

His Excellency
Comodoro

José Simón Vera Camarero
de Serrano

Volume 2d,
Survey of the
Upper San Francisco
by the
Comissão Hydraulica.

1879.

Latitude 9.24 35.6
Longitude 2.4 42 Green

Wed. Sept. 24. RODELLES 11

CAMP N. 7.

4 bags
Paruka

Cold, cloudy morning. Some light like rain.

Arranged to start punctually at 6. A failure. The pilots, very behind time - at 6.37 - the "Anna" sailed, and "Piranhas" in the original canoe.

- At 6.55 The Pilot comes, and the "Milnorá" sails, and rubs on the bottom before the 1st chute ^{comes} men out.
- 7.20 In the open river half mile above starting. Course of River above about N 35W - for a league. Channel toward Bahia side. 2 metres or so deep.
- 7.30 a small swift - sail through it - Cortume on Halfeld's Map - and Canoe-men's name also. It is not in the way of a 5 ft. navigation. Good channel.
- 7.47 opp. large, sandy, stony bar on Bahia side.
- 8.05 Deep wide channel ^{near Bahia rock, sandy bar.} ^{cross a mile or more ahead} N 35W. Sailing 1 to 3 miles an hour fitful wind. ^{to shore.}
- 8.20 Wind almost gone. and too deep to pull well, close.
- 8.30 Spring slow opp. big Sand bar, Bahia side, close to, deep. The "Anna" washed and got in a better poke -
- 8.35 This seems to be tail end of Cax^a do Boi Velho
- 8.45 We meet the Paquette that took our cargo to Cabrito. We stop to pay. 115,000 + 2,320, for some difference ^{of weight} of weight. We pause opp. the Cax^a do Boi Velho, which is only swift water except a slight pitch. Paquette expects to be back to Cabrito within 15 days.
- Start 9.05 - at 9.10 strike the Cax^a pitch - with hard 5 minutes to make it - a fine Steamboat Chan-
- 9.15 - nel 100 ft. to right - Swift water continues.
- 10.00 We stop for breakfast on Bahia side about pt. of big bend - shown on Halfeld's map - about 1/2 league from Rodillas.
Good Breakfast BAHIA SIDE
- Some, slight, RAIN. Water meters 3 ft
- 11.35 Start Beautiful sheet of smooth water a league and more ahead - Course of River abt. W. 15 North. Large squashes 10 lbs
- 12.20 - A view of rock N 55 W
Distant say 2 1/2 miles
- 12.50 Fazenda da Pedra m. Pt.  300 m

4) Thursday - Sept. 25 CAMP N° 8. Bahia

Opp. Isl^d. (Head) Canabrava 293L

We leave this morning.

Carve at 4 1/2 A.M., arranged tent - and at 5, I aroused the camp - 5 o'clock at 5. 20 to 5. 30 - Coffee. cloudy - cool.

5.59' Start, with a fair breeze, up stream. The Sun rose at 5.55 by my watch. Red as blood

6.15 Hard tug with sails and oars against a strong current of a minor chute - we are in the Bahia side - the Steamboat Channel to our right - Our course up river is very little N of West. Run on a sweeping bend toward the West.

6.30 - Working thro' the Chutes of the Caxambu de Barão

6.44 - Just thro' a chute - edge of main channel which here curves from the Bahia side across toward middle and then runs back - all right.

7.00 Ilha e Serrote de Cantagallo - Caxambu

7.15 Just up a very hard tug - had to get the oars of the "Anna", which had gotten thro' before us, to help us up with poles + cord. This is between or opp. the Islands. The deep good steamboat channel - just to our right.

7.30. Canoes close against ^{Upper} Island Cantagallo - (Main Channel close to our right - somewhat strong, but easily navigated with steamer - current 4 miles an hour!)

7.50 We have just passed the hardest part of the Cachoeira da Cantagallo - all hands out on the black jagged rocks for about 1/4 mile - Current 5 miles an hour - the channel is narrow not over 60 ft. and curved, but a steamer not too long (say 100 ft or 120 m) can navigate it very well. Halfeld gives 4 miles an hour current - much of the length it is only that, but there are several hundred feet of 5 miles an hour. Careful steamboat navigation only is needed to pass these rapids safely.

Cool morning

Thursday - Sept. 25. Cantagallo Rapids. 15

8.00 a.m. opp. pt. of Rocks on Pernambuco ^(stay quite cool) to de, passing Canoes along the left side of the main channel. [a stiff breeze and good sails would carry a light draught vessel against the current. Our small canoe, Capt Piranhas sails right up.

8.17' opp. second pt. of rocks 1/4 mile above the first. The river abounds with rocks; but still there is a deep navigable channel. Breeze springs up - sail - Richman.

8.20 Opp. 3^d pt. of rocks 1/6 mile above the 2^d - 

8.26 Beautiful tree on Island - Ingazeira Tree Course of River here N.W. up -

8.45. opp. opening on to Belem - we pause 10 minutes to send Canika on to the Coast Guard. by Piranhas, & to get some ham + bacon in return - intend them to go to Belem to buy a beef and meat + provisions - Hope to see them in 2 days.

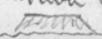
8.55 Start again - with fine breeze just at point of Island Ilha da Bara on Bahia side - Channel between Bahia and Island -

The main deep channel is between the island and the Pernambuco side. ^{Bahia side} This is a nice channel, on the flat, but it will hardly furnish more than 2 to 3 ft depth at the rapids above, in sight.

9.15 - Foot of rapids in this island, ^{Canoe} changed, Bahia side.

9.30 - after hard work - and not getting up, got the pilot to put up the sail - and then I got him to climb obliquely to a more gentle ascent, instead of pitching at the steep swift, and as with this without further trouble. Sent Piranhas with provisions to Belem.

10.00 - We stop for breakfast on the Ilha da Bara pretty well toward the head.

The population on the Bahia side, on this island is greater than at any point I have seen. The same kind of men, women + children - the crop of the latter seems new to have failed. Popⁿ good in inland too.  from Breakfast pt. bears S. 15 E.

How is it? The

- 11:25 - Start after a good breakfast. Wind favorable, but not strong.
- 11:50 We go into a small canal behind the small island - next to the Bahia side - to ascend canal.
- 12:00 We have just passed a nice little chute, ^{or finger} in the ^{main} canal.
- 12:21 - We are at the Head of the Rosario Rapids. We have swished around them, as it were. It is however only a rapids, not a fall - It has deep water, and the water is so broken by the rough, irregular rocky bottom & sides that a good steamer can stem it without Coasting - I would do nothing at this point. It is a wide deep, swift channel a fine, wide, good pool navigation above.

Ilha do Missão - on our Right.
a very long Island - From L. 292 to L. 290 ^{2 Leagues Long.}

- 12:55 - at Imbuseiro Rapids & Missão Rapids. There is a channel here not less than 60 feet, deep - and current not over 4 miles an hour - I would propose nothing to be done here till after running steamer through, and probably nothing need to be done unless it may be to take out or mark one rocky islet now only a little above the water - which with 2 or 3 ft water flung over it might be dangerous - but a steamer can pass on either side of it. Half a mile per hour current - for say 300 or 400 ft. length probably it is no more. The swiftest is not over 4 - a good straight channel from above for $\frac{1}{3}$ mile leads to this rapids - We pass up on one side of it near to it - mainly by our sails with light breeze.
- Ilha do Meio on our right. Bahia side on left.
- 1:25 Upper end Island do Meio - channel bet. it & Curvilinho.

- 1:27 Lower end Ilha da Curvilinho Curvilinho. The good, steambot Channel is between when we sail and these Islands - good breeze - we go along very well.
- 1:36 - We pass thro' channels which are deep enough and wide enough to run a steambot 100 x 20 x 5 thro' - but there are rocks 2 to 3 ft. below the water which will need to be marked, to make a safe ascending steambot navigation. The plan to be pursued is to come here and make a careful survey of this part of the river and then select the best channel. There is here more than one channel, that such a steamer could be passed up safely, and perhaps safely down. Probably a good safe channel can be selected that will need no other work than marking the places of a few broken rocks.
- This relates to about $\frac{1}{4}$ mile below Curvilinho, the few houses, so called on the Bahia side.
- 1:50 We are now sailing along the edge of the good channel which is left of us bet. us & Bahia side - pretty clear river toward the Bahia side.
- 2:10 - We are passing a very wide place in the river - (see map) where it shallows in consequence. I can guarantee a meter depth steambot Channel without cost except marking some broken rocks; but to ensure a 2 meter depth ($\frac{5}{8}$) it will require a more critical examination. I doubt whether it can be guaranteed without some cost. (It might be.) The current is not over 2 miles an hour.
- 2:40 Upper point of Curvilinho Island - see map - above this this branch of the river widens to $\frac{3}{4}$ mile to the long Ilha da Missão - (Wind has slackened some) We sailed a mile in 12 minutes.
- 3:05 - opp. small island Tuberana - lower end - R. $\frac{7}{8}$ mile.
- 3:20 - opp. Upper end of both islands Tuberana & Missão. Run above to Ilha Grande $\frac{3}{4}$ mile wide: good breeze.

8) Thursday Sept. 25 - Opp. Ilha Grande.

3:30 P.M. Sailing good breeze from
Course of river for 4 miles (approx) in full view ahead, W 30 N
Island Grande - an an Right. See maps to chart.

4:07 Opp. lower end of Small island lying out
from Ilha Grande about 1 1/2 miles below the head
of Ilha Grande.

4:12 Opp. upper end of said little island.

All along this part of the river there is a channel of not less
than metre depth of sufficient width for steamboat naviga-
tion. Possibly a channel can be selected which with
little work of removing rocks would give a good
steamboat channel for 1 1/2 m. depth.

The plan will be to put a light draught steamer
upon the river, and with her examine and select the
best channel that can be had with the least work.

4:55 - The "Anna" and "Milnor O" land, and at
5:00 P.M. The "Milnora" landed - at L. 289. X

at the
Fazenda de Abaré (Bahia = side)
opposite the head of Ilha Grande.

We have made 4 leagues to day.

The first league was hard work - and occu-
pied four hours - The other 3 were made from 11 1/2
A.M. to 5 P.M. or 9 miles in 5 1/2 hours - nearly all by
sailing against the currents of the river, part of the
time against the currents of the main channel.

CAMP N.º 9. de Abaré

Report N.º 6.

I have to report upon the 4 leagues examined
today, a good steamboat navigation not less
than one metre deep, requiring no work.

I am not sure that a channel 1 1/2 metres deep
can be secured all the way without some work.
The only certainty is for one metre or not over 4 feet.

Thursday Sept. 25, at Camp N.º 9

Continuation of Report N.º 6

The greatest velocity of currents to be encountered at the
Cachoeiras is 5 miles per hour. Most of the swift
currents do not exceed 4 miles an hour - and the
majority are less than 3 miles an hour. In the
wide, comparatively clear portions of the stream the
currents are about 1 1/2 miles an hour - sometimes less.

The river is here so much divided by large
islands and each of the 3 principal branches
is so wide, that I apprehended difficulty in
finding a natural channel 1 metre deep; but of
that, without investigation I am now confident;
even if the river should fall a palms lower.

The future final examination for the selec-
tion of the precise route of the steamboat channel
should be made with a light draught steamer; say
one drawing about 2 feet of water.

Some rocks will have to be marked, and a
few removed, in order to make a better and safer
channel for steamboats, the details of which cannot
be ascertained until after the selection of the final
channel; but the total cost of all work required
to perfect a low water navigation 1 metre deep, will
need not exceed 15,000,000; and the actual amt
may be less.

I consider that with the exception
of the lower league at the Cax. do Y20 - there is
now a low-water steamboat channel 1 metre
deep from Jatobá at league 314 to Abaré 289; =
= 25 leagues in all, examined up to this evening.
About Sept 25th 6:05 P.M. U.S.M.R. But it needs
work in the upper of the two leagues.

LIMESTONE Here!

MARBLE

a limestone in which it has been ^{found.}

The angle at which this rock pitches is from 35° to 40° from horizontal; and Mr. Derby judges that it is not less than 8 feet thick.

It is a handsome white marble, not of a fine texture, but apparently very pure. I have several specimens and one calcined piece.

There is a ^{porriate, I suppose - see Burton.} chapel at this place, and the main building of the Fazenda is better than the generality of the ^{new} good buildings, thus far.

Friday, Sept. 26th, No. 289.

We leave Abare. CAMP NO. 9. BAHIA SIDE.

5.53 - Start - sail - with moderate breeze. General course of River ahead W. 25° North. River 1/2 mile wide - some isolated rocks near middle - Bahia side clear. The very middle has a wide clear 300 to 500 wide - just above the head of Ilha Grande - which we leave behind.

The Ilha dos Brandão - now on our right.

The Ilhas Brandão and Grande are separated by an oblique channel.

Soundings - beginning at 6.14 a.m. 2 meters 4. 5 1/4. 5 1/2. 6. 6. 6. 3 1/2 R. 5. 5. 5 1/4. 5. 5. 4 1/2. 6.20 AM. sandy bottom. Splendid - clear river, 1/2 M. wide. 5. 5. 5 1/4. 6. 5 1/2. 6. 5. 5. 5 1/4. 5. 5 1/4. 2 1/2 R. ch. 5. 5. 6 1/4. 8.5. 8.5. 5 1/4. 4 1/2 R. 2.R. 7.5. 5 1/4. 6.5. 6. 4 R. 4 1/2. 6. 33.

Splendid channel all along - thus far beyond.

The exact middle of channel would have given even more regular soundings - we should have missed the 3 1/2 the 2 meter soundings. Halsted has noted the few rocks that show along the river opp. Ilha dos Brandão.

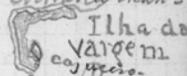
7.00 opp. Rocky Bar in River nearest to the Island - a short distance below a stream on Bahia side which

The channel is unobstructed.

Comes in at the angle of about - not far below L. 288. 7.05 opp. said Creek or Riacho. This league needs no work whatever.

7.31 - opp. head of Ilha dos Brandão. Rocks on this side along shore for a mile back.

7.34 opp. Lower end of the peculiar ^{shaped} Ilha da Vargem the end of which ^{butts} upon the river in a very peculiar way - owing to the island Capoto which stands above it forming another entrance channel on the upper side of the island.



7.45 opp. Brandão do Meio - 4 or 5 houses on Pernambuco side. BRANDÃO.

8.03 Brandão - we call at 4 cocoa nut trees - and several houses - probably the same as in Halsted's time. Certainly the number of houses is not increased.

Having a letter of introduction to ^(from Sr. Cavalante) Capitão - Proprietor of the Fazenda da Brandão Sr. Derby, and called paid respects, and del. letter. The Sr. did not get excited, but in his mild way offered us letters for up the river - said they had failed to have regular rain here for 4 years - that previously they could raise products in the plain; now only along the river.

A few leagues back in the country better cattle. He had (as a favor) sold our foreman Costa an ox, (small & thin, I saw the product) for 50,000 - It would not have brought 30,000 in Rio. But he did not want to sell it, Costa said.

The Capitão, was born on this place. It looks more like a place than any thing I have seen. A crude sugar cane mill & furnace - look rather dry just now. (PERNAMBUCO.) BRANDÃO

Our Breakfast here. Capitão has had his breakfast

Fortunates - has had two children but only two are living - The large island da Vargem, opp. belongs to this place.

There are two little banana trees - and a clog garden - and a fine Cajeup tree here. In need only timely rains - which they have perhaps never had to any great extent - to make this a profitable place.

The house is quite large, plastered inside and outside with square tile floors, roomy rooms, without glass.

9.45 A.M. Bid good-bye to BRANDÃO.

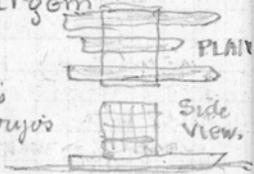
River over 1/2 mile wide - practically clear.

a few scattered rocks 1 foot above water, opp.

The upper channel of Alha da Vargem

Ajorijos for carrying Cattle to and from the islands.

Capitão's
Cattle Ajorijos



9.54 opp. outlet of upper channel

between islands Vargem + Capiciao on Bahia Side

10.09 Opp. new looking large white house red tile roof on Pernambuco side. Wider than usual marginal cultivation along here; banks are low and more or less flooded yearly. An old house in front of the new one.

It is shown on Halsted's map

10.10 River begins to show more inclination - stronger current preliminary to the Coxocais's league above.

10.20 River 5/8 mile wide - practically clear. Channel 1/2 m.

10.29 We cross the first deep Channel obliquely - 1/3 way out from Pernambuco side. We pass 2 Coxocais almost imperceptibly - Brandão + Graiva

10.35 Opp. town and small island on our Rt. We have a fine deep channel -

10.41 Opp. lower end of island Graiva on our left.

10.44 Opp. Upper end of small island on our Rt. Swift channel

The head of this small island about opp. foot of the Graiva. We are passing a Coxocais here.

Channel just to left - quarters 1 mile - 40 ft wide.

The river is very wide here, might have to be a little low dammy to get to the outlet - unless better on the Bahia side of island Graiva.

There is a better channel than this near to the island Graiva on this side of it - (Pernambuco side of it) [I would allow \$5000 - but a good 1 mile channel may require a dam, which would cost more.]

No necessity for this - another channel exists.

11.00 a.m. opp. upper part of high part of Graiva Island.

The river here is very wide - at least a mile, in all - low dam will easily concentrate the water if needed -

Opp. 1.287.

11.09 Extreme upper end of island do Graiva

I mean, river a mile wide - extreme of the island da Vargem - which itself is over 1/2 mile.

This is a very bad place in the river - just above the island do Graiva - on account of its great width and great division of water. Low dams and a chute such as proposed at the best place that can be selected.

This place cannot be properly examined and the best channel decided without the aid of a light draught steamer without any tedious work with sandos.

11.37 We are now zig-zagging through the worst part of the river (so far as a steamboat channel is concerned that I have yet seen -

The only chance is one toward the Pernambuco side, that we will sound.

The river is over a mile wide of irregular rocks and little crooked chutes - Halsted's map don't show the difficulties here.

at 11.47 - got Mr. Weeber to take Capt. Piranhas

cannot sound the channel down the Pernambuco shore the only chance for a natural channel, where Halsted gives some 8 Palmas.

11.47 - Lower Pt. of Island do Casuchy* we then sail our into much better clear water, between said island and the Pernambuco shore. It is 400 to 500 ft wide.

11.57 Opp. Houses on Pern^{co} side - foot of Rapids opp. Island do Casuchy - 400 ft wide - Channel over a meter depth near shore.

Mr. Weiser finds a clear meter depth below where he began sounding - the question will be solved that there is a meter depth up this channel, and that it can be made to meters at 5000 & 6000 - The other 5000 & referred to in page 16 is abolished.

12.08. Opp. the coach of a large barge (5 or 6 water) there is plenty of depth of water; but the channel is curved. A steamer not over 100 or 120 ft long 20 ft - 5 ft deep - can go through here without anything being done; but making the channel. 4 1/2 mile current - now - in this main channel.

Fortunately, a large volume of water passes between the island and the Pernambuco shore - now 600 ft wide opp. some houses - nearly opp. upper pt. of island do Casuchy.

River above very wide and full of islands; but a large share of the flow in the Pernambuco side.

12.27 - above the rapids - opp. a house, Pern^{co} side - Rocks in River - but a ^{fair} steamboat channel exists above the rapids.

12.49 opp. head of Island on our left near middle - means to Ilha da Casuchy.

12.50 Opp. lower end of Boa Vista Island on our Rt. The channel is between Boa Vista of Pernambuco side

1.07. Opp. head of small island on left. ^{Ilha da Casuchy} ~~Ilha da Casuchy~~ (one house) above head of Island - on Ilha da Casuchy a long tele wire appears above the shore fence.

1.50 - We are 1/4 mile above upper end of I. Boa Vista - which lies to the Pernambuco side - where the Channel is - and about 1/4 mile below the upper point of the ^{Ilha} Shaped I. de Casuchy - which lies to the Bahia side

2.06. at Cas - opp. head of Ilha da Casuchy - The entrance is at first about West - then W. S. W then S. W

Now the river rapidly narrows as we ascend, beginning with about 3/4 mile wide opp. head of Island, and narrowing in half or four eighths of a mile to less than 1/4 mile]

2.33 We run to shore to buy some vegetables.

2.50 - I invest 1/2 in cakes of farinha, and squashes - 2 cakes for 1/2 volume opposite house on Bahia side.

3.00 P.M. Begin soundings in meters 25, 20. Lead lost broke the ^{egg}

3.07. The river is not over 800 or 900 ft wide here. Opp. another house standing back, Bahia side.

While fixing another sounding line in fork current velocity; - which resulted in 0.94 mile per hour at surface. (Trials.)

3.	21.	22.	23.	24.	25.	26.
3.22	3.24	3.24 1/2	3.24 3/4	3.26	3.27	3.27 1/2
3.28 1/2	3.29	3.29 1/2	3.29 3/4	3.30	3.30 1/2	3.31 1/2
3.32 1/2	3.33 1/2	3.34 1/2	3.35 1/2	3.36 1/2	3.37 1/2	3.38
3.39	3.40	3.41	3.42	3.43	3.44	3.45

Half day gave 1.09 miles per hour somewhere about here

These soundings correspond, approximately, very well with Halsted's soundings, taken in Palmas. in 1852 or 1853 - 27 meters = 88 1/2 ft. our deepest sounding of Halsted's 131 Palm = 91 ft.

4.28. opp. lower end I. da Ponta = Bosins. We run outside.

4.53 - We are running inside of Ilha da Barra

5.00 P.M. We stop on Pernambuco side - having gone across from the Island - pretty place for a Port!

Mr. Weiser's boat or canoe Capt. Piran has not in sight in Uaqueba and a fire fly.

16) Friday - Sept 26. Camp N^o 10 -
on Pernambuco Side.
Opp. Ilha da Barra - within 2 Leagues of Cabroba

We have examined to day from League 289
to 1. League 284½ = 4½ Leagues = 13½ miles = 22
Kilometers.

REPORT N^o 7.

I have to report upon the 4½ Leagues to
day - that on a large portion of the route
there is a good natural Steamboat nav-
igation for 1½ Mts draught - without work;
and that there is a fair Steamboat navigation
all the way for a Mts draught without work.

The Channel on the Pernambuco Side
which Mr. Weiser went back to sound shows
a least depth in the Channel of 1.50 ^(one ground) Meters.
Above that point, where we passed, there
is a depth of ^{more than} 2 meters ^{all the way}, but in
one place between the Ilha da Caruhy
and the Pernambuco Shoals the Channel is
somewhat Crooked, and the Current about
4½ miles an hour. (Here is where a large
was wrecked 5 or 6 weeks ago) but a steamer,
managed properly, should pass either way, safely.

It may be desirable to make a few shoals;
but the total expense needed on these 4½ Leagues
is trifling - 5,000,000 should cover all.
* 5.30 P.M. W.M.R.

* P. S. A portion of the way, where the river
is only about 800 ft. wide, I took soundings
[see page 15 - the deepest of which is 27 meters =
88½ feet - velocity of current 0.94 Miles an
hour -

I think that deeper soundings could
be found. I did not stop to search for them.

17) Saturday - Sept. 27th - Start from Camp 10 17
1284½

5° 58' - Start. to go to Cabroba to breakfast
P. S. a little wind. (mosquitoes last night
were not very troublesome.)
nice arm of the river made by Ilha da Barra
6.12 Upper end of island da Barra (500 ft wide)
main channel of river is outside of island -

6.15 Beautiful River! Clear - 2000 ft wide -
Channel depth about 3 meters - along here.
Course here N.N.W. - turning gracefully around
toward the West. (Pernambuco side)

6.18 opp. mouth of Riacho da Terra Nova or
do Zigue. An extensive sand bar on the
Bahia side of the River - promises

6.26 a few rocks about middle of river - 18 inches above
6.28 also a few near the Pernambuco - residue of Rain Clear.

We make about 2 miles an hour against a current of
6.55 about 1½ to 1⅓ miles.

on the Pernambuco side - all along here it is very
clayey - on the Bahia side - back of the ex-
tensive sand bar of Bom Jesus, the hills are
also very sandy. The sertão appear green
on the Bahia side - just here - some rocks in River.

7.01 opp. Lavn end of I da Brejo - which is nearest the
Pern^o side. There is another, small island inside of
the Ilha da Brejo - no name.

The sounded channel of Halfed is between these
islands and the Pern^o (or left bank) side. It has 13 fathoms
or 9 ft. of least depth - good.

Rocky lumps in main river - making Crooked channels.
7.11 opp. Upper pt. of Ilha da Brejo - It is an unpopulated island.
Croca in the shoal below Bahia side - loading Canoes
from pack horses going to the Cabroba Falls.

Pretty entrance to the Cabroba arm of River
narrow, compared with river - 250 ft. above entrance low water
ascending arm of River.

20, Com: Hyd. ca
Wm. Exp. no. Com. do
Sen. D. Luiz, Plinio d' Oliveira
Securana, et.

"Cabrobo" Sat. Sept 27th
1879.

We arrived here this morning, having completed our examinations of the river from Jabota' to this point, about league 283 (of Halfeld's survey) in a manner which I consider quite satisfactory.

Knowing that a mail is expected to leave here to day or tomorrow for Pernambuco, I embrace the opportunity to write, though I cannot take time to enter into many particulars; nor is it necessary.

All of the members of the Commission, including Prof. Daby, continue in the enjoyment of excellent health; and are doing their duty faithfully, and entirely to my satisfaction.

Our Ajrijos, and our Canoe (all with sails) work very well. The sails have been of great utility, and they have not only saved time, but they have enabled us to examine the Channels much better than we could otherwise have done.

I will anticipate the future report to be made upon the examinations of the Upper San Francisco, so far as to say, that with the exception of about one league (No 299, Halfeld's survey) we have found a navigable Channel, up and down which proper light draught steamboats can pass in low water between Jabota and Cabrobo, a distance of 31 leagues.

The above is the main and important fact; although there are places, where, at a moderate expense, the Channel should be improved.

The league (No 299) upon to, can be made navigable, at much less cost than has been estimated by former explorers; but I must reserve the particulars for my future report;

Saturday, Sept 27th CABROBO.

121

Continuation of letter to Sen. Plinio.

Some detail plans and Calculations being necessary for a complete explanation.

I am much gratified in being able to say, that the difficulties upon the 31 leagues examined are much less than I had anticipated; the reasons for this will appear hereafter.

Meanwhile I will take occasion to repeat, as already indicated in a former letter, that I consider Engineer Halfeld's survey as of my great value to this Commission; and of great permanent value to the government. In all essential points, whenever we have had opportunities of testing his maps of the river, we find them substantially correct. Without these maps we could not have accomplished the proper examination of these 31 leagues short of occupying three times the length of time.

I trust it will continue so throughout, to me including the Cachoeira da Sobradinho.

Our pilots and Canoe men on our two Ajrijos are excellent, well behaved men, who do their work well. The guard of twelve men advised and selected by Chief Eng. Krigger, has thus far kept on land, bringing our horses with them.

I suppose that they are a moral influence. At least there is no appearance, thus far, of any necessity of armed men with the Commission; but having been recommended and selected by Mr. Krigger, who is much more familiar than I am with the inhabitants of this valley, I do not like to take the responsibility of dismissing them; although their continuance adds fifty per cent. to the cost (and weight) of our provisions, and cost of our labor.

This, however, is a minor matter, scarcely worth troubling you with.

I am now quite confident of completing the examination of the river to, and including the Cachoeira da Sobradinho, before the annual rise, or before the river can rise enough to enter seriously with above water examination.

M. M. R. Eng. in Charge

Reported to me that 3 of the guard had declared, some days ago, their intention to leave us at the end of this month; but that now they thought of remaining. I make it imperative that they shall be paid off and go. I also order that the troublesome drunken one shall leave.

Sr. Costa, the Foreman, intimates to Sr. Amorante that he does not wish to stay with such a reduced force. I express my entire willingness to let him leave, if he does not wish to stay. He concludes to stay. I have thought it better to let him remain.

After much hunting and trouble about pasture for our 12 horses, we conclude a bargain with 2 different persons to pasture mine at 5,000 per head per month - 4 in one place, and 8 in another place.

