 17 30	17 16	2·5
May 19th	3 35 56	3 54 00	18 04	2·4
20th	2 51 53·5	3 10 00	18 06·5	2·5
1838.				
July 16th	9 59 00	5 47 07·5	4 11 52·5	3·5
17th	8 03 00	3 51 05	4 11 55	2·5
18th	9 56 58	5 45 00	4 11 58	3·0
19th	9 43 00	5 30 59	4 12 01	3·0
20th	7 43 00	3 30 56	4 12 04	3·0

TABLE No. 2.

From Mittun to Dera Ghazee Khan. The Time-keepers were examined at Mittun, and again at Dera Ghazee Khan. The following Table shews the result of each rate, while for the Longitude it gives a Mean of both.*

Stations.	Latitudes.	Diff. Longitude by			Longitude.
		Mittunkote.	Dera Ghazee Khan.	Mean.	
No. 1	28·58·25 N.				
2	29·04·38	03·57	04·21	04·9	70·30·34 E.
3	29·04·49	10·45	11·10	10·37	37·22
4	29·23·44	12·54	13·31	13·12	39·37
5	29·31·53	25·36	26·20	25·58	52·23
6	29·42·00	25·15	26·01	25·38	52·3
7	29·53·00	28·34	29·20	28·57	55·22†
8	30·06·02	27·34	28·04	28·4	54·29

Dera Ghazee to Dera Ismail Khan. The Watches were examined at these places, and the following Table gives the Longitude of the intermediate stations, deduced from a Mean of the old and new rates.

Stations.	Latitudes.	Diff. of Longitude by rates.			Longitude.
		Old.	New.	Mean.	
No. 1	30·33·19	02·00 E.	01·51 E	01·55 E.	70·56·24 E.
2	30·56·49	01·00 W.	01·18 W.	01·09 W.	70·53·20
3	31·09·09	01·10 E.	00·39 E.	00·52 E.	70·55·24
4	31·24·55	04·42	04·24	04·33	70·59·02
5	31·37·16	09·57	09·21	09·39	71·04·08
6	31·42·30	05·03	04·24	04·43	70·59·12
7	31·47·54	06·30	05·50	06 10	71·00·39

* Mittun was fixed from Roree.

† Indifferent.

TABLES,

In which the Geographical position of points and places in the line of the Indus, as they stand in the published Maps, are compared with the Observations of the present Mission.

No. 3.

From the Sea to Mittun.

Places.	Latitude.		Longitude.	
	Map.	Mission.	Map.	Mission.
	° ' "	° ' "	° ' "	° ' "
Barree Gorah, ...	24·12·00 N.	24·13·20 N.	67·54·30 E.	67·36·00 E.
Efflux Hejamree,	24·08·42	24·16·42	67·57·00	67·47·03
Tatta Bunder, ...	24·44·00	24·44·30	68·19·00	68·01·06
Hydrabad do. ...	25·22·00	25·22·04	68·41·00	68·23·03
Sehewan do.	26·22·00	26·22·35	68·09·00	67·55·17
Roree do.	27·43·29	27·41·59	68·56·00	68·55·39
Chatchur do.	28·53·29	28·52·07	70·31·00	70·27·57
Mittun do.	28·54·00	28·53·19	70·29·00	70·26·25

No. 4.

Mittun to Attock.

Places.	Latitude.		Longitude.	
	Map.	Mission.	Map.	Mission.
	° ' "	° ' "	° ' "	° ' "
Nowshaira,	29·11·00 N.	29·12·19 N.	70·38·00 E.	70·35·28 E.
Raick,	29·21·00	29·24·20	70·45·00	70·39·01
Sherroo,	29·42·00	29·42·00	70·58·00	70·50·03
Dera Ghazee Khan,	29·58·00	30·03·26	71·00·00	71·51·23
Dera Dean Pemah,*	30·40·00	30·33·19	71·06·00	71·00·24
Ditto,†	30·51·30	30·39·20	70·57·30	
Leia,	31·08·00	30·58·01	71·05·00	70·59·23
Rajun,	31·14·00	31·08·39	71·06·00	70·57·42
Khahree,	31·30·00	31·24·25	71·01·00	70·54·02
Bukkur,	31·44·00	31·37·16	71·14·00	71·06·28
Dera Ismail Khan,	31·57·00	31·48·39	71·07·00	70·59·30
Kalabag,	33·07·00	32·57·36	71·49·00	71·35·23
Confluence of Sehewan,	33·10·00	33·01·48		
Attock,	33·55·40	33·53·53	72·27·00	72·16·27

* East bank.

