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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 arrange-
ment 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