I conclude an agreement with Sr. who is to transport our provisions, baggage, &c. to Pernambuco side for 120,000 milreis. I proposed this to the plan of buying or renting another *ajouros* and hiring and providing for an additional company of canoe men. It is cheaper, and I think every way better.

Sr. the vicar Sr. Sr. call and pay their respects; and we get some interesting information. This is a large parish; but the vicar says it is sparsely populated - about 6000 in all, chiefly marginal along the river. Some ten or twelve leagues in the interior the land is better and there has been some cultivation - Cotton, during the U.S. civil war - reached 5000 sacks in this neighborhood - in the above mentioned interior.

Sr. ASSUMPCA tells us that the steamer "Dantas", belonging to the Province of Bahia is lying idly at Santa Anna, one league above the Cachoeira da Sobradinho.

I decide to send a telegram through Sr. Krueger in my letter to him, to the President of the Province asking the use of the steamer for an *Commissao* to take it up the river some distance and return it to Santa Anna.

Sr. Sabria and I call upon Lt. Col. who is an invalid from rheumatism; his wife is the sister of the vicar - she is the mother of 17 $\frac{2}{3}$ children - the vicar must be about 50 - his sister is older than he. Three of the children died.

The vicar has one of the only two nice handsome houses. He planned & built it himself. The other one belongs to Capitaes who is at present in Bahia.

The business of the valley from the ports above here is done with Bahia, even the ports that are on the Pernambuco side. Cabrobo is 150 leagues from Pernambuco - the distance is so called here. CAMP. N° 11

I write a long letter this morning before breakfast, to my friends Mr & Mrs J.R. Brehm - I also wrote another short letter to Addie, and another short one to Col. James. also 5 pages to Capt. Eads, relating to the Panama Ship railway project. Left a copy of it, in pencil. Sr. Lisboa translated my letter to Chief Eng. Krueger. See page 24 - for my English copy of the same. He arranged the telegram to the Pres. of the Province of Bahia, with my sig. as Eng. in Chief.

24] Sunday - Sept. 28

Cabobo

M^{rs} Sr.

J. Rignold von Krüger - Eng. en chef de
Piranhas

Sunday - Sept. 28

Cabobo

25

Continuation of letter to Chief Eng. Krüger

Cabobó

I arrange that our mail man, if he succeeds in getting our letters to Piranhas in time for the Thursday steamer, he is to be paid 2,000 extra. Mr. Krüger is requested to let me know whether the mail man arrives in town. ^{also} And if he gets favorable answer from the President to send a special messenger with it.

26 Monday - Sept. 29th Leave Cabrobo.

11° 40' - Start with Mr. Lisboa - on the "Anna" to go around to main river.

12° 50' at lower point of island Assumpção Poling along near Channel on Island side of main river.

1° 04' opp. lower pt of island on left. Ilha dos Onca lower channel 300ft wide

1.14 Upper pt. of Ilha dos Onca then rocks to the

1.19 Lower pt. of Ilha da Favella, about 200 ^{200m} ^{1/2 mi} This channel is very shallow - with little current. Very rocky - only canoe nav - hardly that now, worked through (barely) small chute -

from here up in ⁴² 500ft wide - Channel to Favella island #

1.35 - Cachoeira da Favella runs from Is. Favella obliquely toward foot of three smaller islands.

We have to Cord along 1st little island.

2.10 - we are over the hardest part of this difficult Cachoeira - as troublesome as any we have met. There is a quarter mile more ahead; but the slope is now quite -

2.30 - opp. upper end I. Favella - & opp. lower end of Island Pambusinho - a larger island

We are now near the upper (can) part of the Cachoeira da Favella. It is a bad one!

2.50 - We are now only fairly above the said rapids 800ft wide between islands here - working up against a pretty good current in deep water near the Island Pambusinho - after a while I

3.20 - notice persons on the grande island Assumpção - and on looking thro' the glass I perceive that they are our people. We ^{with} ^{our} ^{ajoujos} ^{over} there - and find that Mr. Derby failed to communicate with the merchant to have him bring the canoe over from Pambú - I then send our ajoujos farther up, and ^{we} walk up stream, about 3/4 mile to Porta Larna - where we hear of the merchant, having been taken sick the river and left there, at Pambú. I then send Piranhas over

Monday - Sept. 29th Working around from Cabrobo to Porta Larna 27

in a canoe with its owner, to bring the merchant and the canoe he desires to sell, over here; as we do not intend going to Pambú with our ajoujos. O del

4.00' - Our ajoujos "Anna", arrived at Porta Larna I send 3 of our canoe men back by land down the island Assumpção, to meet the Milnora in the Cachoeira and help them up. They do not start down till about 4.20 - I hope they will meet them about 5, and work up here by 6 P.M.

Pambú is a ruin - It is what is called a "Villa" "Supprimida" a suppressed villa. [I should think it would require but little power to suppress a villa in this part of the valley of the San Francisco.]

Porta Larna consists of two small habitations on the river bank - smaller than usual; but the ground is level, and will make a nice camping place if the Milnora and Milnor C, can get up through the rapids before dark. CAMP N° 12.

7.40 P.M. by the light of the full moon, the Milnora arrived - Dined 9 P.M. in bed, and retired.

Paid 100\$ over for canoe - and 2\$ over to the men bought of Ser. of Pambú and also of Cabrobo merchant. This is the finest canoe I have seen on the river.

Tuesday - Sept. 30 - Porta da Larna. CAMP N° 12.

Remained here to re-arrange the ajoujos "Anna" into a 3-pronged vessel and to repair the canoe taken out, and refit it for Piranhas' sailing canoe.

At 9 P.M. mail man came, but with no letters beyond Piranhas. Only one letter for me, from Sr. Krüger. Arranged to start at 6 A.M. tomorrow.

- 5.57 A.M. We navigate among little islands, poling against occasional swift currents, the main channel being bet. us and Pambu on the Bahia side - Suppressed VILLA.
- 6.30 a hard tug. our crew had to help the merchant's ajoujos up this pitch. It took 15 minutes to get up the B and the Canoe - our people got out on a rock to lighten CACHOEIRA da PAMBU
- 6.45 Start - Channel off to our left - on leagues 283 & 282, I allow 3000 x 000 for making the channel better, by removing and breaking rocks
- 7.38 Opp. mid. Ilha da Touce - Channel 50 to 70 f. deep.
- 8.17 Opp. Cax da Touce left where main channel runs - deep but with wavy surface - Say 4 1/2 miles per hour.
- 8.30 - We strike the pitch in Canoe Channel - Cord
- 8.40 up the pitch, but still deep, swift water.
- 8.48 Strike another pitch - Cord. 8.54 - we are up.
- 9.00 At lower pt. of Ilha da Carnaleão we have just passed out of the Canal de Carnaleão we stop for breakfast on this island
- 10.57 - Start - after breakfast from near lower end of Ilha da Carnaleão.
- Opp. Cachoeira da Pecha do Moleque 282, 20
- 11.25 - Stop 1/2 an hour - on acct. of foolish conduct # of Piranhas, and his Cousin (the New Super Neuzaman whom I employ at 17000 per day - liquor may have been at the bottom of it)
- 11.45 We have just worked thro 2 hard pitches.
- 12.22 Pause - at a Cachoeira just below
- 12.25 Ruin of the old Church of the Assumpção
- 12.34 Through the pitch - without cord. Opp. old Church Ruin Part of the steeple & one side standing. The river has undermined & toppled over the outer or river side of the building.

- The river is a full mile wide just at and below the old Ruin Church of the Assumpção.
- Len. of Church S. of W. 100 or 110 ft. long - The walls are of brick of great thickness, admirable masonry - the fallen masses are very large. It had a handsome ornamental front facing the West.
- 12.45 - Stop - bargain for fish - ask 48 for 3 fishes - no sale - we work up through a small rapid then stop for the other Garçon "Anna" - which is far behind. We wait under the shade of a large Cajuciro tree on the bank of the island but 2 o'clock
- We hear that the Church a short dis. back was in use as late as 1862.
- 2.03 we start - The main channel which is deep, is on the Bahia side off. here. I assume however - that 5000 x 000 may be required to improve the channel - on league 281!
- 2.50 - After coming through another pitch - we approach another, and stop, and some of our men go back to assist the Anna - which does not navigate as fast as the Milnora. Then we had to help the merchant boat up - It delayed us from 2.50 P.M. to 4.08 - when we started - 4.32 Cax da Chaba (Katarina) also head of island on our left.
- This is a gentle Cach - so that we get on better now -
- 5.00 we are now approaching the island Calabouca -
- 5.05 We stop on the outer side of the island near its head a little below Bezoque 280 - we have made, in all, to day - 2 2/3 leagues - over unformable Channels; delayed, but at one time helped by the other Ajoujos crew. The "Anna" is not far behind. We are not yet quite to the head of Ilha da Assumpção - We encamp.
- I will not make my regular report till tomorrow evening. The Pilot states and so it appears, that the deep channel is on the Bahia side - which I may see in our return; but I have no doubt that there is a metre channel all along on the Bahia side on leagues 281 & 282.

CAMP N. 13.

Rainbow
piece of
meat
about 20
cans

30) Thursday, Oct. 2^d Leave Camp 13

Calabouca Island
near upper end Ilha da ASSUMPCÃO -

5.53. A.M. Start - among the islands

The mountain on Pernambuco side, about a mile ahead, appears to be just above the upper extremity of Assumpção Island. It rises about 300 to 400 ft. above the river.

6.15 We sail - but the winds is abating. at last

6.18 Opp. upper extremity of Ilha da Assumpção

6.32 Opp. highest pt. of mtn. ^{on Pernambuco side.}

^{river} ^{channel} There are isolated rocks in the river, but it is very much less obstructed than it is in the 2 leagues back.

Our general course now about S. 25 W. sails forced. Rio de Oiti comes in on Pernambuco side above the mountain. a cool morning like Oct. at home

6.48 Ilha da Anguieria - on an left toward the Pernambuco side. The deeper channel is on the Bahia side of this island. We have a pretty clear river now - wide between said island and the Pernambuco side - where we are poling.

6.52. Opp. head of Anguieria Island, River ^{1/2} M. wide

7.09 opp. lower pt. Ilha da Jatoba MAP Sacco. The Indian canoe men call it. Sacco is - the name of the shore locality on the maps.

7.18 opp. a fine Jatoba tree - on the Island. islands

7.46 opp. upper end of Island Jatoba. 2 small trees
There is a Cap^a in the main river not far below head of Island; but it can not be strong - as we find only moderate currents - a gentle plane.

8.02. We are poling between the Islands Benedicto and Mitum on our left. ^{and one rock in our left} ^{on our right} and above here will have the Island Mitum on our left. 8.08 Sailing, slowly.

8.11 Opp. lower end Island Mitum. - wind freshens some.

8.28 Remanso Benedicto - main Pernambuco side

8.50

10.28. Here we are under some trees, and here we have been, the Milnora since 8.50

Thur. Oct. 2^d, RAIN - BREAKFAST. 31

11.35 - Start after the rain & breakfast.

11.45 opp. lower end of Ilha da Aracapa - a large island. Cap^a da Carakco

Calcao - is nothing but moderate swift among rocks - In higher water it is probably an ugly place.

12.12. Cachoeira - da Imburana - betⁿ I das Boias and Pernambuco side. Halfed given the soundings betⁿ islands das Boias and Aracapa

The main channel is on the Bahia side of the river. This Cachoeira is not a hard one.

General course of River above, a little S. of West.

1.15 On a nice pool of the River - begins to curve to the right.

1.25 - a trifling Cap^a ^{the right (away)} on the opp. side of this arm - some course of this arm nearly N. W. N. W. & West - is perhaps deeper, but all the time here curving to the west. Halfed's map along here shows the river too straight. P.S. the land has obviously been cut away by the river, since Halfed's sun

1.38 foot of little island - a small Cap^a outside of this little island near the island, but none on the opp. side of this arm - near Aracapa Is.

1.55 nice smooth water in this arm. call on shore tell -

2.15 nice pool - continues

2.15 - We stop - ^{near the head of the Ilha da} The Riocho de B reside - comes in at the head of the little island without a name.

3.35 - start to run the channel between the Islands Aracapa and the Island Tapera, on a course about N. 25 E.; thus leaving the Pernambuco shore.

There is a peculiar natural luxuriant growth of bushes and vines - different from any thing below here on both sides of this oblique channel. L. 277.25

3.51. Cachoeira - no name - not bad. CAMP 14

4.15 - Arrive at a place between the said Islands and encamp. I have decided to take the Ajoufos Milnora (after discharging all the heavy weight from the

32 Thursday Oct. 2

CAMP No. 14.

on Ilha da Aracapa - on its head.

on the arm separating it from Ilha da Tapera

ajajis, and go down the Bahia side channel, about 5 leagues, to near Pambu, returning the way we came up. I assume that we can do it in two days; but possibly it may take more.

Halsted says nothing about this deep channel; nor does Krauss.

The Pilot says he has been down this channel at the present stage of water - that it is deep but crooked, and encumbered with rocks.

CAMP No. 14.

Friday - Oct 3d

Going up the arm betⁿ the islands Aracapa and Tapera to get over to the Bahia Channel to run down stream about 5 leagues.

6.25 Start. After running a few minutes, we pass the channel or gut between Ilha Tapera and San Felix, and thence along the arm between the head of Aracapa & S. Pelis, which is only about 200 to 250 ft. wide here - 6.33 - pulling

Cool, like our home Oct. cloudy morning. Puls like rain now

6.37 - Cachoeira - moderate - say one for Canoes and can be made into a steambot chute for 5000 or less. It needs a low dam on each side of a fair width channel to get depth - 200ft in 2 pieces of dam 3 ft high x 1 chute 100ft long - for 1 meter clear depth.

Then clear river 1/4 mile ahead - to the main run -

7.00 In main run between Ilha Aracapa and Ilha Piedade (Halsted's map) Lorus, our Pilot, calls this Ilha Rodonda - the other islands & Chapels etc. We now start to row down the run - we have 4 oars, but only 3 are rowing 1 palavising ^{Wind ahead!}

7.25 Chute 1 1/2 metres - or Cach^a - near Piedade a little island off ^{Joaquim Island} 7.30 2 metres -

Friday Oct 3d - Going down river.

7.31 1 meter - but deeper tonight - 2 metres - 7.32 - 3 m. Good steam channel 150 ft. betⁿ islands - 7.34 - 6m Still deep & good - 4 M. Foot of Ilha Piedade (Rodonda)

7.38 - Main river now - 1500 ft to Bahia shore - our soundings near island Joaquin ^{de Aragon} main channel

7.42 - on bar (1 m) below island Piedade - going to ^{main channel}

7.43 - 2 1/2 M - 5 m. deep soundings as go ^{7.45 AM} _{3.30 E} over obliquely to Bahia side.



7.50 - Head of Cach^a - 200' wide (approx) 7.51 - on gut leaving main flow to our right the main flow coming hard to the right, with a wide deep channel.

7.55 - We are descending a run (but pretty large channel) among the islands - Pilot says the Cach^a on the Bahia side which in just turned from is hard -

7.57 in chute good steam channel - 2 to 3 metres - wide 100ft 7.58 my hand turn to right - only 100ft wide. deep steam can make it - (12 metres 7.59) 60 ft bet. rocks - Swift.

Then good straight channel - Swift - 5 metres - 10 metres rocks to the run - on each 100ft wide clear

8.02 Chute - 70ft wide deep swift good shape - 8.02 1/2 - 80ft wide - 14 metres - good & getting under.

8.04 - wide, good 11 metres - 8.05 Chute - 50ft. one side 50ft the other, 12 1/2 m good. 8.06 a Swift ^{100ft} (deep) 11 metres - across a 4 1/2 mile cut.

8.07 " " 100 m " 19 m. 8.08 Swift, 150 ft wide 11 m. 8.09 Swift 90ft. " 11 m.

8.10 Boiling ending out 5 1/2 m. Wood burn in Cox^a 8.11 - 2 1/2 m. 8.12 - 3m. S. Francisco - Bahia shore.

8.12 1/2 last swift - 3 metres, 100ft. Rocky place in shoal good - only one place where ^{the} mts divide channel ^{fall}

A ready made steam Nav. through this Cachoeira 8.18 - wide run - deep enough over to Island Aracapa (1/2 mile) in an near middle - at 8.20 AM.

8.23 Still fine deep pool - only a few rocks that had better be marked - for a higher stage of the river, but this is not absolutely necessary here

WEST REVER

- 8.27 some more scattered rocks - but an ample clear Channel 400 ft wide near the Bahia side where we are now running - ^{8.29 2 m} 2 m, 30 - 20 meters ^{many hours}
- 8.32 2 - my wide - pool. Bahia shore looks pretty -
- 8.38 3m. Elegant river - wind ahead - Roro better now -
- 8.42 3m. Blue dawn current from a moderate "swift" Good clear clean channel 100ft. in narrow place in night
- 8.44 below for 1/4 mile, or more. 8.45 4 m. opp. rocky end of ridge 60ft above river - Halfed shows it as a Mount - without name. It is nearly opp. the lower end of Island Aracapa - some current, but wind continues pretty strong ahead.
- 8.56 opp. lower end of Island of Aracapa! We are now approaching the double chain of rocks shown in Halfed's maps - which seem to debar navigation; but our pilot knows that there is a channel - we run from the middle toward the Bahia side
- 9.01 1/2 into current 500ft for shore - 2 m. an hour (2 1/2)
- 9.02 Swift. 2 m. 100ft channel. Elegant Channel coming to left - easy clear - wide 200ft -
- 9.04 150ft wide - 7 m. deep - elegant!
- 9.05 15ft " 16 m. deep 1 1/2 m. an hour 17 m.
- 9.06 200 " 14 " - elegant channel
- 9.07 300ft wide 13 " 9.07 1/2 (17 m) " 450ft for Bahia side
- 9.09 " " 17 " little to left
- 9.10 250 " 8
- 9.11 150 " Swift - Beautiful - cum a
- 9.12 Now open out 400 ft wide - 14 m. ^{end of} 7.27
- 9.17 nearly down to opp. lower end Island Mullum
- 9.18 - We turn in at lower pt. of Island to breakfast

Mr. Derby made a nice mess of oat-meat porridge which we enjoyed greatly - we had milk and sugar with it, eggs, peas, carne, crackers and tea.

The wind is fresh from S.E. opposed to our down stream progress.

- 10.49 Start - Going down Bahia Channel. We are out in the mid-channel going obliquely down toward the Bahia side. There are some rocks, but, ^{also} a wide channel - 8 m. 10.55 - 8 miles deep - 200 ^{wide}
- 10.55 300 wide - 5 m. 4 1/2 3.5 4 3 1/4 4
- 10.58 80 " clear 3 3
- 10.57 110 " 2 1/2 3 1/4 6 1/4
- 11. 100 " 4 3 3 1/2
- 11.0 200 " 3 1/4 4 [a few rocks to be marked none to come out.]
- 11.01 250 " 3 1/2 4.4 1/2 near mid river as m
- 11.02 300 " 6 5 5 1/2 (at 100) wide m
- 11.03 500 " 6.7. 5 (11.04 1/2) 800ft wide further
- 11.05 500 " 3 1/4 (11.06) 2 3/4 " " "
- 11.07 500 " 2 3/4 5.
- 11.08 500 " 10. just opp. small island on left - 11.08 1/2 7
- 11.09 500 " 8 (11.10) = 6 m. wide clear channel
- 11.11 300 " 5 Some few rocks begin to break the pool - but still a clear
- 11.12 300 " 4 1/2 on shore
- 11.13 400 " 2 1/2 Bahia side 400ft. to right - ^{rocks} Channel is now heading toward Bahia side
- 11.14 500 " 4 1/2 m (11.14 1/2) 6 1/2 m.
- 11.16 800 " 6 m clear channel 400 ft to Bahia side from the rocks
- 11.17 800 " 5 Surface clear of rocks. 11.16 1/2 5 m. ^{50 ft high} 50 ft deep
- 11.18 1000 " 4.5. 4. 3 1/2 4. 4. 4 1/2 3 1/2 (S. Ferry road)
- 11.22 about opp. end of quite ridge on Bahia side. not far above opp. upper end of Anguereira islands.
- RAIN
- 11.30 800 " 3 1/2 .5. 4. 300ft from Bahia in the and some river
- 11.33 600 " 4 1/2 4 1/2 4 1/2 4 1/2 5. 4 1/2 opp. Small island ^{vee}
- 11.37 300 clear 5 1/2 4 1/2 clear on the
- 11.38 300 " 4 1/2 4 1/2 Rock 3ft up - 150ft. from shore - 300ft
- 11.40 100ft 3. First Swift begins - 3. not much. Then pool
- 11.41 100ft 3-2 1/2 .3. 3. 3. 3. 3 1/4 3. 3 (11.45) 2 = 2
- 11.50 approaching the cachoira - Good time for 2 1/2 to 3 m
- 11.53 Entry - 70ft. Ch 40 50 south, near 100
- 11.55 150-100 - Good channel 6 to 7 m in from the coast

36) Friday Oct. 3, Going down Bahia Channel.

11.56 Channel comes to R- and runs to near Bahia side
300 ft. wide moderate current

11.57 - Small swift 40 ft clear of rocks - 2 miles an hour
Then at one channel widens - 4 m. an hour Currents
Cax-da-Fernando

12.00. In the pool, below the Cachoeira.
This is the heaviest Cachoeira - we have been
through; but, it is a ready made ^{low water} steamboat
channel for a proper steam drawing not over 4 ft
water. The least sounding we find in the rocks -
most of the way over 2 metres.

men lay on their oars a few minutes.
Consider that our examination this morn-
ing thus far down is a perfect success, and that without
a question this is the side on which to run the light-
chaught steamer.

It is not necessary to spend money to make a new
igation - the money should be spent in the right kind
of vessels to navigate (one spot, possibly 7 miles an hour
Current for a few hundred feet) At the worst a steamer
might have to be aided with a cord (ascending)

12.15. There is a good steam channel, with not less
than 1 1/2 metres depth - down this far below the rapids;
although a few of our soundings rising as a bar
showed only 1 metre.
We are running now bet. Bahia side & J. Cachoeira
as the Pilot tells it - It has no name on maps.

12.18. Enter swift - wide just below - 50 ft. as entrance.
abs 49 or

12.20 2nd Swift - 70 ft. 6 miles an hour
action and reaction - deep - wide - proper
steam will make it easy - nearly all the

12.21 - 3rd Swift - wide & deep of pulow
12.22 4th " 40 ft. Short - The great boiling and
reaction here favorable for steam navigation. The
immense friction reduces the velocity of the flow
very materially. No difficulty here - this is
a bend to the left coming out - but easily made.

Friday Oct 3, Going down Bahia Channel. 37

12.26 1/2 Enter 5th (light) swift - wide & deep. There are
Corveta currents here to the westward & a steamer
but nothing really dangerous with a steamer pilot
accustomed to navigating river with rapids.
12.29 In comparative pool. some rocks; but a good
wide, deep enough channel clear.

12.33. enter 6th (light) swift wide, and 3 to 4 metres deep -
then nearly pool again - 300 ft from shore (Bahia)

12.37 Opp. Rocky (low) point on Bahia side
Rocks pitch to S. 40° per hospital -
2 to 2 1/2 miles. 200 ft. from Rocky point - (3 m)
Clear channel say 150 ft -
Many rocks on left in river

12.39 - Beginning of No. 1 smooth swift - wide & just 3 m
Beg. of 2nd little swift - 40 ft clear
3. 2. 4 - 4 1/2 3 3/4 " in swift 2 1/2

12.41 3rd (medium) swift - 100 ft. wide - 1 1/4 - 3. 3 3/4
12.42 4th " " 50 ft 1 1/4 2 1/4 2, 3, 2
Coming to the right - but not too hard to make -

12.43 In wide pool like - through a current - 3 ft 1/2
we are steering out toward the Valado side - 1 1/4 1 3/4
1 1/2 2 - wide easy channel - 200 ft 2. We are
rather crossing channel obliquely

12.45 Now in strait then up a channel 1 3/4 = 2
400 ft. from island - some rocks in river. I think
there are deeper channels near Bahia side; but this
will do - 2 -

12.47 Enter 5th - slight chute for this series. 2 1/4 - 1 1/2 2 1/4

12.49 Opp. lower pt. Anna Peraina Island, Pilot calls

12.51 1/2 Enter Cachoeira rough surface - but 80 ft wide
and deep - comes to left, much reaction of current

12.53 in hole left hand of 2 patches lead back
keep coming to the right 12.56 thro - they pretty
rough one - but the steam will make - the
reaction is powerful retarding the flow

11.57. Enter a third patch - not so rough and
11.58 rocky rough surface water - Cachoeira da
we have come the right channel. MOLEQUE.

38) Friday - Oct 3^d Cachoeira da Moleque.

1. P.M. In beautiful deep canal 300 ft. wide - a splendid natural canal with about $2\frac{1}{2}$ mile curv., all the way to Pambú.

We have lost 2 leads this morning; but we have found a saving of 200,000 \times 000 or thereabouts, in finding a navigable steam channel drawing 1 meter or more ~~at~~ water.

1.05 - we stop - about opp. middle island Force to go up stream on our return -

This day's work has been very much more successful than I had anticipated after studying the Reports of Halford & Krauss. Oct 3^d - all the morning Showery!

4.00 P.M. A half mile above the Ruin of the Church we disembark to enable the Pilot to try to supply the place of a broken pole. After half an hour's return with wind that he could get one - minus the iron point for 3 \times 000 - as I did not see how we could do better I told him to go back and get off; and as he said he could make an Camp No 14 easily tomorrow evening I decide to encamp here till morning.

I can now report that there is a natural Channel, on the Bahia side, as far up as League 1st up and down which a properly constructed steam-boat can pass. One a 100 \times 20 \times one meter draught without any work being absolutely necessary - and that the marking of a few rocks is probably all that need be done; but it should be carefully examined with a light draught steamer in charge of a man experienced in similar navigation.

Instead of 200,000 \times 000, ~~or more as hints for 800⁰⁰⁰ to be~~ needed to make a steam navigation on the 5 Leagues, I would not estimate more than 20,000 \times 000 = Send the Steamer!

39) Saturday - Oct 4th Returning to Camp 14 -

We start a few minutes after 6 a.m. after a very windy night in our tent under the Capicira tree - where we waited the other day.

It rained a little during the night.

A very cool morning - a cold wind blowing across a little down stream.

Later in the day the wind helped us at times considerably.

We breakfast about $9\frac{1}{2}$ a.m. took 1:08 to Cook porridge and eggs and fish and eat breakfast and be on board of the Milvora ready for a start.

About noon we were just at the place where we were noon of Sunday - so that we will probably arrive in good season at Camp 14 -

My watch is of little or no use - I broke the minute hand yesterday - P.S. I have just discarded a minute piece of the minute-hand which I can use so as to note within a minute or so of the correct time.

2.34 Arrive at our Camp No 14 - and find Mr. Weiser and Mr. Lesbova returned, after a successful exploration up as far as League - 275

The Cachoeira da Perussu on the Bahia side, which Halford describes as terrible, and impracticable, has a width of about 4 feet - through a Channel only 20 ft wide; but by blowing out rocks on each side it could be made a good Steamboat Channel. It now has a velocity of six miles an hour; but some expense would be required to make a good Channel to the Cachoeira. In all, Mr. Weiser estimates that 20,000 \times 000 or $\$$ 10,000, would make a good Steamboat Channel 6 ft deep or more on that part of the Bahia Channel.

But this expense is not necessary, because Mr. Weiser found another, intermediate channel, to which

Halpelt & Krauss done refer - which is already a good steamboat channel with least depth of 1.50 meters, and most of 3 meters deep or more. Needing only about \$200,000 - or say 500,000 to remove a few rocks, to improve the channel.

So that our two extra days of examination of the 6 leagues of the river from L. 276 to L. 282 result in dispensing with all the expenditures proposed by Halpelt and by Krauss.

In place of any such sums, I would say, that the sum of \$40,000 or \$50,000 is sufficient to guarantee a good steamboat channel.