† West bank.





Between the Delta and Sehewan, in the months of January and February.—(continued.)

Parallel of Latitude.	Soundings.	Widths.
25° 00'	$\frac{3}{4} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot 1 \cdot 1 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 2 \cdot 2 \frac{1}{2} \cdot 2 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot \dots \dots \dots$	834 yds.
13	$1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 3 \cdot 3 \cdot 2 \frac{1}{2} \cdot 2 \cdot 1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot 1 \cdot \dots \dots \dots$	590
19	$3 \cdot 3 \frac{1}{4} \cdot 3 \frac{1}{2} \cdot 3 \frac{1}{2} \cdot 3 \cdot 3 \cdot 2 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \dots \dots \dots$	400
22	$\frac{3}{4} \cdot 1 \frac{1}{4} \cdot 1 \cdot 1 \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \frac{1}{2} \cdot \dots \dots \dots$ $1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot 1 \frac{3}{4} \cdot \bigcirc \cdot 1 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot 2 \cdot \dots \dots \dots$	—
25	$4 \frac{1}{2} \cdot 3 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 2 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot \dots \dots \dots$	518
31	$1 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{3}{4} \cdot 1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \cdot 1 \frac{3}{4} \cdot \frac{3}{4} \cdot \dots \dots \dots$	460
35	$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{3}{4} \cdot 2 \frac{1}{4} \cdot 2 \frac{1}{4} \cdot 2 \frac{3}{4} \cdot \dots \dots \dots$	700
26° 00'	$1 \cdot 1 \frac{1}{2} \cdot 1 \frac{3}{4} \cdot 2 \cdot 2 \frac{1}{2} \cdot 2 \cdot 2 \cdot 2 \cdot 1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot \dots \dots \dots$	522
11	$1 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot 1 \cdot 1 \frac{1}{2} \cdot 1 \cdot 2 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 2 \cdot 2 \cdot 2 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot \frac{1}{2} \cdot \dots \dots \dots$	600
16	$3 \cdot 4 \cdot 4 \frac{1}{4} \cdot 4 \frac{1}{4} \cdot 3 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot 2 \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \cdot 1 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 2 \cdot 2 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot 2 \frac{3}{4} \cdot 1 \cdot 1 \cdot \dots \dots \dots$ $1 \cdot 1 \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 2 \cdot 2 \cdot 1 \cdot \frac{1}{4} \cdot \dots \dots \dots$	1000



Between Sehewan and Bukkur, in the months of February and March.

Parallel of Latitude.	Soundings.	Widths.
24,	$\frac{5}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{3}{4} \cdot 1 \frac{3}{4} \cdot \dots \dots \dots$ $1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \cdot 1 \frac{1}{2} \cdot \frac{1}{2} \cdot \bigcirc \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \dots \dots \dots$ $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot 1 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 2 \frac{1}{4} \cdot \dots \dots \dots$ $2 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot \dots \dots \dots$	1684 yds
28	$\frac{1}{2} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \cdot 1 \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \dots \dots \dots$ $1 \cdot 1 \cdot \frac{3}{4} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 2 \frac{1}{4} \cdot 2 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot \dots \dots \dots$ $1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{1}{4} \cdot \dots \dots \dots$	1456
41	$2 \cdot 2 \cdot 2 \frac{1}{4} \cdot 3 \frac{1}{4} \cdot 2 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 2 \cdot 2 \cdot 2 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \dots \dots \dots$ $1 \cdot 1 \cdot 1 \frac{1}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \cdot 1 \cdot \frac{3}{4} \cdot 1 \cdot 1 \cdot \frac{3}{4} \cdot \dots \dots \dots$	763

Between Sehewan and Bukhur, in the months of February and March.—(continued.)

