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Livingstone, David, 1813-1873

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Report

On the Navigation of the Zambesi.

[By Dr David Livingstone MD. FRGS etc H.M. Consul
in central Africa,

Commissioned of the Foreign Office July 26th 1859

Read November [28]1858]

In endeavouring to form
an estimate of the value of the Zambesi
for commercial purposes, [it is necessary to recollect] we were
obliged in the first instance to trust
to the opinions of naval officers
who had visited it; and the late
Captain Parker together with Lieutenant
Hoskins having declared that it was
quite capable of being used for com-
merce, though the Portuguese never
did, and do not now enter it directly
from the sea, we trusted in the testimony
of our countrymen, and though we
failed to find a passage in by
Parker's Luabo, we discovered a
safe entrance by the branch
Kongone; and H. M. S. Lynx,
Captain Berkely, at a subsequent
period, found a good channel

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by the main stream (Parkers Luabo) though
we had failed to observe it in a three
days search. The question of safe entrance
from the sea having thus been satisfactorily
solved, our attention was next directed
to the rest of the river - the subject of
his report.

[It is desirable also to
remember that] in an experimental Expedition
like ours, it was plainly an imperative
duty to select the most healthy period
of the year in order to avoid the fate
of the Great Niger Expedition. Had we

come any time between January and April, a large vessel could have been taken up as far as Tette, but [that] is the most unhealthy time of the year, and we then looked on the African fever as a much more formidable disease than we do now. We entered the river in June, when the river was falling fast, but even then, the official reports of Captain Gordon R. N. and other naval officers, were precisely the same as those of Captain Parker and Lieutenant Hoskins. Their

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testimony however, referred to only about seventy miles from the sea - Mazaro - the point at which the Portuguese use of the river begins. We have now enjoyed a twelvemonths experience, which is the shortest period in which all the changes that occur annually, can be noted, and we have carefully examined the ~~whole, without attempting any regular survey~~ from the sea to Tette five times over, in a ~~shaky craft[,] of the Niger canoe or pot-bellied shape,~~ the top speed of which (3 1/2 knots)[,] admitted of nothing being done in a hurry; and may therefore be considered in a position to give an opinion of equal value to that of flying visitors, better qualified in all other respects for the task. ~~As it was expected that my companions should collect fuller information than I could formerly furnish, and~~ [As] a report on the river would be incomplete without a description of it when at its lowest, I sent the journal of M^r[T.] Baines to the ~~R. G. S.~~ [Society] which was written at the worst part of the river, and in a season said by all to be one of unusual drought.

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M^r B.[aines] was taken up by a southern channel which contained much less water than that which we ascended a month later but adopting that journal as shewing what the river may again become in a season of drought. I would only add that in passing from the sea

to Tette, when the river had fallen still lower than at the period when the journal was penned, we were obliged to drag the vessel over three crossings 100 or 150 feet long of from 24 to 18 inches of water. It is not however to be understood that such is then the general depth. In the broad parts of the river we have three or four channels, and the greater part of these channels contains water from 8 to 15 feet deep, even when the river has reached its lowest ebb. But we are often obliged to cross from one channel to another, and sometimes from one bank to the other, and it is in these crossings that the difficulties occur. I am not aware that anything has been written of[n] the form of the bottoms of rivers, but familiarity with that & the signs on the surface, will enable one man ~~will enable one man~~ to fine three fathoms, while

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another will run aground on one or two feet. From our experience of a year in which the river was unusually low[,] and the rise deferred to a later than ordinary period, it is certain that a vessel really of 18 inches or two feet [draught] could ply at all seasons on the first 300 miles of the Zambesi.

At my suggestion a tide pole was planted at Tette by Major Secard and the lowest point the river reached in November /58 - that in which 18 inches were found in ~~the~~ [a] [few] crossings, adopted as the low water mark. By careful measurement with the theodolite the river was found at that point to be (964) nine hundred and sixty four yards from bank to bank, which if I remember rightly is more than twice the width of the Thames at London Bridge. At its lowest ebb it contained between 300 & 400 yards of water of various depths. the deep channel of

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this, in which the vessel lay, was from

twelve to fifteen feet deep. As it enables one to form a clear idea on the subject I may mention that we lost an anchor there when the water rose[,] and the volume of water being always considerable[,] we have no hope of getting it again by being left high and dry as a ship is represented at her anchorage in the Niger * At Shuramba Dembe the river is 3490 yards wide or 1 3/4 geographical miles, nearly. At Shigogo it is broader probably three miles[,] but large islands divide it into five or six channels. It is evident that with such an amount of spread, if the current of the Zambesi were very rapid, a rise of several feet at Tette would be of comparatively small value at Shigago. We therefore took the precaution of marking a perpendicular rock at the East end of Lupata, adopting as at Tette the top of 18 inches at the

* Laird & Oldfield's book (?)