Mr. Weiser estimates that \$10,000 would make a good channel at the falls of Pericassu - which is the worst place in the river.

REPORT N° 9.

284½ to 276 = 8½ Leagues.

I have to report, that from league 284½ to 276 the upper end of Report N° 7, to 276 8½ Leagues, we have traced a navigable steamboat channel - up and down which, I could - in the present low stage of the river, run a steamboat of 1 meter draught without any work whatever being done in the river; but some improvements should be made, and the depth increased at a few points, so as to make, with a least depth of 1½ meters.

For all necessary information on this 8½ leagues, I estimate a total sum of \$29,000 or \$40,000. It may cost less.

But my plan would be to run a light draught steamer up and down carefully under the guidance of a good pilot. (Sous our pilot will do,) with the steamer in charge of a good River-Captain - A captain from U. S. Rivers would be a good investment.

We breakfast this morning before starting. Our Camp as already mentioned is in the Canal between the head of the Island ARACAPA and tail of TAPERÁ.

The "Anna" is re-arranged with 2 canoes; and we now have two loose canoes.

- 10.00 AM Start -
- 10.18 Little Cachoeira - in arm - 250 ft. width arm -
- 10.35 In main river near where we were the morning of the 3^d Oct. - Now we go up along Halpelt's Channel, where Mr. Weiser examined on the 3^d & 4th of Oct.
- 10.40 Opp. lower pt. I. S. Miguel - 400 ft in arm left. Good clear channel of ample depth - see soundings of Halpelt & Weiser's

10.53 A fine old Church (Ruin) on I. São Felix or Felis on our right. Pilot says it was the same in 1862. and we since. It has a Castellated tower; and altogether looks more like a Castle than a church. Cannot see the lower portion on account of the bank of the river intervening. The ruin is in good order, and it might be transformed into a Country Seat. This region seems to be too dry to support all the churches which once flourished.



- S. Miguel Church - opp. about same description -
- 10.59 Small Cox - good channel - in place right through.
- 11.14 Opp. (close to lower pt. of) Almas Island - each a fair steam channel. One rock 2 ft under water. Taken out would widen the channel to 70 ft - when it is now about 40 or 30.

I would call this a meter and a half channel. Halpelt's soundings - none under 2 meters; there are 2 meters on a width of 20 or 30 ft - very little work among a few rocks will make good channel.

42 Sunday Oct. 5th Going up by Islando. ^{almas, etc.}

11.24 Still going up Cap^a Channel near Islando Almas - Halfeld's ^{It needs} some expenditure; but not as much as Krauss' estimate; but more than

11.31 - a pretty hard sudden turn in the island channel - good depth. It will cost something to make a good channel.

11.52 Along near the upper middle part of Islando Almas. Halfeld has no soundings. The river is full of rocks and split into channels. A channel could be made but at considerable more cost than Mr. Weiser's estimate of the other route he sounded down, running round to the Bahia shore to the Cañal Rodonda. I would assume 10:000 \$000 for doing a good channel by the other route.

12.14 Opp. lower end Islando Calende - Halfeld's Channel betⁿ that and Is^l. Almas.

12.14 Stop - to get a hole (open) - 12.20 ^{up for survey} - lost 2 minutes.

12.24 Opp. head of Islando Almas. after turning the head of Almas we conclude to work (partly back) over to the lower end of the

12.45 At foot of Santa Maria Island to run up betⁿ it and Largauxa Islands

1.12 First little Swift - an elegant Channel - wide and deep, near St. Maria shore.

1.15 Islando Corte opp. to St. Maria now we pass the end of Largauxa - just above the little Swift - a semi-cov^d

1.19 tail end of petite inlet on Pt. Channel Swift.

Sunday - Oct. 5th Going up St. Maria ^{and} 43

1.27 at very swift channel - It is a good Steam-boat channel; but we must back down, and go on to Islando Corte side. It runs about 6 miles an hour - deep, and fine width. All the way thus far from the point of St. Maria Island good Steamboat Channel.

1.32 at small Cap^a on the Canal side. 2.00 P.M. another hard pitch, after passing two below here with the aid of Cords. The Steamboat Channel is pretty rough water opp. this Cañal occurs - but it is deep enough and about 6 miles an hour current.

The Channel has at first a direct course then as it comes down toward the St. Maria Island shore it curves to the right; but it is at least 70 ft. wide, and a good pilot will take a Steamboat down safely. Coming up the only difficulty is the Current of Sea 6 miles an hour.

2.12 In the main river of the Bahia Channel side. [a grand old mountain on our right runs that way have been running around - on the Comanche side - 1200 to 1400 ft. above the river.]

We are now running up the Channel examined by Mr. Weiser between the Island St. Maria and the Bahia main land. The river is 7500 feet wide. 2 Cocoa trees ^{Bahia side} on ^{one} ^{side} ^{of} ^{the} ^{river}.

2.30 - (Sailing slowly) a rocky ledge; there is a clear good deep 40 ft. Channel then a rock ^{40 ft} ^{50 ft} just now submerge - then another 40 ft clear channel on the other side. With this with rock removed there will be a clear 95 to 100 ft. Channel. Steamboats can now run either side Current 2 1/2 miles an hour

3.23 opp. another Church Ruin, on Is^l. of Santa Maria [The map shows another Church on the Bahia side a couple of miles back, but I could not see it.]

46 Monday, Oct. 6th Leave Camp 15

- opp. Lower end Id. Curralinho, [cloudy - cool]
- 6.10 Start from Camp No 15. Some rocks in river, just above, but a good ^{wide} channel, over 2 meters
- 6.29- Some rocks in river, but good, broad ^{scattered} channel in upper end of Island Curralinho - behind it is the island Mosquito. [P.S. I killed one last night.]
- 6.35 a gentle little sweep - clear channel 100 ft. 1 1/2 to 2 metres deep. River 1000 ft. wide, to Island.
- 6.46 a channel close to Bahia about a metre - but a deeper channel farther out - 2 metres. River wide.
- 6.50 River almost clear of rocks. River narrows to 800 ft. 1/4 mile below head of island Mosquito -
- 7.02 Opp. little island in front of head of Mosquito Island. Above Mosquito Id. river is 3000 ft. or more wide.
- 7.12 Opp. CARIBBAS on Pernambuco side. Edge of rocks across - but fair channel through - 1 1/2 metres - ^{Carabas} Day 20 hours - Halfed show 25 hours. Curralinho de Cima - on Bahia side, Quite a mountainous region back, a few miles, on the Pernambuco side. Quixaba - 1/2 doz. houses just above Carabas. River 4000 ft. wide.
- 7.30 The river is rather shallow and I would not count on more than 1 1/2 metres ^{clear} depth for steam navigation in return low water - though Halfed open has sounding 8 Palma = 5 1/2 feet, or about 1 1/2 m. and probably 1 1/2 metres can be found in the main channel. The channel has less depth and more rocks on the Pernambuco side.

1/4 m. deep

[Carabeira tree - yellow, in full bloom - Per. side]

- 8.05 Opp. lower pt. of Id. Serrotinho - wind ahead - River going very slow. There is a rock mound, 80 ft. high above low water on the upper end of this island. The residue of the island is sandy alluvium, flooded in high water. The island is only 1/8 mile long, but in low water ^{remains} panning it.

8.35 We row on to the head of island ^{below} ^{the} ^{head} ^{of} ^{island} ^{the} ^{rock} ^{mound}. Conclude to breakfast here - The white Rocks irregular pile, 75' above River - ^{green} ^{mountain} ^{range}

Monday, Oct. 6th Going above I. Serrotinho 47

10.07 Start, after a good breakfast - in river, square across the deep pool, which has a moderate current, but the wind continues strong ahead. Hard poling on account of steep shore on Bahia side.

River widens out to nearly 3/4 mile above the island. 10.31 - some sharks teeth (rocks) in that patch out a metre in low water, which with a 3/2 m. will be 100 feet from the shore, and should be taken out - if it is concluded to run the steam channel near shore. There are 3 or four other mts. just now out of water that should be blown off - about 1000\$ each for clearing a mile along here.

Notes It is not necessary to do any work in order to run the steam, draw 1 mile. Possibly the main channel near middle of river may be good enough without any work - [Run a light draught steam or up and down and map the channel + rocks.]

Some work needed for a higher stage to be safe

> 11.00 We are at last where the poles will reach bottom on one side of the opening - Obviously the long water grasses Capipi, etc. grow out to where the water was over 15 ft. deep.

11.09 - An elegant 3/4 mile wide, clear river - only a few rocks with 1/4 mile up - ^{Chips} ^{room} ^{on} ^{each} ^{side} ^{of} ^{them}. A race between the ajosain - Anna + Milnet O. - The Anna beat; but she is doubly manned.

11.33 - about a mile or more above on the opp. or Pernambuco side a remarkable rock presentation, which stand 70 or 80 ft. and run sloping back at a slight angle - Halfed calls it Pilões de quartzo, Com mica, Chlorite Ferro Itanca. The Ilha Marrecas intervenes bet. us and this rock formation, now.

11.40. Elegant clear river continues - too deep to pole. We have to row - wind not yet in our favor - 400 ft. from Bahia side. We row across the river toward Pernambuco side.

a new from the top of this rock showed mountain range at different distances, some far off, in very distinct m. - both in Bahia + Pernambuco. Rounded outlines generally

48 Monday Oct. 6th Over to Pernambuco Side.

11.56 opp. extreme lower end of Island. (Small) we are on the Bahía side of it. 12.03 upper end of Small island.

12.18 - We stop, hold up, at a little islet, nearly opposite the lower end of Ilha de Maracáis. We are to go up on the Pernambuco side, where no channel is shown on Halford's map.

The tail end of a Cachoeira 300ft below tail of island. It is a moderate Casca - not designated on map.

12.23 - Start - after 5 minutes stop, and go over to the Island side of the chute or swift water - probably 4 miles an hour current.

12.33 Working up close to island along side of the chute so deep that the poles outside can hardly touch. This is an excellent stream channel so far (Can easily run out from it below over to the Bahía Channel.) River 800 to 900ft. to Pernambuco side.

Muddy water going down this channel - swirling.

1.00 P.M. - We continue poling close Island - fine river clear to right.

1.26 at a ledge of rocks - a little swift - but with ample steamboat channels - easy to navigate.

1.30 - Opp. head of island. Here where Halford's map shows the Channel closed (peppered) with rocks, there is a clear Channel around this point, 400ft. wide, deep - We stop. Mr. Derby gets off.

We are at the end of the high ridge of rocks, referred to at 11^h 33' (2 hours ago). The rock is I think rather higher than my estimate. It is probably 90 or 100 ft above low water.

We are stopping on the main land, 200 meters below the point where the river turns so hard from here to the right.

The rocks and Casca which we hear, are around the point. No they are in the other arm - we have nothing to do with them.

We go up to the top of the Itacolumite rock ridge, and get a grand view - as far as we can see up the river this steamboat channel is grand - very deep - but a portion of the river above is hidden from our view - (100ft high)

2.11. after 41 minutes stop, we resume;

2.17. When we fairly start from the point. The line is still against and the channel is proffered.

Monday Oct. 6. Going Round Itacolumite Point - 49

2.20 - Just at Bluff of rocks - almost under the bluff -

where we were standing a few minutes ago -

Quartz dykes - sticks out - which we saw in Trip -

We sounded across the channel 9, 10, 14, 15, 11, 4 on Opp. side about 300 ft. wide - The narrowest place

at the upper of the 2 bluff pts it is about 250 ft. clear deep navigation - 9 meters from the shore it was 9 meters deep

This is really a magnificent navigation around this point and around the island Maracáis back of us.

The current is only about 2 miles an hour -

Calculating it an array of 10 meters deep on a width 70 meters = 50 m. per Min. = 2000 x .50 = 1000 cu. m. per Min. c.m.

70
700
50
35000

We get out and walk -

The Cachoeira begins a short distance above the 2^d bluff - and continues for about 1/3 mile -

The Channel is quite deep all the way. It is no where less than 80 feet wide - The velocity does not exceed 4 miles an hour, and the general course is direct

enough to ensure safety for steamers navigating it up and down with ordinary procedure and judgment;

even if drawing 2 meters or more.

Panella da Dorado - Halford. It is a troublesome place for loaded canoes to get up, because they

cannot pole in the Channel, on acct of its depth, and the shore line is composed of black polished jagged angular rocks.

Panella da Inhahum - Pilot's name -

This day's success is grand! #

3.15 P.M. The "Melhora" and Melhor takes are at the head of the Cachoeira; but some of our men go back to help the "Anna", and we wait - till -

3.50 All the ajurijos are up - and now we go for a good place to encamp, having done a good days work in value of not in number of leagues.

4.00. Opp. lower pt. Ilha de Missão ^{Velha} on our right.

[We left small island do Seno in our night, also, just before]

Nameless island on our left. Channel between ^{going up,} But, we crossed the wide, deep channel 3 miles an hour current and made the lower pt. of Ilha de Missão ^{Velha} at 4.10 P.M.

50 Monday, Oct. 6. Going up along Ilha da Missão Velha

4.10 P.M. To go up on the Pernambuco side of the Island. Having seen that the other side of the Island is a perfect steamboat man. I have no objection to see this side. We tug the Island against a stiff current with a gravelly bottom - river clear of rocks.

4.35 Cross over this beautiful arm of the River to the Pernambuco side and stop for CAMP N° 10.

At Fazenda da Inhamhum - nearly midway of the Ilha da Missão Velha, and a little above League 272. So that we have run about $2\frac{1}{2}$ Leagues; although my report was made last evening up to 284 $\frac{1}{2}$. Leaving $2\frac{1}{2}$ leagues (to L. 272) to be reported upon now

REPORT N° 10.

I have to report that on the $2\frac{1}{2}$ leagues from 284 $\frac{1}{2}$ to 282, there is now, at this lowest stage of the river a good 1 meter draught Steamboat Channel, all the way; and three fourths of the way it is now good for 1 $\frac{1}{2}$ meters draught.

I think it probable that with careful examination with a light draught steamer a safe $\frac{1}{2}$ meter channel can be found all the way without work; but to make sure I will estimate 5000,000 as possibly needed on this distance to remove rocks and make some and thus to improve the Channel.

The Channel is not the same as that recommended by Halford; but a considerable portion of the upper part, around the island of Marecais appears to be the course recommended by Ingenieur Krauss. Mr. Krauss estimated the cost of improving League 273 at 60:000,000 instead of that sum I estimate 5000,000 for the $2\frac{1}{2}$ leagues.

Tuesday Oct. 7. Inhamhum Leave Camp N° 10. 57
To go up bit. main + island. I. 272

- 6.07 Start - 500ft wide deep channel
- 6.25' Opp. Head of Ilha da Missão Velha.
- 6.40' Opp. Ilha da Inhamhum now opposite, - a large wooden cross still standing in front - Behind it is the Serra da Inhamhum - somewhat like the one we examined yesterday afternoon - This is a very deep pool 120ft - with gentle current - we have to row, as the wind does not favor us.
- 6.50' Bet. the Serra on the island and corresponding Serra on the main, and the deep part of the river is part - we come among rocky islets.
- 7.00 Two fine broad, deep smooth Channels - We take the left hand, the "Anna" the right, and the Mel-gut Oaker, another smaller one to the right of that.
- 7.03 All come out into one clear, broad, deep Channel - Still among islands, which are now partly sandy.
- 7.14 We turn L to the right thro' a little side channel the main Channel, deep and wide, we leave on our left - We sail slowly (out of our upstream course) camp a bar of bay - about $\frac{1}{4}$ mile wide.
- 7.25 - We are over the bay - turn up among islets Serra $\frac{1}{2}$ mile to our right 300ft, or more above river.
- 7.28 a little caxo - say 1 foot fall in 100ft. 4 mile an hour current for 100ft. This is only our present canoe route. The steamer Channel is off to the left - (all night)
- 7.48 - We are going along 3 to 4 miles an hour, on the land on Pernambuco side, heading toward another Serra 350ft high in a good steam Channel. We strike a current now
- 8.00 opp. Lower end Ilha da Estreita - Current 2 to 2 $\frac{1}{2}$ miles an hour - about a meter depth - when we turn but come deeper to the right. Main Channel is I think on the outside of Island Estreita.
- 8.10 Can guarantee 1 meter depth + 3 miles an hour current around this part of the arm - 8.10 a.m.

8.23 - We stop, on the arm-foot of the Serra - for breakfast. Mr Derby and some of the others are going to the top of the Serra - which I had estimated at 350 ft.

Ascend to a point of rocks ~~at~~ about 100 ft above the main river, and command a fine view of the valley, the islands and the river - for 3/4 league back and a full league forward. I am now close by the lower end of the 271st league. # at the bend of the arm, where the main road along the valley is just on the river bank - the Serra beginning at once on the hill side of the road.

The Channel in this arm is said to be the best by our pilot. I thought the other side of the island would offer a better steamer channel - though it has bends in it, perhaps not so well shaped as this arm which is one regular sweeping bend.

There are two ^{or a number of} places where it will be better to concentrate the water by low dams; but a steamer drawing not over 3 ft 20 ft wide could be put through now. To make this 1/3 league a good safe 1 metre channel for steamers, some rocks should be removed and the water concentrated as above.

Possibly a low wing dam at the head of the island, at moderate cost, will throw considerable more water into this arm; which would be an improvement.

Above the island Estreito, as well as I can see from my eagle's eye [the birds of passage, have evidently often stopped on this little point of rock.] the river is pretty direct and looks clear, or as if it had a good channel.

So be safe, I assume \$,000 x 000 to make the league 272, a clear 1 metre channel - with the same work it will probably be a 1 1/2 metre channel, good.

About 2/3 league above here another rocky bluff is at the river's edge on Pernambuco side. Boa Vista [White Sleight] bears W. 15° S. from here - course of river above this island Estreito abt W 15 N.

If these leafless trees of the hills and serras were green the view from here would be charming; but they present a desolate aspect. The islands of the river look much more attractive being dotted with numerous handsome green trees, and the usual cultivation up from the water's edge to the top of the bank. On some of the low islands which are every year flooded the cultivation is wider, extending over all that part.

A marked Mt peak 6 miles off (across the wide river region) bears almost due South. It seems to be on a long ridge or range running W.S.W. & E.N.E. on the Bahian side.

9.15 P.M. I will now descend from my bird's eye Spot - having spent 3/4 hour here in a cool wind from the E. S. E.

Mr. Sabor's Barometrical measurement gives the height of the Serra 413 ft. } av. 403 ft. ^{53 ft. more than my}
Mr. Derby's Bar. 393 } _{estimated height.}

10.08 Start - after a good breakfast.

10.20 We are up the Cachoeira - referred to in my notes on the preceding page - we came up one of 3 channels (not the best) and found least depth for a very short distance 1 metre - most of the way 1 1/2 metres with a least width of 25 feet - current 3 miles an hour.

I am now sure that a 1 1/2 metre channel at least 40 feet wide can be secured in the upper end of league 272 - and that the sum given on page 52. (\$5000 x 000) will cover the cost of making a good navigation.

My plan is, however to send a light draught steam up to explore all of these channels and chutes in low water before finally selecting the steamer channel.

10.32 Opp. head of Ilha do Estreito -

now we have the Ilha do Caraputê - a large one - opposite 800th ft. channel broken up with rock islets of this arm, the best appears to be on Pernambuco shore.

10.40 Opp. point of bend in river, Pernambuco side.

L. 268+60

3.20 P.M. opp. Point below Boa Vista. The river is narrowed down to about 2000 ft - a short half mile below the Church - which looks up looking white bright with a red tile roof & white cupola steeple - I think the same that I saw this morning from the Rock where we breakfasted.

Beautiful View, indeed! up the River! with distant blue mountains entirely filling the horizon and the Vista shows well, from the river.

3.32 Arrive at Boa Vista. 268 $\frac{5}{8}$ L
mamm. - made in Boa Vista Oct 8.

283 L. CABROBO - we left Sept 29th 9 Days 65

268 $\frac{5}{8}$ L BOA VISTA Arrived Oct. 7th Leave Oct. 9th 5th

246 $\frac{1}{2}$ L JOAZEIRO and Petrolina

239 L. SOBRADINHO - Cachoeira 20

Called on the Sub-delegado and on Dr. Ventura, son in law of Commandant - and delivered letters of introduction from Dr. Cavalcanti, and from the vicar of Cabrobo.

Boa Vista - CAMP N^o 17.
Report N^o 11 = see page 69.

Memo Exp. Comendador Dr. Luiz Plinio d' Oliveira Secretario do Ministro, etc. Corte.

We arrived here last evening, having completed our examination of the river up to this place, at league 268 $\frac{5}{8}$.

I am very much pleased with the results of our examination thus far, as I find the river materially less difficult to improve than I had anticipated.

From Boa Vista down to Jacobie, I am able to state, that the river can be made into a light-draught steamboat navigation for my much less money, and in a shorter time than those estimated in my previous reports which I have seen.

Engineer Halford, I believe, presented no estimate of cost for this part of the river.

Engineer Krauss' estimates appear to have been based upon a low water depth of three palms (25 $\frac{1}{2}$ inches).

My estimates, ^{thus far} are based on a low water depth of one meter (3.28 feet), and the estimate of securing this depth will be very much less than Engineer Krauss' estimate, between the points Hamady, and the time required to effect it will also be much less.

This is all that I deem necessary to say at present respecting the improvement of the river. Tomorrow we will proceed with our examination up the river hoping to reach Joazeiro, (at league 246 $\frac{1}{2}$) 22 leagues above here, in about a week, ~~with~~ ^{at least} ~~days expense upon the delay in my examination~~

We have had some rains during the past week; but not sufficient to affect the river, which is now considered to be about its lowest stage and consequently very favorable for our observations. The country continues the same as before parched dry, and cultivated only along the banks of the river.

Remains to be done - add to the report - further up, a better region.

few days for the 15 days, I will then take by the road made by the river the same

Col. G. C. James

Rio de Janeiro

My dear Col:

Boa Vista Oct. 8. 1879

Wednesday

Concerning the river, I can say, that it is much more easily susceptible to improvement with a light draught steamboat navigation than I had anticipated. If the same holds good from Boa Vista to the upper end of the Sobradinho rapids, my report will be very favorable.

I hope to reach Joazeiro within a week or so, and will mail letters from that point. I hear that they go from Joazeiro to Bahia ^{about} 10 days. If we happen to hit a mail time our letters from there may reach you before this one, which I propose to leave here to be mailed via Pernambuco. I enclose one for Mr. Roberts. I will have another for her also to go from Joazeiro.

We scarcely know how to give any directions about mailing letters; but I think that by the time you get this, you had better mail ^{letters} via Bahia and Joazeiro, once. We will make some arrangement at Joazeiro to have them carried for. Perhaps in Joazeiro I can write more definitely about our future movements.

We are all well, and all join in kind regards. Remember me kindly to all yours.

I have had no letter from Sr. Plinio since we left Rio. I write to him by every chance - and I do not look for answers.

Our mail man is supposed to have left Pernambuco Friday morning. Possibly may reach us tomorrow. ^{Only, indeed tonight.}
Yours truly, W. M. R.

Sent very long letters - 2 vols. & one of the 23rd of Sept - one half sheet to Adair - enclosed in letter to Col. James.

Camp No. 17.
at BOA VISTA.

Wednesday - Oct. 8.

BOA VISTA.

CAMP No. 17.

Measurement of River.

Oct. 8. 1879.

Distance across	---	602 Meters
Direction of X Sec. ⁿ		17.25W
Average Vel. per Second,		0.29 Meters.
" " " " " " " " " "		0.66 Miles
Area in \square Metres,	4173	Sq. Meters
Vol. of Water per Sec. ^a in C. Metres,	1223	Cub "
Greatest Depth,	(50.84 ft)	15.50 Meters

According to the above the flow in Cubic feet is: ¹²²³ 73,380

Per Second	42,805	cub. feet
Per Minute	2,568,300	" "

My impression is that the average velocity, as above given, of 0.29 Meter per second, is too great to be applied to the total area of the X section.

True, the wind was blowing, up stream, and would reduce the natural surface velocity.

From the total of	2,568,300	c. ft. per Minute
Deduct 20 per cent.	513,660	" " " "
For Extreme Low Water flow.	2,054,640	" " " "

This quantity 2,054,640 C. ft. per Min. is probably a safe assumption at this place.

Project of Canal from a point a mile or so above Boa Vista over to valley of Jaguariço.

62] Thursday - Oct. 9. Leave BOA VISTA

at 2:68 $\frac{2}{3}$ L. CLOUDY,

Wind favors at the start. COOL.

5.57 Start. we sail over toward the Bahia ^{de} rather.
6.02 opp. Church upper end of Boa Vista
6.23 Some rocks in the pool; but under room.
7.05 Rocks and a swift - all night. Boa Vista ^{is} ^{well} ^{from} ^{here}
about $\frac{1}{2}$ miles from Boa Vista.

7.35 - a few more rocks, but all night.
8.12 more rocks - but not very strong current all night.

9.03 a.m. Stop for breakfast. BAHIA
Under a fine Genepapo Tree on the river
bank, about $1\frac{1}{4}$ leagues from BOA VISTA.
The river is here very wide & clear, but with
sufficient depth for navigation - on the
opposite of Pernambuco side there are a
number of rocks in the river - the nearest
rocks are a thousand feet from the Bahia side.

[We are just at the point where the River curves to left:]

10.19 Start - after breakfast - under the Genepapo tree
when the woman has a girl (10) and baby in baby-
hammock - baby 4 months, 21" of age - Cotton tree, short,
but fine staple.

A characteristic of the pools of this river is the projec-
tion above the surface of the water of the tops of rocks,
occasionally, at irregular intervals; and sometimes the
rocks are a foot or two below the surface.

Canoe pilots, however, know where the best
Canoe Channels are; and they know for expedi-
ent navigation most of the Channels which
would be used by steamers. Our Pilot
would soon learn to be a good Steamer Pilot.

11.55 - Poling in the handsome pool, slowly - I notice
several different palm trees this morning on the
bank Bahia side. Possibly this may be taken
a little difference of climate; but it is not certain.
The river continues all night.

We have been sometime around the bend - running S10E.

12.10 Upper end Ilha da Serebina.

Thursday, Oct. 9th Going up river. 63

at above BOA VISTA.

12.15 - a small swift in channel - irregular rocky ledge
at intervals across the river - leaving at least one
steambot channel near the middle, and another
near the Bahia side - nothing needed here.

12 $\frac{1}{2}$ Met 4. sponja & basques - bound from Joazeiro to
Rodrigues - with Raparôa -
Dr. Ferreira - who arrives at Amarante in getting
our Canoes in charge of several of them - came
on board - and greeted us and thanked. The
scene was quite animated - with down crews
in sight at once -

12.45 We resume our slow way, poling in deep
water close along the water capsin -

12.50 Some rocks, of a ledge; but leaving a good chan-
nel through.

1.09 Opp. lower end "I. das Cabras ou Tamogua" near
the Pernambuco side. We are close on Bahia side.

1.21 Ledge of rock across - but good, deep, wide channel -
600 to 800 ft. from Bahia side.

1.32 Opp. lower end Ilha das Caraibas - (Capped Tamogua)

Clear river - 1500 ft. to island - 2 miles poling
along Bahia shore - wind ahead we would
we turned the point - a league back.

1.42 opp. supposed upper end I. das Caraibas. It is at
least 2000 ft. wide - clear river here - and the
island is over on the Pernambuco side; we are
on the Bahia side.

1.50 Opp. of Palm Trees on P. side - 

Ascending to the Rock topography on the
Bahia side on the map, we are opp. the middle of I. das
1.55 Caraibas' L. 265.80

1.58 Cachoera - [So called] is only a wide, deep 2 miles
or near current - through a rocky ledge ^{the} deep River.

It is nothing - but an excellent Steamboat Channel.
Ridge on the Bahia side.

2.11 We stop for short ^{time} on the Bahia side about $\frac{1}{4}$ mile
below (opp. to) head of Caraibas Island. Not up to head ^{side}

2.23 Start (after 12 minutes stop)
2.30 opp. head of I. das Caraibas. we are slow on
Bahia side

League 264.