Parallelof Latitude.	Soundings.	Width.
42'	1. $\frac{1}{2}$. $\frac{1}{2}$. $\frac{3}{4}$.  $\frac{5}{4}$. $\frac{3}{4}$. $\frac{3}{4}$. $\frac{5}{4}$. $\frac{3}{4}$. 1. 1. 1. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{2}$. $\frac{1}{2}$.  $\frac{1}{2}$. $\frac{1}{2}$.  $\frac{1}{2}$. $\frac{1}{2}$. $\frac{1}{2}$. $\frac{1}{2}$. $\frac{1}{2}$.  $\frac{1}{2}$. $\frac{1}{2}$. $\frac{1}{2}$. $1\frac{1}{4}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $1\frac{3}{4}$. $1\frac{3}{4}$. $1\frac{1}{2}$. 1. ...	1600 yds.
44	$\frac{1}{2}$. $\frac{1}{2}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $2\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{3}{4}$. $1\frac{3}{4}$. $2\frac{1}{2}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $3\frac{3}{4}$	658
45	$\frac{1}{2}$. 1. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{2}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $1\frac{3}{4}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{3}{4}$. $1\frac{3}{4}$. $1\frac{3}{4}$. $1\frac{1}{2}$	452
27° 10'	$2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{4}$. 1. 1. 1. $\frac{3}{4}$. $\frac{1}{2}$. $\frac{1}{2}$. $\frac{1}{2}$. $\frac{1}{2}$. $\frac{1}{2}$. $\frac{1}{2}$. $\frac{1}{2}$	622
18	$\frac{1}{2}$. $\frac{5}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{3}{4}$. $2\frac{1}{2}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $3\frac{1}{4}$. $4\frac{1}{2}$. 4.	850
29	$1\frac{1}{2}$. $2\frac{3}{4}$. 3. 4. 4. 4. $4\frac{1}{2}$. 4. 3. 3. 3. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $2\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$	690
40	$1\frac{3}{4}$. $2\frac{1}{2}$. $2\frac{3}{4}$. $1\frac{1}{2}$. $2\frac{1}{2}$. $1\frac{3}{4}$. $1\frac{3}{4}$. $1\frac{1}{2}$. $1\frac{1}{4}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $\frac{3}{4}$. $\frac{1}{2}$. $\frac{1}{2}$. $\frac{5}{4}$. $\frac{5}{4}$. $\frac{5}{4}$. 1. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{2}$. $1\frac{1}{2}$. $1\frac{3}{4}$. $2\frac{3}{4}$. $2\frac{3}{4}$. $2\frac{1}{4}$. $2\frac{1}{2}$. $2\frac{3}{4}$. 3. $2\frac{3}{4}$. $2\frac{1}{4}$. 1.	1896

Between Bukhur and Mittun, in the month of April.

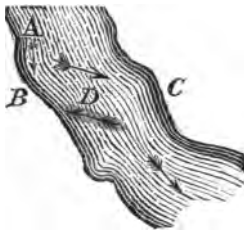
Parallelof Latitude.	Soundings.	Widths.
27° 58'	$2\frac{1}{4}$. $4\frac{1}{4}$. $4\frac{1}{4}$. $3\frac{1}{4}$. $3\frac{1}{4}$. $3\frac{1}{4}$. $3\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. 1. 1. $1\frac{1}{4}$	561 yds.
28° 03'	$2\frac{2}{4}$. $2\frac{1}{4}$. $3\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. 1. $1\frac{1}{4}$. $\frac{3}{4}$. $\frac{3}{4}$. $\frac{3}{4}$. $\frac{3}{4}$. $\frac{3}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $2\frac{2}{4}$. $2\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. 2. $1\frac{1}{4}$. 1. 1. $1\frac{1}{4}$. $1\frac{1}{4}$. 1. $1\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $\frac{3}{4}$. $\frac{3}{4}$. $\frac{3}{4}$.  $\frac{3}{4}$. $\frac{3}{4}$	1067
08	1.  $\frac{1}{4}$. $\frac{1}{4}$. $\frac{1}{4}$. $\frac{1}{4}$. 1. 1. 1. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $\frac{3}{4}$. $\frac{3}{4}$. $\frac{3}{4}$. $\frac{3}{4}$. 1. 1. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $2\frac{2}{4}$. $2\frac{2}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $2\frac{1}{4}$. $1\frac{1}{4}$. $1\frac{1}{4}$. $2\frac{2}{4}$. $2\frac{1}{4}$. $3\frac{3}{4}$. 3. ...	1123