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crossings as low water mark and carefully measured the velocity of the stream at the most rapid parts we knew. the result obtained both by patent and common logs was that no part of the river below Kebrabasa has a current of four knots. We were particularly suspicious as to the correctness of this result as some of our naval friends[,] judging from sight only[,] spoke of six and even eight knots. but remeasuring the common log and observing the Patent log hour after hour[,] in parts that this vessel could barely stem[,] shewed no more than 3 1/4 knots. The general current is 2 1/4 knots and under. The heights of the river observed by Major Secard in the accompanying table and by ourselves at Lupata and elsewhere[,] may therefore be considered as applicable to the whole stream. The amount of fall noticed also in the table, being only once down to 7 1/2 feet shews that the character of

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mountain torrent cannot be applied to the noble Zambesi any more than it can be to the Nile

From November to January the river rose gradually to 8 feet above low water mark. From the 15th January to the 15th May it had depth enough for a large vessel. Though Major Secard remarks that this year it attained only a minimum height and the accuracy of this is confirmed by the fact that only a small quantity of wheat is sown the parts flooded by the river being the parts employed for the crop. The data now submitted appear to prove that a vessel of two feet draught, such as are necessary for the Mississippi could run the whole of ordinary years. We knew of no other observations on which the navigability or non navigability of the river can be pronounced upon but leave them for the consideration of

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of those better qualified to give an opinion.

We have in the course of one year cut up into small pieces upwards of one hundred and fifty tons of lignum vitae alone, which according to the average prices in London during 1858 was worth about £900. This wood when dry was, in the absence of coal, the only fuel with which we could get up steam[,] owing to the boiler tubes being singularly placed all on one side and chiefly below the level of the fire[,] from which novel arrangement one side remains long cold while the other is hot like a patient in the palsy; and four & a half or five mortal hours of fuel burning are required to get up steam - yet by incessant labour

and a dogged determination to

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extract all the good [possible] out of an engine probably intended to grind coffee in a shop window, we have traversed 2350 miles of river. Now had we been permitted to shew what could be effected in this one branch of commerce, it is not unreasonable to say that every time the saw went through lignum vitae it might have been to secure or dress a log. Without any great labour we might have cut a thousand instead of one hundred and fifty tons of that valuable wood, and given a practical exposition of what may and very probably soon will be effected by the Germans in Zambesi commerce.

The only paper that reached us up to the middle of June last[,] contained a short notice of a[the] meeting of the Royal Geographical Society in which some interesting assertions were made in connection

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with a pretty theory, and an engineering flaw, that the Zambesi which under the very serious disadvantages of that flaw, we have actually been navigating, was not navigable at all. If our fellow members will only believe that we have a merry smile on our faces we would venture to move, for the support of the theory, in Parliamentary fashion, that the word ought to be inserted thus. "Wheat ought not to grow at the level of the sea". "Indigo ought not to grow more than a foot high" and "it ought not to contain indigo at all" "The seeds of cucumbers and water melons ought not to contain a fine bland oil[,] fit for purposes of the table" because that would be like "extracting sun beams from cucumbers". "The Zambesiought not to be navigable

for commercial purposes” and
the Steam Launch ”Asthmatic”
”ought to have been intended to draw”
something more than merely ”grist to the mill.”

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~~It is a pity that M^r Laird
volunteered a public assertion in
direct opposition to his own official
statement which we now have here
in his own handwriting, for
we go on the principle of breasting
whatever difficulties we meet, and never blaming others if we should fail,
and would have left un-noticed,
the saving effected by putting a
low pressure cylinder, to a high
pressure engine, had he not
publicly called for a public
refutation on a matter of public
interest. Instead of ”intending the
Launch to draw [tow] only.” His words
were ”D^r Livingstone may calculate
upon one ton for every inch
of Displacement in the Launch,
and as in the River he may safely
lead her to two feet, from ten
to twelve Tons will be available
for stores and crew.” Twelve kroomen
bring her down to 2 feet 2 inches without
any fuel, stores, or cargo; and instead
of ten knots confidently promised~~