Obc here met Sr. who has a nice store
 the best we have seen this side of Piranhas.
 He is brother to our Carpentaria Stanko and they
 had not met for 12 years. He has lived here 7 years.

CAPIM GROSSO is a much nicer town than
 either Cabroto or Boa Vista - the houses are mostly
 plastered or white washed, and there is a faint air
 of business in the appearance of the place.

The largest barge I have seen on the river is
 here and belongs here.

Min. large barge in passing Sobradinho Rapido
 has to unload.

The smaller barge we see here can pass loaded;
 and they tell us that our Ajorjos can pass loaded.

The population here may be 500 - more or less;
 the trade is on a small scale.

The river is here about a short half mile wide.

The town is founded on Quartz Rock, and other
 unalagous rocks - much like the hill on which
 Boa Vista stands, and like that, it is elevated
 above the highest floods.

Half an hour is ample time to do the town.

They are making and drying here on the plateau
 large clay bricks about $15 \times 10 \times 4$ - for building
 adobe walls. The clay occurs here covering the rock
 in places.

The general population has a little better
 aspect - not quite so poverty-stricken, as that of Boa Vista.

Still, there is my little here; my little to be looked
 for here in the way of trade or travel on steamers;
 although there would be some.

Militão Gonsalves Torres - Capim Grosso -
 (and principal proprietor) - He and his brothers (3-)
 He called, and offered his services, in any way
 that he could help us.

Breakfast - Our schoolmaster and some of the
 principal working men of the place.

Sr. Cyrellio Felis Martins who gave us much
 information concerning Bahia Province - lives
 9 leagues from here, at the Serra
 There are ^{three} 4 leagues long, $1\frac{1}{2}$ leagues broad, of
 good, arable land, ~~there~~, where they raise sugar,
 cotton, tobacco, mandioca, sweet potatoes, feijão, etc.

He was born at Villa Nova - 30 leagues
 from Joazeiro - 60 leagues from Bahia. There is
 an extensive area of good land there where
 they raise every thing - they ship to Joazeiro and to
 Bahia. Sometimes a troupe of 100 mules (Cargoes)

He describes an alum cave near where he
 lives - with alum stalactites. Powder has been made
 there; but the alum - which is in large quantity, has
 not been made an article of commerce.

The sertão comprises a long distance, except
 the part of "Serra islands" ^{mountains} and the neighborhood of
Villa Nova.

He says it is never hot, where he lives -
 always cool - that they have plentiful dew -
 that although partial drought comes at times,
 yet it merely reduces the crop - sometimes one
 half. They have plentiful dews.

Thinks there were inhabitants before the In-
 dians - says that there is an ancient furnace, and other
 evidences showing that the alum caves were once
 worked - that the Indians did not work them. They
 are not now worked.

He says that November is the hottest month
 along this part of the river valley - Oct. 10th Oct. 11th -
 very little dew along the river - none in June
 & July - not much.

We bought 2 sheep here 4% - each = 8%
Stanko
Carpenteraria - made present of 2 chickens.

We remained in Capim Grosso - from 7:48 A.M.
 till 1:20 P.M. - Breakfasted there, and called
 on Sr.

68) Friday Oct. 10th We leave Capim Grosso, to go on up river.

- 1.20 P.M. Start from CAPIM GROSSO
We soon sail, but it is a cross wind and soon carries us across the river, near to a large sand-bar and then we sail pole slowly along edging the bar.
- 1.55 about $\frac{1}{2}$ mile above Capim Grosso, we are opp. a fine large grove of Palms.
- 2.20. We are not over 1 mile above Capim Grosso butky well over toward the P. side. Sailing close to the wind spooling, slow motion upward.
- 2.25 - an open ledge of rocks - but no Cachoeira. Heard old hen on Bahia side from top of bank
- 2.55 A Rock, Delanda, near middle of river, rocks & sand 300 ft. long - 50 ft wide in middle. Nearly opp. an island on the Bahia side. (near schistose side)
- 3.08 - opp. a grove of Palms on Bahia side, and a house with a tile roof.
- 3.11 Lower end of faint Cachoeira or swift - and a good channel 2 miles or more current. Irregular rocky ledge - ledge of a low water dam $\frac{1}{2}$ to 500 ft. of its length.
- 3.25 The river is $\frac{1}{2}$ mile wide here. The best channel for low water steaming, will need to be rounded out by the low water steamer.
- 3.40 It is more Cachoeira like here - River very wide - full $\frac{3}{4}$ mile - shallow.
- 3.45 In a shallow $\frac{2}{3}$ mile channel - close to the Pernambuco shore, rocky - Pilot (Halper) says the deep channel is on the Bahia side, not less than 12 meters deep - in the shallowest part - Halper says 7 ft.
- 3.55 Using the cord - 2 men - out 2 more poles - slow start. We stop above the worst place to help the others up - the Rock of the ledge is schistose Calcareo, and a little mica. Half mile ahead on the P. side is a clump of W. which is located, on the plain, near the river, 20 high, rounded from a stratification, within 10° of vertical. Schistose Calcareo maculoso

Friday - Oct. 10th about 1 League above Capim Grosso 69

- In the midst of Cachoeira do Genepapo. Impossible, just now, for loaded canoes to get up; but it will cost little or nothing on the Bahia side for a steamboat Channel.
- 4:18 - We start. The Milner O. sails up another Channel, without help.
- 4.35 We stop for CAMP N° 19 - on the Pernambuco Side - nearly up to opp. the Pedra Branca (Halper) on Bahia Side L. LEAGUE 263

Report N° 11.

From League 272 to 263 = 9L.

I have to report that from league 272 to league 264 at Capim Grosso - From 272 to 268 $\frac{1}{2}$ at BOA VISTA = 3 $\frac{3}{4}$ L. I estimate that not more than 5000000 will be required to make a good navigation. It is now practically to pass a steamer drawing not over 3 ft. water, if run carefully.

From league 268 $\frac{1}{2}$ to League 264, at Capim Grosso = 4 $\frac{1}{2}$ leagues, a steamer drawing one meter can now pass without difficulty, but I will estimate for taking out a few rocks & marking a few 1000000.

From league 264, at Capim Grosso, a steamer drawing one meter can now pass through the Bahia Channel; but I estimate for its improvement, taking out rocks to 3000000. This makes a total of 9000000, for the 9 leagues; but I would first run a light draft steamer through, as I think that this estimate may be reduced. This is up to lower end L. 263. Evening of Oct. 10. 1879. W. M. R.

70 Oct^r 10 Evening. Friday.

L. 263. CAMP N^o 19.
on Pernambuco Side.

For REPORT N^o 11 - to this point - see Page 69.

The weather has been pleasant to day; although a strong wind, much of the day, has been blowing rather across the river and a little down, opposing our progress. An hour or so in the afternoon it helped us a little. We had to go through the Cachoeira Guepapo - on the Pernambuco side, on account of the Swifts - though there is no current there over 4 miles an hour. The down channel for boats is deeper, on the Bahia side.

It is very windy at our Camp now (5.35 P.M.) blowing almost squarely across the river from the Bahia side, nearly from the S. E. a little down.

Oct. 11th Saturday. Leave Camp 19.

on the Pernambuco Side L. 263

5.55 Start. Sun Rise 5.50
5.58 for *Melivora*. The "Carna" goes ahead - we delay a little - We are still in quite part of

Guepapo rapids - poling - Wind across.
6.25 about upper end of rapids on this side; the ledge runs obliquely and the upper end on the Bahia side is about 1/4 mile farther up Halfeld's soundings good depth all along here on Bahia side

6.45 opp. ("Curral") a stream, dry on Bahia side.
7.00 opp. 2 little islands on Per. side of } twin.
Not shown on Map. 350 ft low
River continues half a mile wide, or more.

Oct 11th Saturday. 2 Leagues above Capim Grosso 71

7.08 - Clear channel on Bahia side - a few scattered protruding rocks from middle level P. side - at length.

7.12 sail - gaining a little, perhaps, over the poling - ^{than usual} _{on P. side}

7.15 Clear river 1/2 mile wide - on bend, ^{river} _{the more} Sun shines brightly - still it is uncomfortable. Cool at 7 1/2, 1/2.

7.25 League river - only on P. side - oblique up, towards middle, but within me only 400 ft - on river 1/2 mile wide

7.32 Opp. marked Limestone point - the appearance resembling that of the limestone on the Bahia side (same side) at League 264 2/3 - This is at League 262 2/3. The rocks in the river are not limestone. A stream comes in just below Curaca - Barra Grande Ilha da Barra. also on Bahia side.

7.40 We sail very well now. P.M., clear river.

7.46 Opp. beg. of some islands. rocks.

7.48 Opp. lower end main island Curaca - Halfeld's soundings are now on P. side, least sounding 2 1/2 meters. The islands are not accurately shown on the map; but the general features of this part of the river are correctly given -

7.58 Green Granites of Halfeld - correct. P. side opp. Barra Grande

8.04 - We are sail - poling along under the lee of a narrow island P. side - Channel bet. it & P. Shore -

8.25 above island Curaco - Halfeld's map has too many rocks peppered in the river. It is nearly clear.

9.00 Splendid River - P.M. breeze - sailing nicely -

9.18 Island on our left - We are heading for another island.

9.22 Light, rocks, beg. - foot of island.

9.25 Land on island for breakfast. Breakfast ready ^{35 meters} _{at 9}

10.35 Start - sail - from about head (long, narrow) of Island Curaco Pequeno, on the Bahia side

River well peppered with rocks above this island.

10.44 We sail through swift in ledge which extends across obliquely - Channel on Bahia side - good

10.47 met a large paguette - where just stopped on Bahia side.

10.55 Point on Bahia side - deep channel - ^{in P.M.}
10.55 "As Pedras" of Halfeld.
River here is a few half mile wide - and widens above. River well peppered with rocks except near Bahia side, in main lower tier - on Bahia side just here.

11.12 Opp. a larger house than ordinary - like rock ^{at} _{point}

7 October 11th Saturday - sailing - above League 261

11.15 The Bahia half of river is clear, along here. Good channel P.S. [The Cachoeira Genepepo (of Halfeld's Map) does not constitute the least obstruction to a steamboat navigation.]

(The river is certainly less clear here than it was 20 leagues, or less, below here; when it appeared perfectly clear of sediment. It is here, however, a mere (yellowish) slight tinge.)

11.35 Semi surf - caused by rocks, leagues above here P. side.

11.38 Opp. a well peppered part of the river extending from the P. side to first middle of river - leaving Bahia Side clear.

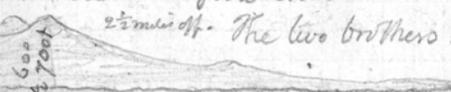
This is the "Coneco of Cap" Genepepo - See Map. 3 miles on here current - but in sail night up.

The pitch of these rocks is up stream - Contrary to the gen.

coral patches in the river; but the river is so crooked, so! Rocks along shore - have a patch nearly parallel with the river and pitch quite 70° difficult for those in the river.

11.43 Point on Bahia side - Good channel and deep.

Looking up River nearly S.W.



R. bank new camp 2 miles of base at least. River We are now sailing over toward P. side.

11.48 Rocks begin in middle - Clear on P. side

11.55 Stop - on small island - till 12.08 = 13 minutes -

12.08 - Start - We are in an elbow of the river - and the wind is baffling just now - we may get it better half a 3/4 mile farther up. The two Brothers. The river is half mile wide here but not clear - Good channel on Bahia side.

12.15 Foot of Island a 1000 ft to left. P. Shore 500' off

12.25 Foot of an Island 600 ft from P. side. League of rocks across from Island to P. shore - channel 50 to 60 ft wide near middle; but we go to new Pt. of island to work up on an oblique channel - 2000 meters; but the main channel is over on the Bahia side

12.32. We are above this slight chain - in a fresh, clear channel on the P. side, 600 ft to island - This is Ilha do Rato

12.50 - upper end Ilha do Rato

1.00 P.M. - View of 2 Bvrs. 1 1/2 miles to or 1 o'clock opp.

October 11th Sat. Opp. 2 Brothers 73

1.15 Beautiful River - nearly 1/2 mile wide, clear. The nearest of the peaks of the Doue Imads. presents a white aspect (quartz) the other dark - being covered with the leafless Saracá - though as we go up the river on the up stream side it shows but not nearly as white as the other. Wind from S.W.

1.15 - About opp. here the Channel begins to edge over from the Bahia toward the P. side.

The wind is abating - and we edge on to the P. Side and begin fooling. (Palm Trees P. side)

1.34 - Sailing again - moderately. 2000 ft from P. shore

1.38 a few scattered rocks - but a good channel clear.

1.45 Opp. lower pt. Ilha da Pontalino ou I. Pedra Branca. Pedra Branca on Bahia Side.

2000 ft. bet. P. Shore and Island. Beautiful River!

Poling now across gravel bank 1 1/2 to 2 miles deep.

2.15 Opp. upper end Ilha da Pontalino ou Pedra Branca

2.20 Opp. lower pt. large Island. Ilha da Pontal.

2.50 - We are now about at League 259. in the Channel between this island and P. shore. There was a church on this island about opp. this point - near the other side. We do not see it.

(Channel here about 1000 ft. wide.) Clear; not very deep; but ample for a 1 1/2 metric steamer. 8 to 12 ft

* The canoe men tell us that the church is still there, and that they have a festa in it once a year; but there is nothing else - no padon, or regular service -

3.20 - Sailing along. This arm of the river is about the size of the Ohio at Cincinnati - 1000 ft. clear water way - the channel here is 8 to 10 ft deep now. It is a beautiful river. No rocks in view ahead or on either side ahead - just as I had within the above 2 very distant blue mountains loom up, over a waterway of at least 4 or 5 miles of water.

3.36. Edge across river - a few rocks protruding above surface - we sail right up the little cleft - depth enough for steamer - all along. # Saw the church on our return trip

74) October 11, Saturday, Behind Ilha da Pontal.

The width of this arm is here at least 1100 ft.

3.45 Another small open ledge of rocks - only a few miles protruding above present water. A good pilot only needs to put steamer through nicely.

3.50 - Now a beautiful, clear river 1100 to 1200 ft. wide.

5.10 - At head of Ilha da PONTAL.

at League $25\frac{1}{2}$

Having run to day about $5\frac{1}{2}$ Leagues.

CAMP N° 20.

This point, or rather the River above this point is famous on account of the difficulty of a foreigner passing it because of the waves caused by the strong winds that frequently blow here.

The river just above the island is nearly or quite one mile wide, and it continues wide though diminishing some, for a mile or more above the island.

Strong winds create waves here which make it dangerous at times for Coasted Canoes or ajunjos; though the large paqueta or barcas can pass safely.

We find the ajunjo with our goods on board waiting here, on account of the wind. We supposed it to be several days ahead, till yesterday we heard that she had stopped here the night before.

We have walked out to the point of the island where we could see what they call a sea.

It is a fine body of water very nearly or quite a mile square, directly fronting the island.

From the point of the island it is about 2000 ft. to the Pernambuco side and 3000 to the Bahia side on Hatfield's map. It is not less in nature.

I think it is a little wider than the map gives it.



Saturday Oct. 11. CAMP 19.
ILHA DA PONTAL. upper point.

REPORT N° 12

From League 263 to League 257 $\frac{1}{2}$
a distance of $5\frac{1}{2}$ Leagues.

I have to report that there is now at this low stage of the river, a good, light-draught Steamboat navigation throughout this distance; needing no work to ensure a depth for running one metre.

I think it highly probable that by running a light draught steamer, and sounding out the channels carefully, that a natural navigation of $1\frac{1}{2}$ metres depth will be found already existing, without any work.

At present, therefore, I estimate nothing to be expended on these $5\frac{1}{2}$ leagues.

Possibly, on a more thorough, careful survey, with a steamer, it might be found advisable to mark a few rocks. For this I would, to be safe, estimate 2000 \$000.

Evening Oct. 11, 1879.

W. M. R.

436 - 300 ft. from E side pass thro. slight cut

As we cannot run with our ajunjo in all cases up the steamboat (or the deep natural channel), it will be proper to include an estimate of work of removing rocks - to cover contingencies.

76 Sunday, Oct. 12. Leave CAMP 20

5.40 A.M. Start. From Head of Ilha da PONTAL. League 257 $\frac{2}{3}$

5.45- opp. extreme upper pt. of Island, ^{begin} on the Pernambuco Channel side. Sandy, sailing and poling - Shallow, as yet.

5.55- Still sand bottom, a meter or so deep. We are now heading toward the Bahia shore

5.56- We are about ^{now} in the middle - Sand, sand.

6.05 - about half a mile above head of Island.

6.07 Soundings 3, 3 $\frac{1}{4}$, 3 $\frac{1}{2}$, 3 $\frac{1}{2}$, 3 $\frac{3}{4}$, 3, 3 $\frac{1}{4}$, 3 $\frac{1}{2}$, 3.

6.09 3 $\frac{1}{4}$, 3, 3, 2 $\frac{3}{4}$, 2 $\frac{3}{4}$, 3, 3, 2 $\frac{1}{2}$, 2 $\frac{1}{2}$, 2 $\frac{1}{4}$, 2 $\frac{1}{4}$, 2 $\frac{3}{4}$, 300 ft.

6.11 2 $\frac{1}{4}$, 2 $\frac{1}{2}$, 2 $\frac{1}{4}$, 2, 2, 2, 2, 2 $\frac{1}{4}$, 2 $\frac{1}{4}$, 2, 2, 6:13 AM

6.17 about 300 ft. from Bahia shore.

The main channel is on the P. side + deep. This is a splendid steamboat navigation.

6.27 In narrow part of river (1000 ft or over wide) sailing along beautifully. ^{by sand the sea charmingly.}

6.30 2 $\frac{1}{4}$ (300 ft) on Bahia shore 3 - 3, 3, 3, 3, 3 $\frac{1}{2}$ (400 ft).

6.32 3 $\frac{1}{2}$, 3 $\frac{1}{2}$, 3 $\frac{1}{2}$, 3 $\frac{1}{2}$ (500 ft) 3 $\frac{1}{2}$, 3 $\frac{1}{2}$, (3' 3/4) The main ^{depth}

6.34 Channel is 400 or 500 ft to the right 20 to 30 ft

6.36 Sand bar just to our left. Still about 1000 ft. of good steamboat navigation in low water.

6.41 Pt. of bar projects 800 ft. from Bahia shore, still leaning not less than 80-85° of good ^{depth} water.

Above this the bar runs to a pt. or binds on Bahia River bends to left - Southward.

COLD WIND.

6.50 River, opp. point 2000 ft wide, + widening.

7.05 River 7/8 mile wide. Splendid navigation, clear.

[A man on PONTAL island told Mr. Derby that the people who occupied these thatched temporary camps did not belong on the river. They had been driven here by the drought, and had from one to two acres for the main leg of working a little patch; but they made that support a family. He said that there had never been so much vazante cultivated before.

X He also said that before this drought they had cultivated the Katinga - or Serfais. [Whereas the near at Cabrobó, said they had never cultivated it.]

77 Sunday - Oct. 12. Sailing on splendid River.

7.17 River 1/2 a mile - beautiful - bars on Bahia side.

7.31 Some palms appear on Bahia side

7.40 More palms on Bahia side - River 2000 ft.

7.50 That bears S.45.W. ^{at 1/2 mile}  ^{Porgans} River

8.20 Stop for breakfast on a sand-bar semi-island ^{Bahia side} River half mile wide. Not far from League 256.

We may be a little above it - We have made about 1/4 leagues before breakfast.

Breakfast ready at 9:10 - ^{Stopped here.} Our goods ^{of course}

9.55 Start up river. Soon sail for half an hour.

10.45 We are now sailing + poling - over sandy bottom.

All this part of the river for many miles on the Bahia side has large sand bars. ^{shallow} But there is ample width of good depth, between them + P. shore. The river is a full 7/8 mile wide with clear surface.

River looks like a fresh lake - Mammies appearing in the distance ahead + a wide, long expanse of water behind us.

We see four or 5 miles of water right ahead.

11.50 - about the same as above - only we are ^{now} two or 2 1/2 miles farther up the river - and the mountains loom up correspondingly, and the range (or ranges) is off more to the right - River still 5/8 mile wide - Clear.

12: noon - Pão de Mel - on Bahia side - reddish.

Splendid Jatoba tree in flower, + reddish.

This is the vicinity of Halfed's Vento Fortissimo - see Sheet 210

12.28 opp. Barra de Viera on P. Side. ^{wide River}

12.35 Opp. a Dile roof house, ^{thatched} called "Paulo Affonso" on maps.

12.43 opp. Paulo Affonso, still - a net 150 ft long

12.55 a good swift. 1 1/2, 1 1/2, 1 1/2, 1.1.1. N.

12.59 2. 2. a good 1 mile channel 80 ft wide

Could easily be deepened 1/2 a meter, at a small cost but pilot says there is a deeper channel farther out - and I have no doubt of it

from what I can see + Halfed's soundings ^{points} ^{show 2 miles along.} Good steamboat

current ^{is now} +

- 10.45 we strike among rocks - we pass thro Channel 300 ft. from Bahia another 600 ft. from Bahia is a fine broad, deep one. I could pass this one with a small steamer - It is deep enough; probably about 35 to 40 ft. wide.
- The current is very little increased from the regular flow.
- 10.55 - a night at the dis. peak up S. 30. W. cross the Pernambuco shore point, thro the Rak.
- Although there are a number of rocks protruding above surface in this part of the river it is a good safe steambot way in low water. With water 5 to 6 ft. higher an experienced pilot would be absolutely necessary # and I think a few rocks should be marked (1000, 2000, 3000)
- 11.02. Rocks project from Bahia shore 200 ft. but there is a good channel 600 ft. out.
- The river is three fourths mile wide, along here - with a moderate current - average say 1/2 mile an hour.
- 11.11. At a fine old Jacobi tree on the very bank of the river, his outer roots washed bare. He is in danger.
- 11.18 Here begins almost a clear river 500 ft. out on the Bahia or Channel side. 11.20 a little swift, rocks.
- 11.40 Rock 150 ft. out. 2 ft. above front water - good channel # on both sides, but the wider one outside.
- 11.46. We leave the great concave side of this big bend and sail obliquely across the wide river gaining some and getting toward the convex, short Pernambuco side.
- Plenty of Palms on Pernambuco side. River 3/4 M. wide
- 12.00 Within 600 ft. of P. shore. Begin poling - [we went nearly square across the river.] Along P. side now.
- 12.48. Near P. shore opp. - Lower end of h. water island. We begin ealing again.
- 12.57 Opp. Lower end Pancarauhy Island, Bahia side. whole river here 1 mile wide. Channel runs from near middle over lower Pancarauhy Island and between that and Island St. Luzia.
- 1.36 - 300 ft. from P. shore pass thro slight swift caused by a nearly submerged ledge lying obliquely up toward the Bahia.

- 1.43 Opp. upper end of I. St. Luzia, which stands this side of, and extends above I. Pancarauhy # "very dis. peak" now bears S. 30 W., from the P. shore, strikes a little above head of Luzia. Some rocks in middle - P. side here clear, shallowest (single) sounding of Halfeld in channel above island St. Luzia 5 1/2 ft., then runs to 10 ft. and deeper, up stream, to 30 ft. [Plenty of Palms, P. side, also at Bahia side]
- 2.15 Opp. lower end of a mass of rocks on I. side - 200 miles to right - Granite Halfeld calls it "Serrito do Estreito"  800 or 900 ft. # We go very slowly - some lower smaller masses in the Ilha do Estreito opp. is on the Bahia side
- 2.19 Small swift - thro ledge of rocks.
- 2.25 We are as yet only opp. middle of the ROCK.
- 2.30 Another point of the rock (separate) runs down to the water in the bend of the river  We sail out toward island Ant^o Padoca. Clear river - but rocks on shores, and islands.
- 2.35 Peak of yesterday bears N 10 E. - a very fine, to right -

Mem - Islands de "Ant^o Padoca" + do "Mt. Francisco" on the left, and "Grande" on the right of the rounded Channel on Halfeld's map. There are I. de Tortos, de Logo, and Domingos. See Map - north. There is also I. de Martins - the most easterly of all.

- 2.45 This bend in the left bank of the river, above the Granite ROCK - causes the river, including the islands, to be more than a mile wide, here. 
- 2.50 The Rock now presents this aspect  we are no more than opp. the upper pt. at the river although we own along the island. We are now poling up the channel.
- 2.59 Opp. lower pt. I. Grande. Clear channel 300 ft. wide - ^{islands} but,
- 3.04 a beautiful steambot channel between these two islands 250 to 300 ft. wide - clear 1/2 to 2 mile an hour current - straight -

84 Monday - Oct. 13 - above the ROCK

- 3.05 P.M. Channel between islands.
 3.18. Channy only 140 ft wide - 3 miles in low count.
 Good steamboat navigation. Widens directly to 250 ft.
 3.24 Head of Island ^{de M. Fortes} Ant. ^{200 ft wide th} ~~Paduca~~ on left. ^{300 ft wide}
 the upper part, near the Bahia side
 now betⁿ the Bahia side & Grande I. 500 to 600 ft
 Good steamboat Channel.
 3.32. We pause on Bahia Side. 7 minutes -
 3.39 Start - 3.43 opp. Head of Grande Island
 River now widens as once to 2500 ft - a few
 rocks at wide intervals; but a very fine Steamboat
 Channel. Over 200 ft. wide, clear - Bahia side
 3.54 Beautiful River - 1/2 mile wide.
 4.10 at point - Large White House - and three
 very fine trees - One of them is Magnificent -
 Several buildings -
 A very fine situation - It seems to be the
 "Porta da Pedra" of Halped's map -

4.17 - Stop for encampment 1/8th mile above the
 large house and fine trees = League 248 1/2
 Having run from League 252 3/4 = 4.16 Leagues

CAMP N^o 22. L 248 1/2

REPORT N^o 14.

I have to report that there is a ^{low water} good Steam
 boat navigation, for vessels of 1 1/2 mels draught,
 on the four leagues examined to day, without any
 work being necessary.

But for a few feet higher stage of the river,
 it may be deemed advisable to expend say not ^{ex}
 exceeding 2500 \$ 000 on the 4 leagues, removing & making ^{rocks}
 Run a light draught steamer up & down etc.

Evening of Oct. 13. 1879. N. M. R.

Tuesday - Oct. 14. Leave Camp 22.

Peru morning.

- 5:35 Start - River 1/2 mile wide Channel ^{Bahia side}
 # a few rocks might be marked 500 \$ 000
 6.05 There is a good deep Channel all along,
 but rocks occur, projecting two to three feet
 above present water; and I think it will be
 # cheap to mark them than to blow them out 500 \$ 000
 P.S. a steamer can easily navigate here safely,
 in this low stage of the river. It is only when the
 river runs several feet that the rocks ^{are} ^{dangerous}
 6.24 - a nice channel - but 2 rocks, ^{mark} 250 \$ 000
 # Above this the river appears clear on this side for
 half a mile. River 3000 ft. wide.
 6.27 Dist. White Rock Mtⁿ bears S, 40 W., up river.
 6.40 - a Rock 300 ft out ~~from~~ 4 ft. but it is so decided
 that there is no danger from it.
 7.10 - Charming river, all along here.
 7.24 Opp. lower end of Island Jatoba - also opp.
 upper end of Isoa Vita - Clear River 300 ft. d. d.
 7.28 We now row over broad island - fine navigation
 7.32 we barely make the lower pt. of the island - against a
 stiff current - too deep to pole - Regent river - we are
 now plying along the island side of the Pernam-
 buco Channel 1200 ft wide -
 7.55 - Some Rocks & a swift - but a fine steam navigation;
 though the Bahia side would be the better path for
 the island.
 8.03 Upper end Island of Jatoba. Just above is the
 8.09 Upper end of little island to left of head of Jatoba
 8.09 Upper end
 8.26 Stop for breakfast, on Bahia side - about 2
 miles below Bazeiro and Petrolina.
 I am disappointed in the apparent dimensions and
 and style of Bazeiro - Petrolina - is nearly as I had
 imagined it might be. Fine navigation here
 River opp. breakfast point 2200 feet - widens below
 narrows above gradually, as it appears from here

We are now 2 leagues below Bazeiro.