<i>Current.</i>	miles.	yards.
The usual current in the freshes is,	5	992
When the freshes are strong,	6	1272
The greatest measured velocity,	8	323
Between Attock and Kalabagh, where the river is hemmed in by mountains, it is estimated in the freshes, ...	10	
In the dry season usual,	2	1376
Ditto ditto strong,	3	1248

In a channel 1855 yards wide, the current in the middle of July has been found to vary its strength in different depths as follows:—

$\frac{1}{2}$ fathom	2·7 knots.
$\frac{3}{4}$ do.....	3·4 do.
1 do.....	4·7 do.
$1\frac{1}{2}$ do.....	2·9 do.
2 do.	4·8 do.
$2\frac{1}{4}$ do.....	5·8 do.

By experiments with Massey's patent Log Machine, the ground current of the Indus has been found equal in velocity to that of its surface.



When the stream *A* encounters the bank at *B*, it is thrown off in the direction *C*; that part of the bed called *D* is thus cut off from a further supply. An irregularity in the level is the immediate consequence, to restore which, a surface stream rushes up, as represented by the coloured arrow in the figure; but as the water at the bottom of the surface *D* runs off by the declivity of the river's bed, no equilibrium can take place, while a rotatory motion, fatal to the bank, is given to a large body of water in its immediate vicinity.

TABLE No. 7.

Tonnage upon the Indus.

Boats, ...	Kurwars from								No. of Boats.	Remarks.	
	100	80	70	60	50	40	30	20			10
Doondahs	7	33	47	50	70	70	100	100	150	627	Between the Sea and Bukkur.
Doondahs Tohruks,	0 0	0 0	0 0	0 0	0 0	0 0	0 60	11 0	0 0	11 60	Bukkur and Mittun.
Tohruks, Duggahs,	0 0	0 0	0 0	0 0	0 0	0 0	0 10	107 0	0 0	107 10	Mittun and Kalabagh.
Duggahs,	0	0	0	0	0	0	0	46	0	46	Kalabagh and Attock.
Total,	7	33	47	50	70	70	170	264	150	861	

Abstract.

Upon the Lower Indus are 627 boats carrying 25,530 Kurwars.

Do. Upper do. 188 do. do. 6,550 do.

Do. Attock, 46 do. do. 1,150 do.

Total, 861 33,230

Deduct for old and worn-out 161 5,635

Boats, 700 carrying 27,595 do.

Available between the Sea and Attock, in which neither fishing craft nor the boats of the Punjab rivers are included.

TABLE No. 8.

Price of Boats at Pind Dadur Khan.

A Tohruk, cedar built, of 100 mds. costs	100	Nanukshakee	Rupees.
do.	200	do. 200	225 do.
do.	300	do. 300	do.
do.	400	do. 350	do.
do.	500	do. 450	do.
do.	600	do. 475	do.
do.	700	do. 500	do.
do.	800	do. 500—600	do.
do.	900	do. 600—700	do.
do.	1,000	do. 700—800	do.

TABLE No. 9.

Hire of Boats.

On the Lower Indus Doondahs of 16 Kurwars $1\frac{3}{4}$ Korah Rs. per diem.

do.	do.	35	do.	$3\frac{1}{2}$	do.	do.
do.	do.	40	do.	$3\frac{1}{2}$	do.	do.
do.	do.	38	do.	$3\frac{1}{2}$	do.	do.
do.	do.	60	do.	$4\frac{1}{2}$	do.	do.

On the Upper Indus, Tohruks of 100 mds. at 10 Rs. Goondah per month.

Ditto ditto 700 ditto 60 ditto ditto.

And in the same proportion for Boats of a greater or less burden.

Note.

The Nanukshakee and Bombay Rupee are all equal. Goonda is one anna short of the Nanukshakee.

127 Korah=100 Rupees Bombay.

18 Mamads=1 Kurwar.