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~~in the same statement; a head
wind holds her paddles so that
even with sixty pounds of steam
she is stopped even going down
stream. Without coals, and it
was only when left without this
fuel, that we began to examine the
matter ourselves, we can barely
keep up with the heavy canoes
of the Zambesi, and their [speed] equals
the saunter of the lazy ploughboy.~~

If there is[be] wind enough to
cause a slight purl on the water,
any one ascending a river may
observe dark blue lines stretching
across the stream. These by
native pilots are call ”kwéttés”, and
betoken the edge of the banks under

water. It may be observed also that one bank or other of the river is worn so as to be perpendicular; and that these perpendicular parts alternate from one side to the other at greater

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or less distances according to the rapidity of the current. the submerged banks are generally of a semilunar form at the lower edge or part farthest down the stream and this is invariably the shortest portion in the whole bank. They lie diagonally to the direction of the river, the angle of direction being less or greater according as the river is high or low. The Kwette is the part immediately below the shoal edge of the bank[,] and the importance of knowing them[,] by the blue line and other signs[,] may be judged of by the fact that while in the kwette you may have from two to three fathoms up to the very edge of the convex mass, onit you may not have one foot. The formation of these banks it is difficult to explain without drawings the water actually rolls over and over sideways towards the part of the bank situated upstream, and there lies the deep channel. The proper course is to curve round [in] the kwette till the upper third of the submerged bank is

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reached, then enter on the bank where you have deep water along [towards and in] the side ~~by being~~ [which is] cut perpendicularly. This which often is miles in length is called by the pilots "kokole". Sometimes the semilunar banks are placed in pairs, and the water between them is very deep; but the furrow of three or four fathoms ends in a triangular shoal. The upper third of one of the banks, on which in our bright sunshine, a distinct bulge shews the most water, is to be chosen for getting out of the deep channel before reaching

the shoal. My ignorance whether anything has been written on the subject, and desire to wipe out, possibly an unmerited reproach by an American author, the Rev^d M^r Bowen, that our officers were ignorant of the laws which determine the channel of deep water in the Niger, are offered as excuses for venturing these few remarks. If

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I succeed in inducing the better qualified among your members either to point out what has already been done in describing the bottom of rivers, or [in] working out the subject which I have but touched on, I shall not have incurred the charge of presumption in vain. In July last year we ran aground perpetually by going ahead straight. While in September when the river was much lower, M^r Medlycott of H.M.S. Lynx seemed to know the kwettes & banks intuitively, and never touched at all.

These submerged sandbanks, as on the Nile, are the greatest difficulty in Zambesi navigation. Each river has its own disadvantages. The Mississippi has its snags, & it is said ~~and~~ requires vessels of a peculiar build and only two feet draught. The Hoogley has its own very peculiar difficulties of entrance & so has the landing place at Madras; But

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difficulties are not impossibilities. A great difficulty - the African fever, is, we hope, rendered less formidable, and in spite of the theory that Europeans cannot live and labour in the tropics, we find that hard work, with the good food most conscientiously supplied by M^r Wilson of Glasgow, and a merry heart, have secured

as fair a share of health as we should have had in London.

From October 1858 to June 1859, 5782 Elephants tusks have gone down the Zambesi from Tette alone, of these two thirds were large or upwards of 50 lbs each, the weight of the whole were in round numbers 100 000 lbs. All merchandise is carried in large unwieldy canoes

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which cost between £60 & £70 each When loaded they draw about two feet and carry two tons at an expense of £10 sterling from Quilimaine to Tette[,] when the river is full. When the small channel between the Zambesi and the Quilimaine river is dry[,] which is the case at least nine months in the year[,] the expense is much increased by the land carriage to Mazaro. English manufactured goods come in a round about way by Banian or Gentoo traders from Bombay - and they are able [obliged] to give a larger prices for ivory than the Americans[,] who are absorbing all the trade of Eastern Africa. Several Tette merchants have been waiting at Quilimaine for months in expectation of American ships

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with cottons. For the information of mercantile men it may be added that the American calicoes are coarse, unbleached, yard wide cottons, costing at Quilimaine between 5^d & 6^d per yard - and muskets, inferior to English trade arms, from 26/ to 36/ each. With calicoes, guns and gunpowder, they easily secure all the trade on the East coast below Zanzibar No attempt is made to encourage the native taste for better

articles[,] which exists quite as
strongly here as on the West
coast. Red and blue colours
are often unravelled, respun
and rewoven into country
cloths, and towards Lake
Shirwa the only scraps of these
colours that come into the
country are exclusively claimed
by the chiefs

David Livingstone