86 Tuesday Oct. 14. approaching Joazeiro

After breakfasting, about 2 miles below Joazeiro.

- 10.27 Start - Practically a clear river - although 1/4 mile above here there is a rock projecting a couple of feet.
- 10.45 Opp. Rock ledge Pernambuco Shore shown on Hayford's map - as Granite and Quartz -
- 10.47 Small rock just at surface 50 ft. from Bahia Shore near
- 11.06 Upper inlet of canyon elbow or arm on the Bahia side below Joazeiro.
- 11.22 Rest at surface. 100 ft. out.
- 11.35 Arrive at lower end **JOAZEIRO.**
CAMP. No 23. League

We encamped under three trees on grounds belonging to Sr. Luiz Manoel Da Costa. I thought ^{at first} the ground was open - public till after we had pitched our tents; but I saw Sr. Da Costa afterward, who was very kind and offered the use of a house for storing our surplus goods, and gave the keys to us, Sr. Saboia and myself. We met him at the house of Sr. Coronel Benedito Moraes do Prado, to whom I had a letter of introduction (from the vicar at Coboto - Sr. Ant. Joze Ferrnino de Novaes)

We also called on and delivered a letter to Sr. Ant. Luiz Vianna, (from Angelo Vieira Sampaio of Boa Vista) who received us kindly. Several gentlemen called, evidently to see us, while we were visiting, at both of these houses.

We visited the nearly finished nice white Church - It is very strongly built, and is modern in style - one of the best looking Churches I have seen in the interior.

There is also a brick Theatre here, but it is the most dingy, unlighted, miserably ventilated thing I ever saw; though it has pretensions as to size.

The Villa of Joazeiro is much larger than I had supposed them meaning it from the name. It has a number of streets, and many

JOAZEIRO - Tuesday - Oct. 14 187

houses with glass windows, and a few handsome private houses, and several nice looking stores.

The streets are simply beds of dry sand, at present. (Yesterday the thermometer in the shade 98°) Some private pavements raised about a foot above the street occur. The streets are mostly quite narrow, to give more shade, proportionally (and actually) Some of the houses are two stories, but most of them are of the conventional one story order of architecture. The population may be 1500 living in 150 to 200 houses - gaes.

The vicar called to see us at our camp in the evening - also a number of the citizens, whose names we did not get.

We bought bananas that were brought to our tent at 3 for a quintal; very good ones; yet we afterward learned that they had come from 5 leagues off - none being raised near us.

We were also informed that no change takes place in the general character of the Valley, the sertao. The drought, or the dryness, for 200 leagues above here at or near Jamiania.

A river comes in about 5 leagues above here on the Bahia side which always has water in it - and it floods marshes, which can only be cultivated after the rainy season is over.

Otherwise there is only the same sort of marginal cultivation along it, that we see along the main river.

The S. Francisco rises somewhat here in Oct. [The cause not referred to] but the real, annual rise does not begin till November - and it continues rising, usually till February - or even March. In May it is down tolerably low again, and continues low till November; though the lowest is September; and early October.

Our goods arrived in the hired apozos in the afternoon, and are deposited in the vacant house placed at our service by Sr.

Evening
Joazeiro, Oct. 14/79

Mr. G. on
Exp. Sen. D. Luiz Plinio d'Almeida
Secretaria de Ministros, R. R.
Corte.

We arrived here to day, having finished our examination of the river to this point.

I had the honor to write to your Excellency at Boa Vista on the 8th inst. That letter was mailed so as to go via Pernambuco, and I now enclose herewith a duplicate of it, as this mail via Bahia may reach Rio de Janeiro first. I am glad

that the river from Boa Vista to Joazeiro is ~~in every respect~~ ~~more favorable~~ ~~of improvement~~ ~~than it is below Boa Vista; and at any~~ ~~small cost.~~ In other words it needs very little ^{work} to make it a good, light-draught steamboat navigation.

On the 28th of Sept. I wrote to Mr. Kruger at Piranhas enclosing a telegram to be forwarded by him to the President of the Province of Bahia, as follows:

The "Commissão Hydraulica" expect to be above Sobradinho, at Santa Anna, within a few weeks, and learning that the steamer "Dantas" is lying idle at Santa Anna, respectfully ask permission of your Excellency to use the same for running up the river and returning to Santa Anna. Authority can be telegraphed through Chief Engineer Kruger, na Perledo, who will forward it to the Commission; or it can be done sooner authority could be sent to the person in charge of the steamer at Santa Anna if your Excellency thinks proper to grant permission.

It is a ~~very~~ ~~long~~ ~~time~~ ~~for~~ ~~an~~ ~~answer.~~
We will have a cross section of the river here tomorrow.

We left our horse - put out to pasture near Cabrobo, and we now have three ajajós. We had to send a cargo of provisions, baggage, &c. up to this place. It arrived this evening.

A mail from Bahia ^{is} due here and may be in any hour; and the return mail should have gone to Bahia yesterday. I am writing so that my letter will be ready to go by this chance.

We are also looking for a mail from Piranhas, not having had any promise time.

We will probably complete our examinations above here to and including Sobradinho, within a week.

If we do not get permission to use the steamer above Sobradinho, ^{we} ~~we~~ ~~will~~ ~~not~~ ~~be~~ ~~able~~ ~~to~~ ~~get~~ ~~any~~ ~~far~~ ~~up~~, before the river will rise; but if we had the use of a steamer, we might run up 200 or some leagues in ten days, and return in seven or eight days to Santa Anna.

We will have some additional observations to make on our return down the river. ^{I regret to find no improvement in the country along the river, but I will write again after finishing an examination of the Sobradinho.}

* it is the same
Senao, suffering
from drought.

I have the honor to remain with the highest respect,
your Excellency's O. S.
W. M. R. E. etc.

All the members of the
Comme and our excellent coadjutor
Prof. Darby Cortes will.

Col. O. C. James,
Rio de Janeiro
My dear Col:

Joazeiro, Oct. 14
Província de Bahia, 1879

We brought sundries and air examinations to this point to day. A mail is our due here from Bahia, and may be in any hour, and I write to catch the return mail which only awaits the arrival of the other.

The river continues to yield most satisfactory results, but the country along it remains the same as below, chronically parched & sterile on both sides, and only the marginal slopes of the river cultivated.

If this letter gets through in any reasonable time - say within about two weeks, (or only a few days over) please mail one batch of letters, here, addressed via Bahia, care of Mr. Genl. Col. Benedito Moreira at Prado.

I do not include in the above letter for Mr. Dab; because I believe he has made some other arrangement. I do understand him.

I write to you at Boa Vista Oct. 8, suggesting the mailing of one batch of letters, via Bahia to this place.

We expect to finish our expedition to and including Sobradinho, within a week. We had been looking for a route mail from Piranhas for some days.

Possibly you may get this letter before you receive the one of the 8th via Pernambuco. I cannot write more definitely till after finishing Sobradinho. We are all perfectly well, with kind regards to all
W. M. R.

REPORT N^o 15.

I have to report that there is a good navigation from League 248 1/2 to 246 1/2 = 2 Leagues upon which no work is necessary in the present stage of the river; but with the river a few feet higher there are some rocks, near the surface which it may be advisable to remove or mark; for which I would allow 1500 \$000.

W. M. R.

Joazeiro Oct. 15, 1879 The day of my return from the jubilate Allegheny mt. campaign - 1826 = 53 years.

Camp N^o 23. Oct. 16th

I to day paid over, or handed to Sr. Amadante, \$500,000 - being the balance of the \$4,057th - rec^d from Sr. Ruggis - excepting the \$78,000; for which I am still accountable.

I also make an arrangement to day with Sr. Antonio Luiz Vianna, to receive from him \$2,000,000 - giving him therefor a receipt etc. etc. in O. C. James, age 47 Rua 1^a Marce Rio de Janeiro - for \$2,000,000th dated October 17, 1879, at Joazeiro, Província de Bahia.

A number of the gentlemen of Joazeiro, call and pay their respects at the Camp - among them Sr. Col. Benedito Moreira do Prado, and Sr. Con^{te} Luiz Vianna and

Wm. E. G. no
Comunhaoad Soazeiro Oct. 15th. 1879.
Sr. D. Luiz Plinio d' Oliveira
Secretaria do Ministerio, &c.
Corte:

Referring your
Excellency to my letter of yesterday, I had leave
to say, that my general plan after finishing
the examinations of the Sobradinho rapids,
is to move up stream till about the begin-
ning of November, with our *ajajis*, and
then to commence our return voyage down
the river; but in case we can't see the use
of the steamer, to continue farther up the
river, in order to see more of the valley.

Intelligent gentlemen here who profess to be
acquainted with the valley, inform me that
there is no change in the general character
of the valley for 200 leagues above, near Jamanaia.

In that case, we could not hope to reach
them with our *ajajis*, and return to Rio de
Janeiro before February; and we should be
wasting much time ^{and money to little purpose} along a flooded river.

All the information needed to make
a satisfactory report upon the river and
its proposed improvement will have been ob-
tained when we have reached the upper end
of Sobradinho rapids.

I have the honor to
remain with the highest
respect Your Excellency
Obedt servt.
W. M. R. C. on C.

Col. O. C. James
Rio de Janeiro
My dear Col.

Two letters from
yourself, for which please accept my thanks.
I am glad to learn from your letter of
the 19th that the reported failure of the D'ours
tour is not true. I also thank you for the
various interesting items of news you give me.

I have read the views of the "News" about
Coolie labor, and I concur in the ideas
which elicit them. Some months ago
I wrote and nearly finished a paper on the
general subject of the future labor of Brazil; but
I lacked some detailed information in regard to
the law (or laws) of emancipation. A gentleman
intimate in the "News" wrote me that the law
(or laws) would be published in the "News".
Have not you seen the same, and the aforesaid
paper remains in *status quo*.

How a little business. Wanting some funds
for the Commission, we tried arranging by a draft
on Mr. Souza, in Pernambuco; but no one was
disposed to entertain that arrangement.
I then suggested a draft on your bank in Rio
de Janeiro. That they were willing to arrange.
So I am making a draft on you for two
Contos de reis (2,000,000) in favor of Senr

I make it payable at sight, and I arrange
with Sr. Vianna who starts tomorrow for
Bahia, to send a telegram to you from Bahia,
as follows:
"Soazeiro, Oct. 17. 1879

O. C. James, agent,
47 Rua 1^o Marco, Rio de Janeiro.
for two Contos will be presented in favor of
Please pay W. Melnor Roberts
A draft
Continuation - overleaf.

I left some funds in the hands of Sr. Krueger, and I will arrange to get the same on our return; but as needed funds, to keep things straight, before we could get any from Piranhas.

About the beginning of November we will be on our way down the river, I think.

I am not sure of getting the use of the steamer "Dantas." If I get her, we may go farther up, and in somewhat later turning our faces homeward.

With kind regards to all my truly yrs
W. Melnor Roberts

P.S. When I began this letter I had no thought of the money arrangement trouble. I hope it will be all right.

Friday Joazeiro Oct. 17 1879

Received of Antonio Luiz Vianna two Contos de reis 2:000,000 for which I gave an order, at sight, on O. C. James, Agente N° 47 Rua 1° Marches Rio de Janeiro.

I handed the money 2:000,000 to Sr. Amasanto through Sr. Saboia, on my return to Camp, before 9 a.m.

a handsome dinner present, from Sr. Luiz Manoel Da Costa - the gentleman upon whose grounds we are encamped - His son dined with us to day Oct 17.

Sr. Saboia and I called to pay our respects; he and Mrs. Da Costa were out but we saw the daughter and the son promised to see Senator Cunha, in Rio de Janeiro, relative of

"Commissão Hydrographica" Oct. 17. 1879.

M. Ex.ºs Comandadaos
Sen. Sr. Luiz Plinio d' Oliveira
Secretario do Ministerio, etc.
Côte.

We were to have started up the river to day; but we have remained, in the hope of arranging with Ser. the gentleman in

Charge of the Steamer "Presidente Dantas," for the use of that vessel about Santa Anna; which place we expect to reach within four or five days in our ajorijos.

We have not yet been able to ascertain how many leagues per day the steamer can run. If she can run in an average 20 leagues per day, she would reach Pirapora in about 12 days, from Santa Anna; and return in 12 more; so that if we could leave Santa Anna on the 21st of October, we should see Pirapora and be back in Santa Anna ^{at night} the middle of November.

We may not ~~be able to~~ accomplish quite so much; but I may be able to write more definitely, after reaching Santa Anna.

We have rec^d. a ~~private~~ mail from Piranhas, forwarded by Chief Engineer Krueger. It brought only private letters for the members of the Commission - to the 19. of Sept.

P.S. Oct. 18. We have secured the use of the Steamer and will start tomorrow morning for the Sobradinho rapids.

I have the honor to remain, with the highest respect
Yours obt.º serv^t
W. Melnor Roberts
En.º em chefe

Duplicate of this
via Bahia mail.
Original via Piranhas.

96) Letter to Wm. Sen. Capitano
The gentleman who is in charge of the
Steamer "Presidente Dantas", which is now
lying at Santa Anna - above Sobradinho

Wm. Sr
Capitano Joao Luiz Ferreira Oct 17. 1879

In behalf of the "Commissao
Hydraulicas of the Government, I respectfully
ask the privilege of using the Steamer "Pre-
sidente Dantas" to go up the river and return
to Santa Anna about the middle of Nov.;
the Comissao will pay the additional
expenses incurred during this period.

We expect to be in Santa Anna
within four or five days, and if we have
the use of the Steamer we will leave our
ajouros there till the return.

Get a portuguese
translation of this letter
for preservation.

I have the honor to ^{remain}
with high respect to
H. B. Roberts
Eng. en chef.

On the morning of the 18th Oct. we learned
that owing to changes in appointments, a letter would
have to be sent to the present Delegado who resides
5 leagues from here, to obtain his official sanction
so we sent a messenger, or he was sent by Capitao
Francisco Luiz Ferreira to the Delegado Manoel
Pidia Nunes da Silva, with an officio from me
as Eng. en chef. da Com. asking for the use of the
Steamer.

In the evening of Saturday Oct. 18th
the messenger returned with the written authority
from the Delegado, addressed to Sr. Senhor
Jovino Antonio Pereira Machinista encarregado
do navio "Presidente Dantas". and ^{Capit} Sr. Francisco
Luiz Ferreira the former Delegado & present Port Master here
brought it down to our camp at night, and gave us
also a letter of introduction to Sr. Jovino Ant. Pereira

Saturday - Oct. 18th
We talked over the matter of engaging a Pilot;
and Capitao Ferreira suggested that we might
inquire here tomorrow morning in order to ascertain
whether we could not get a private pilot here.

We also have an letter to the Machinista
of the Steamer, from his friend Tenente Coronel, Ben-
edes Moracia do Prado, of Joazeiro.

We offered to pay the expense of sending the mes-
senger out to the Delegado. asking that he should
come to the Camp in the morning.

Sunday Morning Oct. 19th
Joazeiro.

I closed letters this morning to Sr. Plinio
to Col. James, to Mr. R. to John Bogart, to
Chief Eng. Krigger - some to go by our private
mail man, Victorina - and a duplicate of my
letter to Sr Plinio, and a memo. duplicate to
Col. James, with message to Mr. R.

Addressed letter (officio) of this date to Sr.
Jovino Ant. Pereira Machinista do navio
a vapor "Presidente Dantas" - Santa Anna

Tenho a honra de remetter the inclose
a autorissao official do Sr. Delegado Manoel
Pidia Nunes da Silva, pela qual a Comissao
Hydraulica podera utilizar-se do vapor "Pre-
sidente Dantas" no rio acima de ^{Santa Anna} ~~apresentacao~~ do
Sr. Senr. outrinm uma Carta de apresentacao do
Sr. Capitao Francisco Luiz Ferreira e outra do Sr
Tenente Cor. Benedito Moracia do Prado.

Dentro de tres ou quatro dias esperamos
Chegar nossos ajouros em Santa Anna
entre Tercei o prazer de encontrar-me com
V. Sa

Sunday, Oct. 19th

Continuation of letter

to Sr. Juwino Ant. Pereira Machinista & Co.

Meu fim emendado adiante de rios e officios e ao Costo e de dar - lhe tempo de fazer guasquet preparos no vapor, que V. S.^a julgue necessarios para Collocal-o em boas Condiçoes de navegar.

Demos as servico de Commissão homens que poderao servir, como foguistas aboras do vapor e durante o trajecto para o Corte de lenha para Combustivel e em outros misteres.

Desejamos subir o rio ate onde podermos, esperando poder estar de volta a Santa Anna por meados de Novembro, se não houver alguma demora sensivel no portada.

Por Conselho do Sr. Capitão Francisco Luiz Ferreira temos procurado um piloto nesta cidade.

English of the above.

I have the honor to enclose herewith the official authority of the Delegado Sr. Manoel Fidei Nunes da Silva, for the "Commissão Hydraulica" to use the Steamer "Presidente Dantas" on the river above Santa Anna.

I send also a letter of introduction from Capitão Francisco Luiz Ferreira, and one from Tenente Coronel Benedito Moravia do Prado.

In three or four days we expect to arrive in our ajoujos at Santa Anna, when I will have the pleasure of meeting you in person.

My object in sending the paper and letters in advance, is to give time for making any preparations on the Steamer that you may deem necessary to put her in good condition for running.

We have in the service of the Commissão men who can act as firemen on the steamer, and along the route in laying in wood for fuel, and in other service on the steamer.

Sunday - Oct. 19

Continuation, in English, of letter to the Machinista & Co.

We desire to get as far up the river as we can, hoping to be able to return to Santa Anna about the middle of November, if there is no material delay in starting.

At the suggestion of Capitão Francisco Luiz Ferreira we have made inquiries in this place about a pilot, and learn that the best Pilot is Fabio who lives in Correntoga, and we will see him probably tomorrow and engage him if we can. We learn that you are acquainted with him and from what he says of his services with respect to N. M. R. in the past.

I had intended to start at 9 this morning; but not having yet heard any thing conclusive concerning a pilot, and some of the men have expressed a desire to attend mass, I have postponed to hour of starting to 12 o'clock, noon.

246 1/2 L. JOASEIRO. Leave Camp 23.

Sunday Oct. 19 League 246 1/2

- noon
- 12.00 noon start from our Camp lower end of City -
- 12.18 Upper end of city - last buildings.
- 12.21 Cemetery - white wall-tile Curved. 300' Sq.
- 12.22 Rock - also, on Mt. on Island. Day 90' abm. Run above island I. de Foz. The whole is 1/2 a mile wide. Barometer Price Mantel along the Vazanti. BAILING.
- 12.40 opp. Lower end of small sandy island. Fairwind, (near Bahia side.)
- 12.50 " Upper " same. Serranica
- 1.03 - Steep Current - river Indian call this growth, when in pass shallow 1 1/2 miles - some scattered rocks and pools near bottom.
- 2.03 - just around the bend, near where a small dry run enters above. See the Mountain ahead on the Bahia side. 2 1/2 miles from Camp. Dark from blue
- 2.20, Black polished Rocks on Bahia shore - shown on Halfpado map at League 245 1/2 about. At a low stage they do not interfere with the navigation and at any stage up to 6 or 7 ft. abm low water they will show and there is ample room to avoid them. - See page 101

100 Letter to Chief Eng^r Krüger - dated Oct 17th
with Post script - dated 19th see written copy in
English - filed - #

Sunday Oct. 19 above Jaazeiro.

101

- 2.50 At about League 245 $\frac{1}{2}$ begin to sail over toward
foot of Ilha. Rodeador, a pretty large island.
- 3.16 We have worked off to opp. Lower end of Island on the
Pernambuco side - there are two large bars -
But the main channel is good
and deep - on the Bahia side
- 3.40 - After sailing very slowly up
along Pernambuco shore, begin feeling
and sailing - a little faster
- 3.55 Rocks - on both sides; but a clear channel
200 ft. wide near the middle - Current 2 M. an hour!
- 4.15 Upper end of these Rocks. Scared over a steamboat
of a meter draught. Up and down through without dif-
ficulty; but as there is a much better channel on the
Bahia side of the Island Rodeador, there is no
occasion to run on this side among these Rocks.
- 4.40 On Bahia side - one mountain near stands just
in front of another larger and higher flat-top dist.
mountain - one 3 miles the other 2^{or 3} day. S. 20 W. alt.
We are heading now for a point on Pernambuco side
a little above the head of Ilha de Rodeador.
A number of palms on P. side
Drops of rain falling out of a nearly clear sky - I have
noticed rain at a distance this afternoon. There is
a loose cloud overhead. A pleasant breeze now
taken in along with us with our sails.
- 4.50 opp. Terra firma head of Rodeador. There is another
small island on the other side of the head extending
nearly $\frac{1}{2}$ mile farther up the river; and reaching not
far below the head of Rodeador.
- 4.58 - Beautiful scenery on the river, the shore, and the
near and distant mountain in great variety of
shape, size, and color - white patches. brown. dark
blue - bluff & rounded - wide splendid view about
the Island Rodeador - **CAMP N^o 24.**
- 5.00 P.M. after trying for half an hour to see a good
landing along a flat gravelly coast - a fine
breeze came in along to about League 244 $\frac{1}{2}$
2 leagues this afternoon - Good S-B. nav. - all the way.

width 693.40 M. W. 23-50 E. greatest depth 8 m. P. side 475 ft.
area 2786 sq. m. vol. 0.53 m. per sec 1.19 per hour.
Volume 1488 c. m. per sec.

League 24 1/2

on Pernambuco Side - 2 L. above I. Rodocodori
about opp. Serra de Sacapeto (on Bahia side)

5.40 Start. (two or 3 mints delay - aground)
Sun rise a few mints before - about 5.38. ^{Time}
all along here for half a mile or more each way
is a very flat gravel beach.

The good, deep channel is on the Bahia side. ^(3 1/2 to 6 Meters)
[Women and men engaged on the shore, getting
Salt out of the clayey earth of the river bank - They heat
in large drip pans or hide sacks, and then evaporate by
boiling.] (we sail) about 2 leagues

6.00 a whitish, rocky peak on B. side bears S. 10. W. dist. ^{W. 20 S. 1/2 S. 1/2}
another peculiar ^{white} peak ahead, W. 20 S. ^{1/2 S. 1/2}

6.35 a fine stretch of water ahead - abundance
of Palm on Bahia side, all along.

6.37 opp. lower pt. of I. do General - lying toward
Bahia side. Channel runs between it and
Bahia 3 meters or more deep.

6.40 Rock pt. on P. Shore - ^{Rocks a couple - nothing more}
Fine steamer navⁿ on both sides of I. do General

6.45 another Rock pt. P. Shore - Palms behind it,

6.46 - a Rock in the water near P. shore - Black, polished

7.03 - opp. Riacho de Salitre on Bahia side -

7.09 - Rocks - swift - on P. side - Good nav. outside

7.23 - Rocks - Swift - on P. side -

[The foregoing Riacho de Salitre is the outlet
of the Valley described by intelligent gentlemen
in Joazeiro, as more than usually fertile; but
after all, it is a mife, and hardly enough to sup-
ply the Villa with provisions

7.24 opp. lower end I. San Goncalo - small I. ^{San Goncalo}

7.25 another swift on P. side.

7.31 opp. small I. P. side - we sail oblique toward
lower pt. of Coqueiro I.

7.36 Lower pt. of Coqueiro Island - in pass it
our destination is the Bahia shore to hunt a pilot -

7.47 On Bahia side of I. Coqueiro - bound for
the Bahia shore at. Correntez q. for Pilot.

8.15 - a Rock in midwi - swift - but fine steamer
Channel 500ft wide on Bahia side.

8.23 Stop on Bahia side for Break Fast.
about opp. head of Coqueiro Island.
Some sea birds, rocks in view above the island; but an
ample width of fine steamer navigation.

9.39 Start - Bahia Side

9.46 Rocks 200 ft. from Shore - wide, deep Channel outside

9.55 Stop - to inquire for Radio - the Pilot. [Stop 12 Mins.]

10.07 Start - ascertained that Tabio lives a league above.
Rocks in view - but a clear 300ft. Channel between -
cannot less than 2 miles an hour. Fine Navⁿ

10.35 about opp. head of I. de Tapeta - on P. side
we are sailing near Bahia side, where the
good deep channel is. Many Palms to day.

11.10 - We are now about opp. Division

between Bahia & Perm ^{Arco}

Above this, I will use the

terms Rt. B. ^{for Right} and I. B. ^{for Inland}

left bank of the River. SAILING.

11.25 Lower end of (near)
Iha do Carnaubeiro - this nearest Rt. B. the other the
Iha do Lameiro is outside a little above at lower end

11.25 We stop nearly up to opp. Iha do Carnaubeiro to
inquire for Tabio the Pilot. [Stopped 10 Min.]

11.35 Start opp. lower end I. Carnaubeiro in the arm.
Pilot went to Joazeiro yesterday - SAILING

11.43 opp. lower end I. de Chumbada, which is inside of
the other islands. We run between it and Carnaubeiro I.

11.50 Upper end of inside island Chumbada.

11.52 Upper end I. Carnaubeiro + Lameiras / Bama

11.52 And opp. lower end I. de Serra - Midway - 11.55 Stop

We send a note to the Pilot Fabio - whose house is up the Creek or little river - asking him to come to Sobradinho - or to Santa Cruz today or tomorrow - [Barra Tatahuy.]

12.17 Start from the Barra - and sail obliquely out towards the rock ^{over} upper end of I. Serrote.

Itacolumite Rock  about 35 ft above low water - Boatman - natural -

12.32 at said Rock a little swift - just opp - but in sail right by it. Pretty good current in river above island. The river is rather less width than usual - 10 to 15 ft deep. It widens out gradually above here.

1.09 and below A few rocks approaching I. Cachoeira at the outlet of the navigable ^{and bar} arm. I. D. grows but there is a good, deep, wide, navigable approach. The rocks are not in the way.

(Soundings)

- 1.15 Opp. lower end of large island, Cachoeira!
- 1.15 1 1/2 1 1/4 1 1/2 1 1/2 1 1/2 (1.16) 1 1/2 1 1/2 1 1/2 1 1/2
- 1.16 1 1/2 1 1/2 1 1/2 1 1/2 (1.17) 1.1.1.1.1
- 1.18 1 1/4 1 1/4 1 1/4 1 1/4 1 1/2 (300 ft wide) 1 1/2 1 1/2 1 1/2 1 1/2
- 1.20 1 1/2 1 1/2 1 1/2 Swift current 1 1/4 (1.22)
- 1.22 2. 2. 2. 2. (300 ft wide) 2 1/2 2 1/2 3. Swift 3 1/2 3. 2 1/2
- 1.24 2. 2. 2. (1.26) 2. 2. 2. 2 1/2 2 1/2 2 1/2 3. 3 1/2 2 1/2 2.
- 1.28 2. 2. 2. 2. 2. (sailing right along) 2. 2. 2. 2 1/2 3. 2 1/2
- 1.30 2. 2 1/4 2 1/4 3. (250 ft wide) 4. 3 1/4 3. 3. 3. 3. 3.
- 1.32 3. 2 1/2 2 1/2 2 1/4 (300 ft) [1.34] 2. 2. 2. 1 1/2 1 1/2 (out)
- 1.35 Channel. 1 1/4 (330 ft wide) 1 1/2 1 1/2 (Swift) 1 1/2
- 1.37 1 1/2 1 1/2 (1.38) 1 1/2 1 1/4 1 1/4 1 1/4 (350 ft wide) 1 1/4 1.39
- 1.40 1 1/4 1 1/4 1 1/4 1 1/4 (soundings) 1 1/4 1 1/4 1 1/4 1 1/4 1 1/4
- 1.43 1 1/2 (300 ft) 1 1/2 1. out of channel. 1. (deeper to right)
- 1.44 1. 1. 1. Swift water - (1.48) 1. 1. 1. 1. 1. 1. Each =
- 1.46 each 1 1/2 1. 1 1/4 1 1/2 in Swift part - (1.48) 1 1/2 1. Chub. Bay
- 1.49 deeper to the right 50 ft - 1. 1 1/4 1. 1. 1. (350 ft) 1. 1.
- 1.52 1. Swift river (350 ft smooth) 1. 1. (said spot) 1. 1. 1. 1/2 1.
- 1.55 1. 1. Deeper channel to right - 1. 1 1/4 2. (Each) 3. Swift
- 1.56 3 1/2 3. 2. 1 1/4 1 1/4 1 3/4 1 1/2 1 1/2 1 1/4 1 1/4 1 1/4
- 1.59 2 1/2 2. 2. 2. Swift river (300 ft) 2.
- 2.01 1 1/4 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2

- 2.04 1 1/4 1 1/4 1 1/4 1 1/4 1 1/2 (2.06) 1 1/4 1 1/4 (350 ft) 1 1/4
- 2.07 1. 1. (3) 3/4 3/4 3/4 (2.09) 3/4 Swift river 1. 1 1/4
- 2.10 1. 1. (350 ft, deep river) 1. 1. 1 1/2 (2.11) 1 1/4 1 1/4 1 1/4
- 2.12 1 1/4 1 1/2 1 1/2 (350 ft) 1 1/2 (2.14) 1 1/2 1 1/2 1 1/2 1 1/2 1 1/4 1 1/4
- 2.16 1 1/2 1 1/2 2. 2. 2. (2.17) (300 ft) 2. 2. 2. 2.
- 2.18 1 1/4 1 1/4 (near stone) Swift) 1. 1. 1 (2.20) 1. 1. Each. Swift
- 2.21 in each (stone) near stone 1 1/4 1 1/4 1 1/4 (2.22) 1 1/2 1 1/2
- 2.22 abn. near stone. 1 1/2 1 1/4 1 1/2 (350 ft) 1 1/4 1 1/2 Swift - only 1 1/2
- 2.25 Clear river 1 1/4 (350 ft) 2. 2. 2. 2. (2.27) 1 1/2 1 1/2 1 1/2
- 2.28 in Swift 1 1/4 Swift (each stone) 1 1/4 1 (in each) 1 1/4 Channel.
- 2.30 1 1/4 Swift 1 1/4 (2.31) 1 1/2 (300 ft) 1 1/2 (Swift - 1 1/2 1 1/2)
- 2.32 1 1/4 1 1/4 (300 ft) each thin bar on river - 2. 2. (Swift) 1 1/2 at night
- 2.34 1 1/2 1 1/4 1 1/4 [2.35] 1 1/2 2. [2.36] 2. 2. Rocks
- 2.37 2. 2. [2.38] 2. [400 ft wide] 2 1/4 2
- 2.39 1 1/2 2. Clear river 1 1/4 (350 ft) 1 1/2 [2.40] 1 1/4 1 1/4
- 2.41 1. (350 to 400 ft wide) 1. Channel to the right. T. J. Swift from
- 2.43 1. 400 ft wide - over submerged rocks head of bank 1. 1.
- 2.44 1. (2.45) 1 1/4 [sails poles] 1 1/4 [near sails] 1 1/2 1 1/2 (400 ft)
- 2.46 1 1/2 (near island) 1 1/2 2. 1 1/2 [2.47] 1 1/4 1 1/4 [near island]
- 2.48 1 1/4 1 1/4 near u (400 ft) 1 1/4 1 1/2 (2.49) 1 1/2 Swift (sails) 1 1/4
- 2.50 1 1/4 1 1/4 1 1/2 Swift part - near island 1 1/2 1 1/2 near island
- 2.52 1 1/4 1 1/4 (2.53) slow - 1 1/4 (2.54) 1 1/4 1. dark island point
- 2.55 1. Clear to island (pole boats) 1. 1. 1.
- 2.57 3/4 3/4 (2.58) 3/4 3/4 (300 ft from island) 3/4 Channel not here.
- 2.59 3/4 [400 ft wide] 1 1/4 50 ft from island - 1 1/2
- 3.00 2. [600 ft from island] 2. 350 ft wide 2. 2. (700 ft from island) 2
- 3.02 2. [700 ft from island] 2. (330 ft) 2 1/2 (3.03) 2 1/2 " " 2 1/2
- 3.04 2 1/2 2. (3.05) 1 1/2 (330 ft) 1 1/2 (3.06) 1 1/4 1 1/2 (3.07) 1 1/4 1 1/4
- 3.08 1. 50 ft from island 1. (3.10) 1 1/4 (350 ft) 1 1/4 1 1/4 1 1/2
- 3.10 1 1/2 " " " 2. 2. 1 3/4 1 1/2 (3.15) 1 1/2 1 1/2 300 ft
- 3.14 1 1/2 (3.15) 1 1/2 1 1/2 1 1/2 (3.16) 1 1/2 1 1/2 near island.
- 3.17 1 1/4 (300 ft from island) 1 1/4 (300 ft) 1 1/2 (350 ft) 1 3/4 2.
- 3.19 2 1/4 2 1/2 (3.21) 2 1/4 2 1/4 (3.22) 1 1/4 2.
- 3.23 1 1/2 1 1/2 (3.24) (3.25) 1. near island 1. 1. 300 ft from island.
- 3.26 1. 1. (3.27) near S. 2. 1. Channel to right (3.28) 1. 2
- 3.29 Swift from island to right - 2. (400 ft from island) 2. 1 3/4
- 3.30 1 1/2 abn. Swift (1 1/4 = 50 ft from island) 1 1/2 (350 ft wide)
- 3.31 1 1/4 2. (3.32) 2. 1 1/4 1 1/4 (3.33) 1 1/4 1 1/2
- 3.34 1 1/2 1 1/4 (3.35) 1 1/4 1 1/4 (3.36) 1 1/2 1 1/4 (3.37) 2. 2.

- 12.04- 2 (150m fr 3^d little island near head of it) 2 1/2 2 1/2
- 12.05- 2 3/4 (Opp head 3^d little island) 250m fr Bahia 2 1/2
- 12.06- 3, 3, 3, (12.07) 3, 3, 3, (12.08) 3, (12.09) 3, 2 1/2
- 12.10- 3 1/2 5 1/2 (12.11) 4 3/4 (Swift) 4, 4, (12.14) 4.
- 12.20- 4 - only danger here for west of land - Channel all night 200ft wide clear - 4, 4 - Approaching rocky part + the 3 islands.
- 12.21- 4, 4 - 3 1/2 (12.22) 3, 2 1/2 - Reck 10m to night - Swift
- 12.23 - Reck 10m to night - submerged - 3, 2 (12.24) Swift
- 12.25 - Reck 10m to left 4 - 3 - 25 miles clear with 4 with a slight curve to left 4.
- 12.26 opp. long and 1st island 4, 4, 4 1/2 for 2 islands (12.27) 3, 3 (12.28) 3.
- 12.28 1/2 Opp. for 3^d island 30 miles to night 3 1/2 3. We turn away for 3^d island to left. in acct
- 12.30 of rocks ahead - 4.
- 12.37. Trying a channel 2, 2 1/2 2 1/2 angling to left toward Bahia - 3.
- 12.39. 3, 5 1/2 4.
- 12.52. after trying 2 alternate channels with our light breeze we worked up through a canoe channel near Bahia shore - We are in the real Cachoeira now.
- 2.36 - we had sailed and poked among the rapids, worked up to and rounded the head of the island and arrived at the Camp No 25 - when we found Dr. Joaquin Enguier of the Steamer Presidentes Dantas and the others.

I checked the current by the cork

My report of the Channel on the Bahia, or right bank Channel is, that I found an excellent Steamboat Channel from the lower point of the Ilha da Cachoeira to within less than a third of a league of the upper point of said island. From that point up there are serious obstacles, on account of there being no direct flow through of any one Channel. A Steamboat Channel could be made by blowing out rocks, and building some dams; but

It would cost very much more to make a good safe Channel there than it will to make a good Channel (which will be safer) around by the arm along the left bank of the river, which we came up yesterday.

This morning I went down the Cachoeira Island side of the Ilhote da Cachoeira shown on Halped's map, where I found a least depth of 1 meter, except a single spot where it was a half meter. Generally, it is 1 1/4 to 1 3/4 meters between the two islands.

On either side of this small island, a one meter Channel can be made at small cost on that distance which is only about half a mile or a little more.

Mr. Weiser reports that his examination on the outside of and near the island Cachoeira, shows that there is no Steamboat Channel; and, shallow, rocky channels, unfavorable for the construction of a Steamboat Channel.

I also verified this myself, by running over from the upper end of our good Steamboat Channel, on the Bahia side, or right bank.

I report, therefore, that I will recommend the improvement of the Channel along the left bank, between that and the Ilha da Cachoeira.

The measurement of the present flow of water in this arm of the river made to day by Mr. Weiser and Sr. Lisboa - Shows - 232 meters wide - 1,66 miles an hour average rate of current, meters average depth - meters greatest depth meters least depth.

The soundings cut obliquely from the head of the island by the same engineers - show the following soundings.

It will be a matter of future calculation to determine whether to construct any dam to throw in more water or to construct low dams at the small Cachoeiras along the arm or a combining of the two - I have no doubt that the amount est^d by Mr. Krom 35,000\$ will be sufficient.

We here met Sr. Jovino (Machinista) of Steamer "Presidente Dantas" and also the Pilot, Fabio - who pilots her on one of her 3 trips, which she has made in 7 years [1872, her advent].

The Engineer reports a good ^{number} of things lacking to enable her to run - and reports ~~that~~ the Cylinders or the pistons out of order, so that it has to be hemp-packed every three days, and he has no hemp, and can't get any shore of Bahia - In our suggesting ropes, he says there are no hemp ropes here except tanned ones, and they won't do.

We suggest using all of little bits of hempen ropes replacing them with the ropes of the Country.

Our trip up the river, therefore, it seems, is likely to be regulated by the amount of hemp (or some substitute) we can command.

We must send back to Joazeiro for the needed things. This we will do.

We must also furnish Stenmen, and firemen, and hands, to get the wood on board. This we will do.

It strikes me as singular that the Govt. should keep an engineer under pay in charge of this steamer, without requiring him to have maintained it in such order that she could be run on the river without the delay of sending to Bahia for hemp to pack the Cylinders.

The Engineer also says that the Engine was to be run with 35 lbs. of steam, whereas she has to be run with ^{40 to} 45 lbs.

5.35 P.M. Break up Camp 25 - and start for Santa Anna. Obliquely across the transverse of the arm - 1. 1 1/4 1 1/2 2. 2 1/4 2 1/2 2. 2 1/2 1 1/2 1 1/2 - and then up to Santa Anna 1 1/2 to 1 3/4

6.22 P.M. arrived at Santa Anna and all went on board the Steamer "Presidente Dantas", and quartered for the night.

On Board Steamer "Presidente Dantas"

Wednesday morning
October 22^a

Santa Anna, Province of Bahia. Oct. 22^a 1879.

Mrs. Exp.^{ma}

Comandador
Serr. D. Luiz Plinio d' Oliveira
Secretario do Ministerio de Corte.

We finished our examination of the river from Joazeiro to the head of Sobradinho rapids last evening. Between Joazeiro and the foot of Cachoeira Sobradinho there is already a good steamboat channel.

I examined, personally, all the possible channels for a steamboat navigation at the Cachoeira Sobradinho. I sailed up the arm or channel along the left bank of the river between the main land and the island "Cachoeira".

The next day we rowed down partly on another route through the same arm to the foot of the large island "Cachoeira", and then sailed up a channel, which I selected for examination, toward the right bank of the river, outside of all the islands, noting the intermediate island channels, ^{as} ~~im~~ ^{marked} ~~by~~ ^{them}.

I found a remarkably fine steamboat channel for about one league above the foot of the large island "Cachoeira", but from that point up, (although our ^{boat} ~~we~~ sailed up, through tortuous minor channels) I found the river so seriously obstructed by ^{large} ~~rocks~~ ^{and} as to offer serious obstacles to the construction of a safe steamboat ^{channel}, although the falls are ^{much} ~~less~~ than I had anticipated.

The arm or channel ^{along} the left shore of the river, is not difficult to improve, but I desired to be perfectly certain as to

The difficulties of improving the main river are now sure that the arm mentioned ^{very much} is the best for the steamboat channel.

For a sum not exceeding the estimate of Engineer Krauss which I believe was 35:000,000 it can be made a good safe steamboat channel allowing draft of one metre draught to pass.

This arm is by no means small.

It is about one hundred metres wide in its narrow parts, and over two hundred metres wide ^{in many} at the upper end of the island of ^{Eachoera} ~~Eachoera~~.

^{surrounding and descending throughout its whole length of 8 km.} We made a great number of soundings. It is generally from 1 1/2 to 2 1/2 metres deep, in a good channel; but there are a few places where it is only 1 1/4 and 1 metre deep at present, for short distances, and in two places, ^{at short distances 3/4 and 1/2 metre} we measured the flow of water in this arm, and found it to be nearly one fifth of the entire volume of the river, and, if deemed necessary, a large additional supply of water can be thrown in, at moderate cost, and this may be considered as being included in the above mentioned estimate.

^{as we are ascending by ascending obliquely across about the head} We have now completed our examinations of the difficult portion of the river, from Jaboa to Santa Anna, and I have to say, that it can be made into a safe steamboat navigation, for draft of one metre draught, for a sum ^{far, properly considered, less than} ~~less than~~ the aggregate estimate of Engineer Krauss; and less years ^{one sufficient} ~~one sufficient~~ ^{to do the work} ~~to do the work~~ ^{in the year of studies, and preparation along the river, not in the office, and one year for the actual work.}

I am sorry to say that there is no change thus far in the Country, in right of the river. The Angaites still continues. The Marquial

Slopes of the river banks being about the only cultivation, we still hope for a better country above.

Joazeiro, Sr. Capitao Francisco Luiz Ferraria the gentleman in charge of the steamer Presidente Dantas, has informed me that a special messenger arrived at Joazeiro with orders from Presidente Antonio de Araujo de Araujo ^{from Bahia} ~~from Bahia~~ to place the steamer ^{under} ~~under~~ our command. We are now in possession of the vessel.

I have this day addressed a letter of thanks to his Excellency, in behalf of the Comissao Hydraulica.

There are a number of little matters ^{about the steamer} to be attended to, which will occupy several days before she will be ready for the trip up the river, which is not surprising as she has not made a trip for three years. ^{we have secured the man, Pato, who piloted her before. It is of iron 100 feet long, about 15 feet width of hull, side-wheels, and draws now about 3 Palmos, and when loaded 4 Palmos or a little more.} She is well suited for our explorations.

The engineer, ^{however} apprehensive that she may not be able to run many days up and return, on account of want of an article for keeping the cylinder piston tight; but we will try to remedy that. He says that the river ^{here} is a palm or a half more higher here now than it was at its lowest stage in September. We will get up the river as far as we can.

I have the honor to remain with the highest respect
Your Excellency's Obedient
N. Milnorbooth
Eng. in Charge.

Letter forwarded by special messenger to Joazeiro to Capitao Fran. Luiz Ferraria - P.M. 15h mailed by him.

* The Sergeant Antonio Augusto Pomar is an intelligent man.

Wm. Ex^oSenh^o

On board steamer "Pres.^t Dantas"
Santa Anna Prov. of Bahia
Oct 22^o. 1879.

Antonio de Araujo de Aração Bulcão.
Presidente da Província da Bahia
Bahia.

I have had the pleasure to be informed, through our friend Sr. Capitão Fran.^{co} Luis Ferreira, of Joazeiro, that your Excellency has been pleased to grant the favor of using the steamer "Presidente Dantas" in the further exploration of the "Commissão Hydraulica" in the river above this place.

There are a number of little matters to be arranged, which will occupy a few days before the steamer will be fully prepared for her trip; but we expect that she will render us excellent service.

In the name of the "Commissão Hydraulica" I thank your Excellency for your kind and prompt attention to our request.

I have the honor to remain
with the highest respect
Your Excellency's obed^t. serv^t
W. Melner Roberts
Eng^o em chefe.

Wm

Sr. Capitão
Franc.^{co} Luis Ferreira
Joazeiro:

I have the honor to acknowledge the rec^t of your two letters, dated Oct 20, which, however, I did not get until after the steamer's boat had started for Joazeiro.

I am very glad that you rec^d authority from the Provincial Gov^t which sanctions the favor you had the kindness to offer in behalf of the "Commissão Hydraulica", as it makes it still more pleasant for all parties, and more

satisfactory to yourself.

We have engaged the Pilot, Fabio; and I have no doubt we shall find him entirely competent, as you describe him.

There are a number of little matters to be arranged before the steamer will be ready for the voyage up the river, which is not surprising, as she has not made a trip for 3 years. Renewing the thanks of the Commissão for your great kindness.

I have the honor to remain
with high respect
Very truly yours
W. Melner Roberts
Eng^o em chefe.

P. S.

I have the pleasure to say that we find the Cachoeira Sobradinho much less difficult than we had anticipated before commencing with yours and others in Joazeiro. It can be made a good Steamboat navigation at moderate cost.
Yours. W. M. R.

Wm. Ex^o

D. Rivaldo Von Krüger
Eng^o em chefe

On board steamer "Pres.^t Dantas"
Santa Anna, Oct 22, 1879
Estrada de Ferro da Paulo Affonso
Piranhas.

We have completed our examinations of the difficult part of the river, from Jatobá to Santa Anna, and I have the pleasure to state that we find that it can be improved into a fair Steamboat navigation at less cost and in less time than we had understood from previous reports and estimates.

The Sobradinho Cachoeira is very much easier to improve than the Vão, it can be made into a good safe navigation one mile deep in the lower stage of the river for a less sum than Eng^o Krauss's ^{Estimativa}

Contⁿ of Letter to Mr. Kruger.
The Provincial Govt. at Bahia haathu kinians to send a special messenger to Joazeiro, with orders to place the steamer "Presidente Dantas" at our disposal, and we are now in Command of her.

She has not made a trip for 3 years, it is therefore, not surprising that many little things are required, which will occupy several days before she will be ready for the voyage.

One of the parts of the machinery not being so perfect as it should be, the engineer is not quite sure how far she can go up the river and return.

We will go as far as we can.

The members of the "Commissão, and our Co-adjutors, Prof. Darby, join in kinia regards to yourself and staff

Wrote also to O.C. James
and Mr. R.

I have the honor to receive
N. Milton Roberts
Eng. in Chief.

SANTA ANNA,

on left bank - San Francisco River,
PROVINCE of BAHIA.

Wrote the foregoing letter on board the
Steamer "PRESIDENT DANTAS,"
which we took possession of last night,
by authority of Sr. Capitão Fran. Luiz Ferreira
and of the Presidente of the Province,
His EXCELLENCY, Antonio de
Araujo de Aragão Bulcão.

October 21st 1879 (Tuesday) ^{night}

Wed. Oct 22^d. Santa Anna.

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on board Steamer "Presidente Dantas."

I sent the foregoing letter by special messenger to Joazeiro, to be mailed by our friend Francisco Luiz Ferreira, the P.M. in Joazeiro.

I walked out half a mile, to the Sertão, on top of a small rise of ground, on looking the town - which I judge contains about 40 houses, scattered, with very sandy streets or spaces; a remarkably plain looking place; but it has not as poverty-stricken an appearance as some of the places farther down the river.

The Sertão is dry, sandy and gravelly; much the same as the Sertão 200 miles below. There are occasional green trees, and a smaller proportion of cactus; and the trees appear larger, and the cactus smaller; but the soil is much the same as below.

There is no appearance of cultivation now, or at any former period, excepting on those portions of the irregularly washed bench of land that is subject to the river overflow.

Last night the wind blew a gale, the direction up, and across from the opp. or RT. bank. It raised the water about 9 inches; which however fell toward morning as the wind abated. The morning quite cold.

During the day the weather pleasant.

We gave the Engineer, Sr. Jovino, all the help he needed to put the engine to, in order and sent out a gang after wood.

We had sent the evening previous to Joazeiro for articles to be purchased there - list made out by Sr. D. Amarante Pomicino Eng.

122] Friday, Oct. 24, SANT'ANNA

Our men are now engaged bringing wood for the steamer, cut about $1\frac{1}{2}$ leagues above here.

Steamer ready for trial.

5.30 Start up river - run about $1\frac{3}{4}$ miles - to within $\frac{1}{2}$ mile of upper end of island "Junco" or "St. Anna."

6.20 Turn - 23 minutes overrunning up

$\frac{15}{38}$ " " " down

38 " $3\frac{1}{2}$ miles = $5\frac{1}{2}$ miles an hour

Steam 33 to 43 lbs. gradually getting up -
Consumption 1 mile an hour, when we ran

Frenchmen our own men

Steersman Henrique & our Cook.

Pilot J. Adro.

Engineer Joventho Ant. Pereira.

I think that the steamer will run 6 to 7 miles an hour in still water with 45 lbs. steam pressure. Her wheels make 25 revolutions per minute.

Cylinders (2) each diameter 8. Stroke.

Engineer Joventho says that the boiler is a fine one; but that the engine is inferior.

We arrange for our departure from St. Anna up the river Sunday morning early.

Heavy rain storm in the night, with thunder and lightning. Leaky roof brought considerable water into the cabin. I hoisted two umbrellas, and came off pretty well.

Saturday - Oct. 25th Santa Anna

123

M. José ^{Maniana} Hanna, called this morning from Riacho Caraxova, asking privilege of passage up to Samaria. He is a Cousin of the Engineer, who had written to him about an expedient place on the steamer; but perhaps without mentioning the other chief point, that if we allow one to go, we can make no limit. He is a nice gentleman, and it pained me to decline granting his request. I invited him to break fast, but he declined, saying he had already another invitation.

A letter rec^d from our friend, Sr. Luiz Ferreira, of Soazeiro, offering to have published, as the Correspondent of the "Diario da Bahia" any papers I might send to.

Answered by giving him some points, which if he thinks proper he can publish. No chance of sending my letter here, I will take it along to the Riacho. I made English copy of my letter on the letter rec^d from Sr. Ferreira. See letter - blue paper.

Sunday Oct. 26th - Before sunrise - just as we are preparing to start, Sr. Ant. Dewast came with a letter from our friend Capitão Franco Luiz Demie of Soazeiro, dated 22 - urging our taking his friend Dewast to Samaria - my answer or translation to the gentleman was as follows:

Santa Anna Oct 26, P.M. Before your friend Sr. Antonio Dewast came this morning with your letter of the 22^d. The Commission had already been obliged to decline taking gentlemen who had come here and applied for passage to Samaria. We were compelled to adopt this course, as in admitting a single one we had no ground for refusing another. Your friend is already the fourth person who has applied.

I regret this very much; but it cannot be helped.

N. M. Minor Roberts

L. 238. 1

- 7.15 We whistle and unmoor - $\frac{1}{2}$ mile above S. Anna
 7.19 Start. At 7.25 - Stop. ^{Sometimes wrong} - Cannot get the supply lock of the border open. Anchor. in Chan. 500ft. from island. Junco on Santa Anna. Wind up stream - Pretty strong. No rocks in sight.
 8.12 Real Start. Our course along mid-river.
 8.17 Opp. small island, Head of Short Junco.
 8.38 " Upper end of large island JUNCO. There is a bar 200 meters long above island. Least sounding ^{W.P.}
 Breakfast - with good appetite.
 8.57 Opp. L. end Sand Bar Id. near R.B.

[8.55] Lower end of I. 237. L. sound. g.P. But another Channel Grand River above the large Id Junco.

I am sure that there is a deep channel not less than 3 metres the entire length of this league.

- 9.15 Rocks in river 20 meters to an left - just submerged. This (Pedra) is marked on Halford's map. $\frac{1}{2}$ 150 meters from L.B. ground
 9.17 Just above the Rocks, pass a very large Barca bound down. These Rocks about $\frac{1}{2}$ way of the league
 9.18 Opp. Rocks - just up to surface 300
 Steamer touched a rock. Watch stopped.
 9.32 Opp. Pedra da Bode on left B. Fresh Start, approaching I. Grande on das Pedras de Mathias.
 There is a large Channel on the L.B. side; but at the lower end there are rocks near the L.B. shore and Sand Bars out from the island. I think there must be a channel clear between; but it is not sounded.

Upper
 9.48 Opp. Lower Pt. of Island. End of I. 237.

L. 236.

- 9.48 We are in the widest and probably the best channel
 9.55 Rocks - not marked. We touched again
 10.01 Close to rock just submerged - not marked on map.
 10.08 A large Rock 150 meters to our Rt.

- 10.09 Rocks - 100 meters to Rt. not shown on map -
 10.12 Opp. Pt. upper pt. of island - Rocks come this way from island 400 feet - Opp. the long sand bar Spit. not shown on map.
 10.24 Opp. many Rocks on our Rt. not shown on map
 10.26 about 80 meters below Rocks not shown on map
 Reguéis careful steering all through here.
 10.33 Opp. Serrote. on L.B. "Gross Branch"
 10.34 Heavy range of Rock. 100 meters on our Rt. 1 mile above
 We clear in Curve to clear Rocks not shown on map -
 10.36 Rock. 50 meters to Rt. also 50 meters to left.
 10.43 A little island near to L.B. not shown on map
 it consists of gravel sand and may have come since Halford's survey
 10.45 About at upper end of L. 236. 3 minutes less than one hour coming this league.
 now river looks clear to the foot of island -

10.45' I. 235. Lower end of.

- Opp
 Bar puts out near lower pt. of island on L.B. side
 10.53 Opp. Lower Pt. of I. Tamandua on the Pacheco. We are within 50 meters of island on the R.B. side of River - marked on map Considera - without sounding

11.02 This channel appears to the eye clear. $\left(2 \frac{3}{4} \text{ } 3 \frac{1}{2} \text{ } \text{meters} \right)$
 Large open flat between the river and Blue Mts distant on R.B. The island is on a long curve to Rt.
 # This is a fine navigation. #

- 11.19 Opp. a magnificent Taboa Tree on R.B. Palm and other vegetation look as though the rain had freshened them.
 11.25 Assumi - Head of Tamandua Island.
 Heavy shore sand bar on R.B.
 11.38 Opp. up end I. da Velha Ignacia - which laps the large island.
 11.38 also opp. Upper end of I. 235.

11.38 I.

I. 234. (Lower end of I. 234)

wide, clear river appears above the islands. $\left. \begin{array}{l} \text{meet a } 2^{\text{d}} \text{ barca} \\ \text{discovered} \end{array} \right\}$

126 Sunday, Oct. 26. above I. Tamandá.

11.38 L.

[larger C.N.]

11.49 Opp. Houses, on L.B. called Casa Nova [not the
11.54 Little Sandbar island (no house in it now) see Map

which shows situation of the Little Casa Nova
we keep up on the unsounded Channel toward
I.B. We took soundings all the way through $2\frac{1}{2}$ to $3\frac{1}{2}$ miles

12.00 Opp. another sand bar near mid-river-low.
we are 100 meters from R.B. approaching pt. of bend.
Wide, clear river above Sand bar-for about 1 mile.

12.12 Rocks project out 800 ft. from R.B. Irregular chain
not shown on map - stick out 2 to 3 ft.

12.13 Steamer now mid Riv. Str. Home opposite
Steamer whistled opp. said House. A sand bar
apron in front of Casa Nova, which keeps off intruding Steamers.

12.15 Opp. up end of chain of rocks just above mentioned.
Now clear River. (15 meters deep)

12.28 opp. CASA NOVA - stop - outside against a
Sand bar. The whole low

12.28 also opp. Upper end of I. 234 we came thru
last league
in 50

Lower end of - I. 233

We stopped opp. Casa Nova - with a Sand bar
and a shallow arm of the river intervening,
to get some necessary articles for the Steamer
which we could not get in Santa Anna.

We brought the mail carrier from
Santa Anna and landed him here -

I sent my letter to Minister Simimbu
ashore, with "Skico", to be mailed here.

[Under a misapprehension or misinforma-
I wrote in my letter to Sr. Simimbu that we had run a
league in 40 minutes

Casa Nova lies low; and much of it must
be overflown in high water. I sent word
on shore that we expected to make a call at
this place on our return.

Sunday - Oct - 26] at CASA NOVA - in River

We receive a present of an ox - or a large portion
of one, from Sr. Vianna - the gentleman who
applied for a passage to Tamaria. He has hoped I would
dine with him to day.

Between Santa Anna and Casa Nova -
that is from League 234 to League 238 inclusive, a
number of rocks should be blown out in order to
make a safe steamboat navigation. I would esti-
mate about 1,000,000 per league or \$5,000,000 in all - pro-
visionary - dependent on what kind of a navigation
is to be in the main second. A steamboat, with
Cau, can navigate the channel with a good pilot,
and good day light, with the water not too rough,
in the present low stage; but with the water 3 feet
higher, it will be more dangerous than now; be-
cause these rocks, which are now barely visible,
would be 2 to 3 ft. under water - just enough to dis-
turb a steamer running down stream at seven to nine
miles an hour. We struck, pretty hard, twice this
morning; fortunately, while going slow; and fortunately
again, the rocks were nearly the draught of our
steamer below the surface. If we had been going
faster and the rocks had been a few inches higher
the steamer might have been sunk. Halfed's
Halfed's Est. in this is not too much.

League 235	2500 ft
336	1543

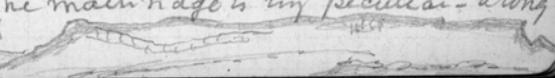
4° 38' I. 253

4.38 Start - from Casa Nova - We run over toward the Rocky
Serrate do Bogueirão - in order to get to Channel.

4.47 When opp. Serrate - we are 150 miles from L.B.
Then run parallel with shore. Very wide river - clear.

4.55 We turn away from L.B. - much as shown on map, only a
little more - nor. or straighten up, and curve, like the actual line
soundings generally 3 meters -

A mass of massive mountains on the L.B. side as
shown on the map - portions of them perpendicular bluff
rocks on top the main ridge is very peculiar - a long
nearly level top



128 Sunday - Oct 26 - above CASA NOVA

- 3 meters deep -
- 5.06 Steering up toward pt. of I. Gr^{da} Encaibro. maps
just as shown on Halfeld's map -
Some Rocks off toward B. Shaw, about as shown on maps
- 5.16 Opp. Lower pt. of I. Encaibro Island. pass within
250 feet of pt. of island - West of it. 3m. Sandy 3 1/2
we then incline off to 400ft. (3 1/4 13m) (River looks
+ more
5.20 clear on this side of island.) 150 meters from island.
3 meter soundings all along - Keep about 150 m. " "
- 5.26 Big sand bar puts out on R. B. Shaw - Fine navigation
between that and island 200 meters clear - wide (3m) f
clear run for a mile up.
- 5.35 About upper end of L. 233. - running slow now
100 meters from L. B. (5° 37') 90 m. (3m.)
- 5.38 Approaching island to stop -
- 5.40 as good as stopped. For the night - Say at
Lower end of L. 232. I. Grande do Encaibro.
League 233 - is a perfect navigation - 3m.

Staⁿ night - Oct 26th - just above lower end L 252

Monday - Oct. 26th - Pilot went up to
Anticoz. Came back - and asked for
some of us to make soundings.
Sent Mr. Weiser - who reports a good
wide channel least depth 1 1/2 meters
through the worst part -

Monday - Oct. 27th Lower end of I. 232. 129

- 1.45 Start up - along near Encaibro Island
- 1.51 "Slow" - Preparatory
- 2.05 Steaming for the bounded channel
- 2.15 In channel 150 m. 200ft. from Island -
- 2.22 -lean Rock 50ft on left - another 100ft on right -
- 2.25 Rock 60ft on right - another 100ft on left -
- [I think there is a deeper channel near the mid a rock -
but it would have to be sounded carefully up stream.
It may be wider & better for a good steamer.]
- 2.28 Touches a rock - not my hand - Had sound some feet
before. The rough water from wind & current makes it rather
difficult to discern out - a sand bar projects out, about
400ft from Island.
- 2.35 Stop - Pilot wants to sound with the boat before running
the steamer up. Says there are rocks. That the old
regular channel along the island is filled up with
sand! and I see that it is -
- I watched the course of the boat and the poles and I got
satisfied he sounded out a 2 meter channel for a 1/2
mile up to above Rocks that he left to the right
- 2.50 Pilot turned the boat just about the rocks and round
back rapidly toward the steamer he went up on
down the gentle cum; but returns nearly straight. All night as
far up as he wants 10 minutes long
- 3.00 P. M. Return to steamer -
- 3.07 Steamer starts - up -
- 3.12 up to where Pilot sound a Rock 80ft in R. -
- 3.15 Submerged Rock 100ft on left 300ft. from Island
- 3.25 Opp. up. end I Encaibro
- 3.25⁺ Opp. Lower end I. do Fereiro. These two islands
almost cap their bay as - we run outside of the
Island Ureco de Barro -
- Dangerous navigation for 1/2 a league
I would examine this carefully with a steamer
- 3.28 Lower end I. Ureco de Barro

The rocks on the mountains - already referred to, now
opp. on the R. B. side have a pretty fresh tint
contracting with the whitish gray - and the reddish soil

130 Monday - Oct 27. Just above a dangerous
Pice of River below these islands.

3.34 The channel we are now in between I. Ureco de
Baixo and I.B. appears clear. Current about
2 miles an hour, about 900 ft wide.

[A new kind of tree on island on left. a different looking
Pilot says this is a good channel - $2\frac{1}{2} + 2\frac{1}{2}$ M.]

L. 231

3.50 In good channel clear about 900 ft wide - be-
tween I. ^{Ureco} de Baixo and I.B.

The island is un-
usually luxuriant in tree growth - more so than any
place yet seen on the river -

3.56 $1\frac{1}{2}$ mile in shallowest place - then 2 miles down

3.58 a tree sticks up 3 ft - 200 ft. from I.B. and in River
We are now within 100 ft. of I.B. $2\frac{1}{2}$ M. sounding -

4.04 Channel widens out by an indentation worn by the river
on I.B. a sand bar opp. close to island - $2\frac{1}{2}$ M. Sounding

4.10 Upper end of I. Ureco de Baixo

4.25 Upper end I. de Camelia in mid River above I. de Ureco

4.28 Slow up - to cross oblique - where ^{cut sounding don't show}

4.35 In mid River - wide - good - opp. I. Capivara of I.B.
We are passing a large "barca" which is pulling logs
along the R. B. The wind is strong, empty the River
nearly at L's Palm in numbers in R.B. show
Sounding 2 to $2\frac{1}{2}$ m

L. 230

4.40 Sand bar, in River, 200 meters on our Pt. R.B. 150 ft

4.46 Sounding $3\frac{1}{2}$ m - 200 m. from R.B. - mi wide.

4.48 Slow up - on account of supposed shallow - my width

4.50 $1\frac{1}{2}$ 2. 2. $2\frac{1}{2}$ m. River my wide $4:50 \frac{1}{4}$
Shallow com! because there is a little patch in the
Yeta + River my wide

4.55 Rock 100 meters on our Pt.

4.56 Steam on again - Very windy and disagreeable
towing note - Steering for Channel inside of Illia
de Ureco de Cima.

5.04 100 meters from R.B. 5.05 50 meters from R.B. $\frac{1}{2}$ ^{near shore}
Channel strikes out toward island.

5.10 Opp. Lower pt. of I. Ureco de Cima, meet an ajonjol
sounding -

Monday - Oct 27 - on League 230 131

5.10 Fri channel - between Island and R.B. 3 miles ^{wide} 200 m.

5.12 Slow up South near island $2 + 2\frac{1}{2} + 2\frac{3}{4}$ m -

5.12 $2\frac{1}{2}$ m. near main ^{5.14} strip - close to island - $1/2$ speed

5.15 Head of swift - Steam ^{newly} on again - $2\frac{1}{2}$ m. 2 -
narrow channel along here - near island; but it
seems to be safe - for $1\frac{1}{2}$ miles

5.20 Pt. or bend in island hard to the Pt. near mid. of I.B.

Steam on - steering out toward mid channel. $2\frac{1}{2}$ M. 2

5.25 We steer on to near R.B. $3\frac{1}{2}$ M. 3. [I see Rocks ahead on the
island to near mid River
not shown on maps]

5.30 Opp. head of Iha Ureco de Cima

a long bar extending up river above island, ^{Barca Map show fallen on}
clearing rather away - toward mid River -

5.31 a submerged, invisible rock 30 ft. from R.B.

We slow up for fear of other rocks, and steer away from
them. 50 meters from shore now. Going slow.

L. 229

5.37 Steam on -

5.40 Opp. head of white bar - above island -

5.45 STOP - for the night - on R.B. not far above
lower end of League 229.

Report - in a general way - from
League 232. 231 & 230. That,
while there may not be much work
really necessary - it is important to
make careful future examination
with a steamer - W.M.R.

October 27, 1879

League 229 - a little above ^{lower end}

- 6.00 Start - Run out to mid river -
I see no rocks on the R.B. side to past mid river
{ Opposite - Serrote da Salina da Turema }
6.12 { Ou da Justina - Granito + Quartz. }
It looks like Itacolumite, 1/2 mile off.
We are running slow - said to be a shallow place, 1 1/2 m.
Rocks appear on our right in front of Serrote, as shown on Map.
6.15 Some rocks within 100 meters of R.B. shore (not shown on map - Steamer is in mid River, going slow)
Swift water this side of the R.B. rocks.
I think that can, only, is needed here. Strong wind ^{up}
Opp. a few more rocks. 50 meters from R.B. not shown on Map - Steamer on - a little faster.
6.21 Opp. Small round (or oval) island 200 meters from R.B.
It may have been only a little sand bar in Halford's time
The River is very wide 3/4 mile, at least.
6.23 Sand bars show about 150 meters from R.B.
6.23 Rocks in mid river - 6 inches above surface 50 ft on an ^{night}
Pilot orders slow. Waves render it difficult to see slightly submerged rocks
The map shows no rocks from mid river to R.B.
Rocks appear (abundant) on L.B. shore.
Swift water along here - 2 miles an hour.
6.28 Long sand bar begins (and a rock inside of it) 250 meters out from R.B. shore - making up (Continues) ^{apparently}
to the point, (or turn) nearly or quite a mile above, not shown on map -
6.33 Running 1/2 speed about 80 meters from said "sand bar".
Rocks 100 meters off - toward L.B.
Space betⁿ Rocks + sand bar narrows to 100 meters -
6.39 We pass 50 meters to left of rock (1 ft above surface) Rocks scattered all the way to the L.B. - and Swift between.
There seems to be another channel 200 meters to Mr. X
It requires care here.
Pilot now steers to the R. of some Rocks which project 1/2 mile
6.45 some of these rocks are barely submerged. we pass with 30 meters of the care are + 20 meters of a submerged one Bad place

- 6.46 one sand - 1 meter - then 2 m -
This part of the river to be searched for a safe channel
6.48 Steam on again. Rocks on toward L.B. none in view toward R.B. 2 mile an hour current - River is somewhat narrower - Map shows it.
6.51 We are steering now from mid R. river toward R.B. pt. Villa de Sento-Se in view - or houses along shore; but on the map there are nearly a mile from the Villa.
6.57 150 meters from R.B. - swift, 2 mile an hour.
7.05 Arrive - we dropped at 7 - opp. houses + about houses - anchor within 40 feet of shore - Half a dozen gentlemen on horse back - among them, I hear, is our friend Remicio (Brazil) from Soazeiro. River 1/2 mile wide here River looks clear.

Copy of letter mailed in Villa de Sento Se - to Sr. Jose Mariana Vianna. of Casa Nova, Oct 28, 1919

In the name of the "Comunidade Hydravelica", I have to thank you for the handsome and acceptable present you had the kindness to send to us, and we hope on our return to have the pleasure to meet you and thank you in person. I have the honor to remain

Very resp^tly your ob^d. serv^t.
M. Mendes Roberto
Eng^o a chefe

M. Lisboa translated it into Portuguese.

VILLA de Sento-Se.

This is no longer a Villa.
Mr. Derby and Devino the Machinista - go to the Villa
They return at 9 to a.m. and report the Villa to be a mile from the River. Halford's map shows it less than half a mile.
Breakfast - began - just as M.D. & I returned. They met Col Sento-Se. One good house, his, in the place. This the gentleman who undertook the bringing of the

134 Tuesday - Oct. 28. Santo-Se.

We ^{over} ~~very~~ ^{2 1/2} hours by an ^{stop} at this place. ^{no longer a Villa}
My object in stopping was to allow Mr. Derby to make inquiries concerning some reported Coal - which it was thought he might hear definitely about here, but he learned nothing of any consequence.

Santo-Se is a very unimportant place. ^{very windy w.p.}

18.45 Start. Fair. I. 228. ^{Strong wind} at the port! below opp. Villa.

we run, at first 100 meters then 150 meters from R.B. in 2 to 3 m. soundings, 300 meters on this side of run clear - this far. I see we are aiming for outside of I. de Catherina different from Halford's soundings, which are behind the island. No, he is turned.

11.05 Opp. Lower part of Island. - Wind just in on the point. HERE WE WORKED 2 HOURS.

Grounded a little, finally got up by Kedging - absence of experience

1.14 Start - in arm 100 to 120 meters wide between Island and R.B. ^{our man (type) released the Steam by getting out into the run} #

1.19 130 m. wide -

1.20 Stop at Island. Very good channel as far as we have come up it.

The approach to this island with a strong wind blowing obliquely toward the island makes the passage difficult. The deep channel is not over 20 meters wide though there is a meter channel 30 meters wide.

The current sweeps close upon the willows of the island, about 10 feet deep nearly 3 miles an hour; and for the length of a steamer perhaps fully 3 miles.

If we had approached it a little differently with due allowance for the wind, we

Tuesday Oct 28, -

would have gone up without the delay; but I am not surprised at the want of this sort of experience in our pilot. He is a pilot - but not a Steamboat Captain. Henrique is the nearest to a Captain of anyone on board.

1.37 Start again - a beautiful clear channel

1.43 100 meters wide - 2 to 3 meters deep - 3 1/2 + 3 - [The Pilot dived it badly - and met 1/2 when he could have had 3 1/2]

1.45 The middle appears to be about 3 miles - 3 1/2 + 3 1/2

1.47 2.22 50 ft. from R.B. 2 1/2 Catharina I

1.48 Opp. head of Island - 3.3 - 50 ft. from R.B

1.57 Island das Bois now, on an Rt. 300 meters off - 2 1/2 m -

Opp. head of BOIS Id. about mid way 150 meters to island 150 meters to R.B. swift on left.

1.58 Under Run above island - Sand bar to L.B. side Requires careful piloting - but we have 2 1/2, 4, 8 miles -

2.00 3 1/2 m - 3 - 200 meters from R.B. 2.2.

2.05 Have inclined toward R.B. dist 100 meters 2.2 1/2

2.07 ^{conceal} a Submerged Rock 50 meters from R.B. 50 meters to safe DANGEROUS

2.11 # 3 1/2 to 4 m. 20 meters from R.B. #

I. 227

2.15 We have passed the point of I. Porto Alegre we are running outside 3. 3 1/2 m. (Halford's Channel is on inside of island - 5.5. 3 + 6 Palmos)

2.19 Approaching a large sand bar from R.B. just 160 M. we pass the bar 80 meters outside of wider sand - 2 + 2 1/2

2.23 - Stuck on an invisible sand bar. The steering seems to be all right, and the soundings just before, 2 meters; but we stuck. Could not back off. Indians stripped and with their boating us got off - but there are some pedras Submerged - and behind the Wind, the sand - bar and the pedras we came to an anchor - ^{original} Pilot took boat and went sounding ahead 1/3 miles.

136) Tuesday, Oct 28 - on I. 227. at anchor.

2.23 P.M. This is a bad & dangerous navigation unless with a Pilot thoroughly familiar with the river in this low stage. Our Pilot seems to be at a loss part of the time; though I would not blame for running in this particular bar. There is a rock in line ahead $\frac{1}{4}$ mile and several rocks a hundred meters to the right; and the large sand bar (referred to on page 135) 70 meters on our left - when we are anchored.

3.03 Pilot seems to have turned - He is coming down farther away from the R.B. than when he went up.

3.12 Pilot is back - From the middle of the river over to the L.B. I see rocks a foot or two above water - at intervals - but there may possibly be a steamboat channel over there. This part of the river will have to be carefully examined with a steamer.

3.19 Start a gage - Took an hour less 4 minutes

3.24 Rock - 50 m. to left. 250 meters from R.B. 3.3 m, ^{nearby} Another nearly submerged rock - 50 meters near shore - Wind has abated some - Still pretty strong westerly across R.

3.28 Steer to left to avoid another rock.

3.29 Rock 30 meters on our Rt. 1 foot out. We are now opp - upper end of the big bar referred to on R.B.

[The Island Port Alegre - very unattractive] I could see neither end of it. We should now be above it.]

3.32 The [Stuck on invisible sand bar - Sounding 1 $\frac{1}{2}$ m. just before.] 0.75 sounding - Moved a while & at

3.38 stuck on another spot - moved off + shot out toward mid river. Begin to cum up.

3.40 Opp. immense sand bar on our left - One seems to run continuously to the shore (R.B.) above - opp

3.51 Santarem on left bank. 30 or 40 houses - some of them large, but only two with tile roofs - new looking. 2 $\frac{1}{2}$, 2 $\frac{1}{2}$, 2 $\frac{1}{4}$ - Rocks but us and Santarem. Surely 40 meters on our left - Some brush over bar in water.

Tuesday - Oct 28 - Santarem L.227. (137)

5.58 Approaching lower pt. of Ilha de Canafistula (It is still $\frac{1}{2}$ mile above.)

3.59 Dinner bell Rings

4.10 Lower end Ilha Santarem People - people.

4.26 Upper end Ilha Santarem

4.26 Lower end Ilha Malhada - we go outside of all of these islands but within 100 meters or less of them - Malhada's soundings were inside

4.32 Good soundings 3 meters or more for some time past and a clear appearing river - we go along at good speed - River 1500 ft wide here

on - I. 226. (3. $\frac{1}{2}$ - 4. $\frac{1}{2}$ m)

4.40 About nearly $\frac{1}{2}$ way of League 226, opp. the Ilha MALHADA.

4.43 1 m - $\frac{1}{2}$ - $\frac{1}{2}$ $\frac{1}{2}$ - Slow. 1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 2 - 4° 45'

4.46 1800 ft. wide - we run 300 ft from island. 1. $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ -

4.55 # Rocks. 50 meters on our Rt. -

Opp - upper end Ilha Malhada - Extended up since Malhada's time - and lower end of I. da Lagoa, which has extended down some -

5.00 Swift water - L. 225.

A very wide open space on R.B. side to the blue mountains 2 or 3 leagues away - This must be my low or my fleet ground across here - on the L.B. side it is also low for along distance -

5.01 A pretty sand beach begins on R.B. side and extends up in dipping into man in home back and numbers of curious people gathered at water's edge to view the steamer.

5.07 Opp. Rock 20 meters to our left 70 meters from shore ^{at low water} -

This will be a dangerous Rock with the ^{water} $\frac{1}{2}$ ft higher -

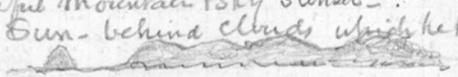
We are going along Ilha da Lagoa - making about a league an hour since we got clear of sticking -

But little required on League 226 + 225

5.20 Upper end of League 225 - somewhere near here

138 Tuesday - Oct. 28. League 224 - Lavn and

5.25 2 1/2 - 2 1/2 2 1/2 - 3 1/2 (5° 27') 5 1/2 near to L.B.
5.32 4.4:4 (5° 42') 2 3/4 - 2 3/4 - 3 1/2 4-4-4 1/2 4 3/4
Iha Munda Nova - above Iha a. Lagoon

Then above Munda Nova - an immense
5.50 Sandbar on R.B. side - extending up 2 miles.
Beautiful mountain sky scene!
Up River - Sun behind clouds which he has
5.55 set ablaze  4.4.

6.00 Sunset - by my Watch - Watch is too slow -
4.4.4 1/2

6.13 Stop for the night. on R.B. or ~~at~~

We are only a little below opp. Barra da Cruz, which is on the L.B. side
on League 224 - about 22 3/4 -

We stop against a sandy bank
current in main channel about 2 m. an hour.

We remain here during Wednesday
Oct. 29th - men out getting wood
for steamer - and engineer fixing
his machinery.

I write a very long letter to Son T.P.R. 0429

on I. 224. 14
Thursday - Oct. 30 - R.B.

1/2 mile ^{or 3/4} below opp. Barra da Cruz

5.52 Start - We start away from shore toward a main
central channel - shore channel stopped up
5.57 Mid River - just below sand bar
6.05 Bars on both sides - which confine the channel to 400
meters - giving 3 meters or more depth.
6.16 # Rocks near Barra da Cruz - below opp. lower end of Barra da Cruz
within less than 100 meters from shore - not on map

139 Thursday - Oct. 30 - on League 224.

The old bar on map - opp. Barra da Cruz is now a
low sandy island - with bushes -
6.20 Upper end of Barra - many Rocks 100 m. from shore
White channel here narrows to 350 meters -
On channel near the sand island (or rather
Rocks - just submerged 50 meters from sand island -
numerous rocks - breaking up the channel - a very
bad place (about 2 1/2 m.)

6.27 a large Rock in mid river 1 m. from up - not shown
6.32 Upper end of new sand island - a small new sand
island just above it - on our right - we go between.
Large bar on R.B. side - not shown on map.

6.37 Opp. lower pt. of Paupisque Island L.B. side - we
are steering obliquely for R.B. - to get our wood pre-
pared yesterday. L. 223 (1/2 m. below pt. of
Island Paupisque
now on I. 223

6.43 Bars on both sides of the river help to deepen
the central channel, but it is still quite wide 3.

7.03 Stop for our wood - [Anchored, like dunes, instead
of putting the steamer right to the shore - deep water.] about
2 cords of good wood nicely piled - our men slept
here last night. Some 200 or 300 sticks also bought here
[5 meters deep] a little better dry about party the unburnt

8.15 Start - a little better with the wind -
The Serra ahead to our right looks beautiful!

 8.29 Small rocks on R.B. shore discolored by acids of iron -

8.30 100 meters from R.B. - 3 1/2 m - Clear now - good depth

8.40 Running obliquely over to L.B. side. Must be about
upper end of League 223 - and lower end of
I. 222 - lever handle broken on cork of
can still work.

8.50 Along L.B. sandy banks. The bars have changed
much since Haldfeld's time

8.55 Our boat behind upset - we have to anchor and
lose another half hour, or more - Breakfast

140 Thursday Oct. 30. League 222 ^{a little above}

Start - after losing ^{minutes on acc^t - upset boat}
Between Sandy L.B. (or island one) and the visible bar
on the R.B. side run about 300 meters - clear ground depth

9.45 Now comes the Engineer, and says, that the one
valve or cock that feeds the boiler (the handle of
which is not broken) is not very good; and he
advises us to stop, and cool the boiler, and let him
file down the other, so that he can use a strong
lever that he has and have the two working again.
My answer is, that any thing obviously in the
line of proper or additional safety, that the
Engineer advises, I deem it my duty to adopt.
That is, I will not take the responsibility of sum-
mering the steamer contrary to his advice in the
matter of which the Engineer has special charge
merely to save some time. Time is impor-
tant and cost considerable; but I will not
take or assume responsibility which would
render it possible, in case of any mishap,
for the Engineer to say "if you had taken
my advice this would not have happened."

Every thing in the line of additional
change of safety, I will encourage.

This is nearly another day lost, on acc^t.
of defects in the details of the Machinery
of the Steamer; but there is no remedy;
but Paciencia - and taking ad-
vantage of the delay to bring up Corres-
pondence.

I hope to have a chance to mail
letters for Bahia or Remanso - where,
if we could go a couple of leagues to day
we could omni laurus.

Mmo Exmo San Francisco River V41
Comendador League 222. Oct 30. 1879
Sr. D. Luiz Plinio d' Oliveira
Secretaria do ministro. &c

We left Santa Anna on
board the steamer "Presidente Dantas" Oct. 26
Since starting, we have found various matters
about the steamer needing attention, causing
delays; and we lose not less than one day in
just cutting and getting wood; there being no
provision for such hungry wood eaters (as this
steamer is) along the river. Considering that
it is three years since the steamer made her last trip,
that the Pilot has of course had very little experience
with steamers, and that, excepting the Engineer and
Pilot, all the others (steersmen, firemen, etc) are
imprisoned from among the men we had with us,
we are doing pretty well.

As stated in former letters, there is a super-
abundant supply of water in the river; but
~~but~~ in places, the river is very wide, & divided
into several channels, and some of the old
channels with which the Pilot is familiar, have
become closed, by sand-bars, and he is not yet
well acquainted with the others; so that we have
sometimes to feel our way, with our sounding,

In a number of places, there are rocks
obounding above the surface; some just at the
surface, and others a little submerged; which
it is necessary to avoid.

The wind is at times, as Halford
style it "vento fortissimo"; though, thus far, its
direction, has generally been favorable for up-steam
running.

Sand-bars are much more extensive
and frequent along this part of the river than they
were below. Some of these have changed con-
siderably since Halford's survey. I have no doubt
that his map represents them as they then existed.

Thursday Oct. 30.

Where there are no obtruding rocks, visible or hidden, in the way of the navigation, the sand-bars are generally advantageous; as they contract the water way (which is always as a rule, too wide) and thus assist in deepening it; but the combination of sand bar on one hand and rocks on the other, is unfavorable for safe navigation.

In a majority of cases Halfeld's map shows where there are rocks; but not in all cases.

Generally, in a river of this size, ^(width) with such an immense volume of water in its lowest stage, the sand bars are likely to be more beneficial than hurtful. The running upon a sand bar with a steamer, may be only a trivial matter producing no serious damage, if any; but the running upon a rock, unless going very slowly, at the moment, may sink the vessel.

This steamer is very much better suited to our purpose than the "Paulo Affonso" would be if she were here. The "Paulo Affonso" is not at all adapted to any part of the river above Jatoba that I have seen.

But this is not the kind of steamer best suited for this river. She has not power enough. Her draught is moderate; but I would have one of still less draught, and more power, with a stern wheel.

As far as our train comes right-running, on this river, would be out of the question; without a ^{very} considerable expenditure of money devoted to the special purpose of improving the river for it. Unless there should be a very much greater commerce than there is now, such an expenditure, for that object, would not be advisable.

above Santa Anna, as far as we have

Thursday, Oct. 30,

come, the river is by no means a clear river. Great care, and the guidance of an experienced Pilot, are absolutely essential to safety, even at the moderate rate of three or four miles an hour, which is about the ordinary up-stream movement of this steamer. Running down stream, in the same stage of the water, will be still more dangerous.

The very strong up-stream winds, meeting the river currents, which are often two miles an hour, do wrinkle the ^{surface of the} water as to render it difficult for the Pilot to discern the places where there may be submerged rocks a foot or two feet below the surface. With frequent running, a first class pilot might become acquainted with all the obstructions, and be able to steer clear of them; but, meanwhile, a steamer might be lost.

According to Halfeld's map, there is a considerable distance above here without rock obstructions. (I am unking this on league 222, while the engineer is doing some needed work to the machinery) I hope, therefore, to find a safer, and perhaps a better channel between here and Remanso, which is about eleven leagues above.

Some of the stretches along the river between here and Santa Anna are beautiful, clear of all obstructions; and the Mountain scenery is often charming. The foliage also appears greener and more abundant than it is farther down.

Prof. Derby found some fine emerald yesterday, not far from here, in a peak about 50 miles high, on league 221. Halfeld shows it on his map.

See page 152
for continuation of letter to Sr. Plinio

Friday, Oct. 31 - on I. 222.

River now over 600 meters here.

- 5:20 Start - on I. B. Sandy bank shore - Channel
 3 1/2 m. - 32. 30 meters from land - ^{to middle} in run out.
- 5:37 The pilot meanders across the river to get into Sh. on R. B.
 Bars in river have changed somewhat since Halfeld
 2 miles or more current. River wide now
- 5:45 We are on R. B. side, 60 meters fr. land. ^{2 to 3 miles sandbar} Sundry Slopes
- 6:07 Opp. a point on R. B. side. The opening of water
 outlet from Lagoa do Pico [on L. B. side] about opp.
 This lake is on the river level. It is more like a
 lagoon than a lake. Good fishing place.
 The Lagoa stands at the base of the beautiful
 range of mountains I have been admiring for 2 days.

6:23 About up. end, I. 222. Good nav. today

6:23 now on I. 221

- 6:23 Opp. Serrate do Pico [Fero Oligiste] of Halfeld
 and which Prof. Derby visited on 29 Oct. and got
 specimens. Hematite iron ore, much mixed with quartz.
- 6:26 running 80 m. fr. shore R. B. Bar at foot of island opp.
- 6:30 Opp. lower end of Ilha do Pauapique - 150 m. ax.
 We run bet. Island and R. B. - inclining to Island.

6:35 Rocks - ledge ⁶⁻³⁵ meters fr. R. B. shore. Not shown on map.
 # a clear river 130 meters wide outside toward island.
 This ledge now projects only 1 foot above surface. MARK IT!
 A good channel 2 1/2 to 3 1/2 m. wide along here behind
 this island.

- 6:40 Channel ^{good} now on R. B. side - all clear to I. d. (160 m.)
- 6:50 Opp. Rock Serrate close to river shore R. B. Itocolumite.
 Halfeld. called Morro das Trahiras (Quartz) ^{Low in I. das Varquinhas, M. above}
 Strong current 2 1/2 miles. Bar 150 m. above
- 6:52 Opp. head of Ilha do Pauapique, ^{Low in I. das Varquinhas, M. above} Bar 150 m. above
- 7:07 Opp. ^{Low in I. das Varquinhas, M. above} on the marked range of rocks 200 m. fr. R. B. running quite
 parallel. The serrate lies on the talus in front look green
 very back bony  quartz.
- 7:18 Out about 1/2 amp. wide river Upper end I. 221

Friday Oct. 31 - on I. 220 V45

- 7:25 30 m. from R. B. 5 m. deep. The river is cutting this clay ^{bank}
 a little newish sand bar inlet 100 meters fr. shore.
- 7:28 Channel close to R. B. side - deep
- 7:31 Opp. up. pt. inlet it is rock at extreme end - part of ^{Rock not on} gated ^{map} ^{1/2 way across channel.}
 which obstructs ^{outward} ^{1/2 way across channel.}
- # Pilot clear out, and is abt. mid channel opp. upper end
 Probably a narrow ^{50 ft. deep} ^{newly} channel near R. B. where we
 went on a crooked course in forest 2 miles - now about ^{1/2}
 We are now returning toward R. B. [I would have kept
 night along close to R. B. shore] apparently clear river now
 [Clear river - wide]
- 8:08 Opp. Morro do Monteiro (Quartz ferruginoso - Halfeld.
 Behind these 3 rocky knobs (units) there are 2 more
 (called Morro do Estreito). River wide, but clear
 (has large patches of dead and yellow green)
- 8:10 15 houses along River bank - in front of Morrow - not
 on Halfeld's map. Morro 1/4 mile back and not
 directly on now as a map -
 Beautiful, clear river a mile ahead 3800 ft wide.
- 8:20 Opp. some loose rocks on shore edge of water ^{more than in river.}
 8:21 opp. another better defined ledge on shore edge of water
 clear river 2500 ft wide.
- Vegetation on R. B. - flats much more luxuriant;
 but note, it is all on flats subject to overflow.
- 8:25 About upper end of I. Cague 220.
 The sand bars and shores and islands
 on the L. B. are changed and it is difficult to get
 distinct land marks. But we are now
 on I. 219.
- 8:32 Opp. ^{small} Cluster of houses on R. B. about opp. head of
Ilha do Riacho, which is on L. B. side.
- 8:38 Opp. ledge of rocks 30 meters from R. B. - 1 foot above water -
 # 100 meters long parallel with shore - not on map. #
 (as all marks on it).
- 8:40 Opp. lower pt. of Island ^{summit} ^{unclear} water on
 the L. B. side. No water there on map
- 8:45 Opp. Upper end RIAXO - a dozen houses - the shore all
 River 2200 ft wide

Friday - Oct 31. I. 219.

- A nice beach ^{along and} in front of RIAXO.
 8.50 Sand bar extends ^{back} from L.B., and Contracts river to 1800 feet - so much the better - It makes a fine, clear navigation all along R.B. side. much clay in bank R.B. side.
 8.55 Boat upset again - at same time word
BREAKFAST - so,
 we put the Steamer against the clay bank on R.B. side, and in a few minutes the boat was righted, and soon bailed out: but of course on delay induces others, and we do not start till [40 minutes long] Start - Clear, as far as visible. The Concave, and the good channel on R.B. side.

Large areas of flat Tanar not elevated above the flood on both sides of the river - apparently extending some leagues, and bounded by ranges of Mountains - River here would be very wide, but fortunately is contracted by sand bars on L.B. to about 2000 ft.

- 9.59 We begin to steer obliquely away from R.B.
 10.00 opp. hardened clay at Surface R.B. 100m. to left.
 10.05 about opp. present head of Selana Cavallo Morte.
 It has changed greatly since Halfeld's survey -
 H. hardened clay - or rock, all along R.B. Shriv, just at
 Still steering obliquely across toward L.B. toward the village Queimadas - on L.B. ^{a few miles} near end of (upper) League 219

We are now on I. 218.

- 10.15 Some rocks - but these are clear to L.B. show inside of a sand bar, entirely out of the way of navigation
 10.17 above this the bar is transferred to R.B. side, and there is very deep water in front of Queimadas, the river being narrowed by the bar to about 1000 ft.
 10.24 Opp. QUEIMADAS - Quite a number of houses only 2 or 3 with tile roofs - many people on banks.
 10.27 Swift opp. upper end of Village - popovers. Clay bank.

Friday - Oct 31 - Queimadas, 14 and Bembom.

on I. 218.

- Bembom - a long scattered lot of houses opp. the Ilha da Zabele.
 10.42 We are now just opp. Lower end of Island. Running toward the R.B. shore. (Sandy?)
 10.50 Running along within 90 meters of R.B. (Shriv-banks.)
 10.59 We begin to incline away from R.B. keeping at a distance below immense sand bars extending more than ^{one third} way across ^{the} wide river - we going obliquely toward L.B. River nearly 3000 ft. wide here near the upper end of I. 218, or about ON 217 I.
 11.15 150 meters from L.B. (or island - as the Case may be) No bar visible above surface now, river 2600 ft. wide. The L.B. bank - (sand, pun) is obviously cutting away.
 11.22 We now incline away from L.B. obliquely up. 2400 ft.
 11.33 Opp. Cadella on R.B. only 2 or 3 houses. Bars above in middle, and toward L.B. side here. The channel is entirely different from Halfeld's Channel. On R.B. side running within 150 meters of Shore. River 2000 ft. wide. [Good view?]
 11.53 River narrowed by S. bar on L.B. side to about 1600 feet
 [Mem - about 11.45 (my time) scene was highest - and it is South of us, perceptibly.]
 12.05 Opp Serrote do Tombador - I see distinctly the appearance of iron-ore - Halfeld refers here to "Pero Origiste". (R. 1600 ft.) river is now narrowing - perceptibly.
 12.13 Opp, Tombador - about 8 houses & 1 man of a house
 12.17 Opp. ^{former} head of the Long Id. Pinsade or Zabele which we came to on I. 218 - and which is so indefinite as to whether it is main or island. It appears to be entirely closed with sand at this time.

Friday, Oct 31, L. 217 - begins just below Tombador

12.22 Opp. a point a bluff of iron ore 15 ft. high, fronting the river for 200 meters - just above the village of Tombador - and about opp. head of Island. Hundreds of chunks or young boulders, which appear to be iron ore.

On I. 216 2 mile current lower end.

Going along

12.28 about 100 meters from R. B. Sand bars and some islands over on the L. B. side.

12.32 a beautiful river - and good depth on R. B. side 1500 ft. wide to the bar - 3, 3, 3 1/2, 3 1/2 (50 m. on gentle Conceiv along here - 3 1/2 m.

12.40 1200 ft. wide to bar - 3 1/2 - 4 - 3 1/2 m elegant channel. Still current 2 1/2 miles an hour.

12.43 1100 ft. narrowest - Then begins to gradually widen, the bar getting farther away from R. B.

12.50 Iha do Imbruseiro is on the L. B. side - it is indefinitely mixed with large sand bar. We are about opp. Imbruseiro - say 10 scattered houses. The banks now on both sides of river are sand. [Sun. is hot to day - but I do not suffer.]

12.55 Half mile below large island - River 2000 ft - Skimmer going half speed - 2 3/4, 2.

12.59 a Rock - no mid run - Sheds up 2 ft. 800 ft from R. B. - 1000 ft from bar - isolated - The pilot stands within 40 meters of it leaning towards L. B. side.

This will be dangerous with the water 4 ft. higher. It is very plainly seen now in daylight, and certainly calm river, as now - 1 1/2 mile below island.

This Rock is not far below upper end L. 216.

1.04 opp. Lower end of I. de Tapera do Muniz This long island is nearest the R. B. map Shows the channel of the island closed with sand.

1.11 We are within 100 meters of L. B. a large bar along the island - River 1200 ft.

1.34 about upper end of I. 215 - NOW on I. 214. Lower end

Friday - Oct. 31 - J. Tapera do Muniz (149)

Narrow - 1000 ft. wide - fine navigation (214) on I. 214

1.46 opp. Head of I. de Tapera do Muniz - the Channel between it and the R. B. is closed with sand, precisely as shown on Halfed's map. In high run much water runs thro' it.

Immediately above the island River widens to 1800 ft. River 2000 ft. Banks, on both sides, sand.

1.54 Sand bar on L. B. side reduces water way to 1000 ft. - for a short dis. then widens out again in a 1/4 mile to 2000 ft.

2.02 Sandy banks on R. B. side carrying + washing away.

2.05 River 2500 ft wide (200 ft) a branch limb sticks up in mid river - very little mid. We incline now toward mid river - from R. B. side 2 1/2 - 2 1/2 - 2 1/2 - 2.2, 2.2, 2 1/2

2.12 2 3/4 " 1000 ft. from either shore 2 3/4.

2.15 Opp. a sand island of modern formation, bet. in the R. B. 3. 3 1/2 3 1/2 [Note spot of bar in channel] 3 1/2 [Don't do Sobrado opp. to R.] Upper end L. 214

2.17 now on League 213 as nearly as I can tell. Channel here say 1200 ft.

[Little or no cultivation in sight along here for several miles back and a mile ahead.] SAND!

Sand bank on L. B. cutting away. We are now inclining obliquely away from L. B. side.

2.30 Opp. Halfed's Pedras do Marcos - quartzite down near level of water on a curving point in the river. See Map. I see no houses for MARCOS. Half a mile up there are houses on L. B. side - Barro Alto. 4 houses.

2.38 We pass near limbs of a tree sticking up - 3 or 4 ft. - Still heading obliquely for R. B.

2.40 within 150 m. of R. B. The sand bar are now in the L. B. side - Fine Navigation! 2 1/2, 2 1/2. [1300 ft]

2.45 4. 4. 4. 4. 80 meters from R. B. Carving banks on R. B. some clay with sand here.

2.49 River here is very wide 4500 ft but the L. B. side has immense sand bar which leave a good navigation on the R. B. side 1000 ft wide.

2.55 Good channel 50 meters from shore.

LAND

Remanso Nov 1. 1879

We arrived here last evening, having run ten leagues during the day, which may be not far from what the steamer can do when ascending the river. On these ten leagues, the river is almost clear, and the navigation is excellent. Sand bars occur, on one side, or both sides of the river, and sometimes in the middle of the stream, and in all cases where a large share of the width is filled with sand bars, there is a good ^{free} channel of ample depth and ^{width} ~~width~~ ^{width}. This accords with my experience, and is as I had hoped. The Pilot says that above here the river is better. I am therefore greatly encouraged. Besides, the Country is improving in the appearance of the foliage, and ~~the~~ the agricultural capabilities are certainly greater than they are below.

We have sent a number of our men to a point $3\frac{1}{2}$ leagues above here, said to be a good point for getting wood, and we will pick up the men and the wood tomorrow morning. We remain here to day.

Remanso, is about the size of Joazeiro, but has no quite as many good houses.

The entire population came to the front last evening to witness the arriving steamer.

No wonder, after three years without ^{them} ~~them~~ ^{them} at all.

Alluding for necessary delay, I judge that we may reach Januaria about the 18th to 20th of November.

About going above there, with this steamer, there is some ^{diff} ~~certainty~~ ^{diff}. She has never been above Januaria. I can judge better when we get there.

Unless I receive instructions calling me back, I propose to continue an examination up stream, as far as we can get in any reasonable time - to Pirapora, if possible.

This will of course delay our return to Rio de Janeiro, but I regard the examination of the river as primary, and the return to Rio de Janeiro as secondary.

We are informed that the mail man will take the mail today, from here toward Joazeiro and Bahia.

I thank the honor to remain
Very respectfully
Your obedient servant
W. Milnor Roberts
Engineer Chief

Col. O. C. James

Remanso Nov 1. 1879

Rio de Janeiro:

My dear Col: We arrived here last evening, having run through ten leagues of good navigation yesterday. All that part of the river has sand bars on one side or both sides, and in some places large bars in the middle; but we seem to have gotten clear of the rock obstructions, which prevail in spots further down the river.

As I had hoped, in all cases, where ^{sand} bars fill a large share of the width of the stream, there is a good free channel of ample depth and width for steamboat navigation - needing no work whatever. This accords with my experience. Here, therefore, the large sand bars are valuable adjuncts, in connection with the enormous low-water volume of this river. I am greatly encouraged. The Pilot says that the river is still better above here.

The Country is also improving in appearance. The foliage is more abundant, and greener; and there are large areas - ^{seen} ~~seen~~ ^{seen} yesterday, capable of cultivation - ^{for} ~~for~~ ^{for} agriculture.

It now looks as if we can get at least to Januaria - though not quite as soon as we had been led to believe. Perhaps by the 18th to 20th Nov. This steamer has never been above Januaria and I know not whether we can take her up; but unless an Office mistakes me calling us back, I will try hard to reach Pirapora, which is 5th leagues above Januaria, and thus make one complete job of the whole thing.

November 1, 1879. REMANSO.

Continuation of letter to Col. O. C. James.
We cannot expect to be back to Rio de Janeiro until some time in January - instead of Dec^r as we had expected when we left.

Remanso, seems like a stirring town. The whole population - or some hundreds, of men, women and children lined the bank in front of the place to see the steamer come in. I think, from the bustle along shore this morning that it must be a fair-day here.

It is yet early in the morning and I have not yet been in the town, but our young men report it to be about the size of Joazeiro, with not quite so many good houses; but plenty of shops.

The population is precisely like all the population we have met with thus far along the river - Negro-Indian, with an occasional white streak. A harmless, good-natured kind people, with leather hats. They bring their canoe loads of Melons, sweet-potatoes, farinha, and a little corn, to the towns, or clusters of houses along the river; but how the inhabitants of these towns or clusters of houses live is a mystery. In Joazeiro, we had a

great many professional beggars at our camp, and in every place we meet beggars and cripples of various degrees, and blind people.

With the comparatively few exceptional prosperous men in the town, and a few still on what are called fazendas, as far as we have come, all the people are very poor, and there is quite a large marginal population along the river.

We all have perfect health and I call the climate charming. It is very cold, in the mornings - people wear clothes, early in the morning, and sleep under blankets - in do, at night. The other young men join with me in kind regards to you and yours

Very truly yours W. M. Roberts.

REMANSO. NOV 2^o 1879

Sunday. This has been the hottest day - Thermometer 100°. The padre says it has never been up to 100°. Probably not in the houses. But on the sandy plain behind the town, where there is no vegetation except low thin bushes, it was as hot as the sun, at any place I have ever been in.

The Padre (who is a bright, intelligent, lively gentleman, past middle age) said his district extends 3 leagues below and 27 L. above, along the river, and 10 to 40 leagues back to the PIAHUY bandon - and thinks there are about 8000 people in the district. Formerly it was much larger, down the river, and had 16,000.

There is no cultivation, and none has been, except the varzante and islands which are inundated by the floods.

In a big flood the river flows on the flat country several leagues back from the sea - and with a great current in front of the town.

The river bank at the town is clay, and stands in places quite steep.

Salt has been the primary article in the growth of the place. Halfeld reports the houses 25 years ago at 217 pop. 1100 - so that it has not doubled in that time. Many must have gone to other places; the natural increase would be more than the actual.

The shape of the river and islands in the vicinity is radically different from what it was in Halfeld's times. There is now a wide river 1200 feet in front of the upper end,

Sunday, Nov. 2, Leave Remanso.

- 2.05 Start - and go nearly sq. across Channel 1000 or 1200 ft. wide - ($2\frac{1}{2}$ $2\frac{1}{2}$ $2\frac{1}{2}$ 3)
- 2.11 Cross within 80 m. and running up - along island - [Quite different from Halpedi term]
- 2.17 Bar on Rt. side of channel to 800 ft. $3\frac{1}{2}$ $3\frac{1}{2}$ $3\frac{1}{2}$
- 2.23 Channel widens to 1000 ft. - $2\frac{1}{2}$ $2\frac{1}{2}$ $2\frac{1}{2}$ 1. (1100 ft. wide)
- 2.25 80 m. from island - $4\frac{1}{4}$ $4\frac{1}{4}$ 4. ($1\frac{1}{2}$ m. current) $4\frac{1}{4}$ K
This island here is part clay - & cutting away -
- 2.26 $3\frac{1}{2}$ - $3\frac{1}{2}$ 3 - $2\frac{1}{2}$ (Shallows off to right) $2\frac{1}{2}$ $2\frac{1}{2}$
- 2.30 Opp. head of porous island. width 150 m. to left -
[Sand bar island 150 m. to right -
[This is all changed since Halpedi term] $3\frac{1}{4}$ $3\frac{1}{4}$ 3
A large bar now immediately abn head of island
2.32 two or 3 ft. abn low water - little bushes on it. 3. 3.
2.33 Head of sand bar island on Right. 100 m. off. cur
Cross a little winding - to left $2\frac{1}{2}$ $2\frac{1}{2}$ $2\frac{1}{2}$ 3 $3\frac{1}{2}$
Channel 1000 ft. between bars: [but note a large
volume goes down along R. side of river] the
other side of the big bar.] $3\frac{1}{2}$ This is an immense bar on
our left. The river including islands and bars is over a
1 mile wide
- 2.42 Upper end of said large bar - an opening 100 meters wide 3
and at one lower end of island. We run to Rt. of
said island - I. Angical - Channel now 600 ft. only
- 2.45 $3\frac{1}{2}$ $3\frac{1}{2}$ 10 m from Island only - $3\frac{1}{2}$ but then away to 30 m.
- 2.49 Steer over to Rt. side for channel (coming to left) 3. 3. 3
- 2.51 A long, curv. area to left. 3. 3 [entirely different from H's map]
- 2.53 30 m. from Rt. side of 600 ft. channel. $4\frac{1}{2}$ Steep current - 2 2 m
- 2.56 The clayey banks lying along here. 3.
- 2.57 About lower end of I. 211 - now on
I. 211.
- 3.01 Running close to bank on our Rt. Channel 700 ft. wide.
We may be in the Channel behind Lamocero
island. (3.04) ($1\frac{1}{2}$ $1\frac{1}{2}$) - 2 - 2 - from the shape -
- 3.07 3. 3. 3. (3.04) opp. high W. side on island. Lamocero
- 3.17 Opp. head of J. Lamocero - We now pass
below I. do Soares - which has a fender down
to within 350 meters of J. Lamocero.

Sunday, Nov. 2, Very hot, 99° - above
Remanso.

- 3.23 Coming round into main river, obliquing across -
- 3.27 Opp. Lamocero. The most home - like cult-
ized looking establishment I have seen on the river
White houses with tile roofs - fencing & pretty trees!
Bar runs up to opp. houses. Large island below.
Lower end League 210
- I. 210.
- 3.34 Steer running obliquely toward R. B. aiming now
for the Iron Mountain visited this morning
by Prof. Derby - who reports it very good ore to
work. It abuts of Halpedi - Pedro da Ferro
The mountain slopes down to the river leaving
only a narrow bench - 20 to 30 meters wide.
- 3.40 Opp. Lower pt. of Iron Mountain - It is in
3 distinct, principal mounts, the 1st 50 meters, the
2^d 100 meters & 3^d Deep, fine navigation, 1200' wide
- 3.46 Opp. 2^d mt. about midway - [3.51 Opp. 3^d Mt. Lower pt.]
- 3.50 Opp. Upper end I. do Soares.
- As for Iron Works - Where's the Fuel - and
the demand for the iron?
- 3.58 Opp. upper slope of Iron Mountain! It lies
along the river about a mile.
- 4.00 We then come to and pass a little island with
rocks on the upper end of it. The rocks shown
on Halpedi's map just above the little island
are not visible. If they are here, they are entirely
submerged.
- 4.03 The current is a little swift and there may
be submerged rocks, but there is a good channel
- 4.06 I. do Narciso away, 1500 ft. from R. B. and
River widening very much above. we slow.
- 4.20 Opp. lower end I. da Cascalho
- 4.27 About opp. Lower end of I. 209.
I. da Noronha on Rt. I. 209.

I. 209.

4.30 Steering for Point on L. B. - Supper Wood Point.
4.35 Opp. up, end I. do Cascalho - on our left.

4.50 Arrive at the Point - good wooding point
at least 2 1/2 cords on pile on the beach -
at about 208 2/3 on I. 209. I. B. K.

The 3 leagues - from Remanso
to this point are good navigation
in day light, with good pilot.

The rocks shown on Halford's map about
League 209 1/2, above the ^{now} Iron
Mountain are not visible.

Sr. MILITÃO has a Fazenda
[Sobrado] here. He and his wife and
daughters, and several sons - one of
them a young man, came on board &
paid us a visit, and sent us a Melon
present.

This gentleman is a son of the
famous Tenente Cornel Militão -
who ruled despotically, and made
rights in this region, years ago -
one of the Col.º sons recently was
engaged in a family war, which cul-
minated in Riqueixique, which place,
it is said, was seriously injured.

Our yawl was staved in last
night, in the wood loading operation,
and it rained during the night
and rained quite hard early this
morning - The loading of the wood was
not finished till 6 1/2 A. M.

The men don't know how to do this sort of work.

RAIN.

Wooding ^{to} Militão Fazenda
near middle of League 208.

- 8.34 Start - (8.36 opp. lower end Sand bar ^{500ft wide} leaving
Sand bar continues, and is a ^{not cultivated} ~~island~~ ^{at upper end}
- 8.40 Channel widens to 800ft. [very little wind]
The land on L. B. is only about 3 miles above low
water, and of course sparsely cultivated. This gives ^{valley} ~~valley~~
- 8.53 Opp. upper end of said Sand bar island
- 8.54 Opp. lower end of another low island - pasture / Cult. ^{slight}
- 8.57 Opp. some houses - on L. B. ^{place}
- 9.06 Opp. upper end of said low island ^{not shown on map}
- 9.23 Opp. a little bit of an island ^{or} ~~or~~ ^{hundreds of golden} 200m
from L. B. River 1500ft wide - to I. do Riacho.
- 9.34 We are running up on the R. B. side
Saw lands - i. e. not above flood, on both sides of
river for a league on R. B. - and much more on L. B.
on I. 207.

- 9.35 opp. lower end of small island ^{is success on} ~~I. 207~~
 - 9.41 opp. upper ^{we are running near R. B.} ~~end~~ ^{both ancient} ~~island~~ ^{on C. L. on L. B.}
 - 9.41 opp. lower end of ^{large island} ~~island~~ ^{do Cascalho}
- These two islands head and foot are now nearly
opp. - with only a narrow water way 100ft between.
On I. 207. Riacho Island

10.15 If I am right, we are running on a Channel not
indicated on maps - between R. B. & Riacho Island
The trees on the mountain are decidedly green now
3 + 4 miles on the R. B. Channel.

10.35 opp. Upper end I. do Riacho, and at a
Point on R. B. Side - another pt. 1/2 mile up.

Doubtless, the R. B. Channel opp. I. do Riacho is the
good Channel now.

10.53 We are about lower end of I. 206.
3/4 mile above head
of Island do Riacho

10,55 Lower end I. 206.

11,00 2 M. on hour current - near R. B. shore, near Point-
Vegetation ^{noted} in the R. B. side looks fine - no cultivation

11,02 Opp. lower pt. of island (Perhaps Limoeiro) 900 ft. ^{R. B.}

11,10 "Barra da Enfiada" - Very narrow - 20ft. dry -
Opp. ^{near} end I. do Limoeiro. Oblique
opening between this and I. Campo Largo.
We run for the opening between the islands

11,19 Between the two islands, where the channel
now is - Upper end of I. Limoeiro - Sand is
now cutting away - stands very steep - ^{cut} ^{cut}
Water way between islands is 300ft. wide

11,25 Now in main River on L. B. side; Raining -
I. S. The island above Limoeiro I. is nearly all gone -
houses on L. B. not more than shown on map.
Clazy bank on L. B. Cloudy - Rainy - Cool

11,29 Sp. up. pt. of what little is left of I. Campo Largo.

11,32 No bar in sight on L. B. shore for a mile up. ^{near shore}

11,33 Large bars in main River - 2 snags stuck up opp. ^{opp.}
1000 ft. between bay and L. B. Channel 3 to 4 miles -

11,40 The clayey banks on L. B. are cutting away. ^{2 3/4}

11,50 Steering over away from L. B. toward I. do Matto Grosso

11,55 near Island - which is sandy, & part cultivated. ^{2 3/4}

11,56 Opp. pt. on I. do - where water goes down 1/2 mile
to a bar - on map it is shown as sand. I. 205

12,00 Channel is now along near I. do Matto Grosso
Bar on our right 1 1/2 miles from Island. ^{Channel}
on I. 205. Slight rain - Cool.

12,08 We are running away from Island toward L. B. in
front of Matto Grosso - 2 or 3 houses - 1 tile roof.
River water on this side of island 1800 ft. ^{2 3/4} ^{2 3/4} ^{2 3/4}

12,23 Opp. lower end of an Island on our right nearest
to L. B., not shown in map - cultivated - 800ft. gap
Channel between it and L. B. We run outside. 1500 or so

12,26 Some houses appear across on L. B. Taboleiro. ^{thrust}

12,32 We are steering away from Island toward Ponta
Taboleiro on da Terra - which hugs the R. B. side
We steer toward upper pt. of Island.

12,40 opp. upper end of new island - Haven me. another
The upper end of the new island on the L. B.
side runs ^{nearly as} far up the river as opp. the
Upper end of I. Taboleiro - The fact is, there
is no upper end - for it is not an Island - is cut
in high water

12,45 - seem to be about what represents upper end of
The river is so changed that it is difficult
to follow the map - Island T.

12,48 I believe we are now running up near R. B. shore
perhaps the I. do Carratinha - which is ^{on map} ^{shown}
below the I. do Carrapato - though I did not
think we were so far up. We are in a channel

12,51 about 700 ft. ^{800 ft.} wide, here. Large trees on R. B. side.
Sandy alluvial. River bank cuts are along ^{by} ^{sandy clay.}
I. 204

1,05 Large patches of fresh looking green ^{poor} ^{poor} show on
the mountain side - mt. 1000ft high a league
across the low lands - Rocky tops. The range
seems nearly parallel with river. R. B. bank ^{calculatedly} ^{clayey}

BOQUEIRAO SINHO. I. 204

1,10 2 mile an hour current - River perceptibly more discolored
with sediment.

1,12 Opp. 2 houses - Probably - Boqueiraosinho. - Island
Opp. is now 1100 ft. off. Clayey bank cut badly -

1,17 I assume that in opp. the I. do Carrapato. [Palms on R. B.]

1,19 Now steering obliquely toward said Island.

1,26 Opp. lower end of sand bar on our left - 1000ft to I. D.

1,33 We now incline away from island toward R. B. again
Nearly to R. B. side and opp. head of I. Carrapato

1,40 We now run along close to R. B. sandy 10ft banks
A bar ^{is} outside reduces river to 800ft. Then end of I. S.

1,46 R. B. bank falls away here to very low - only a foot or two
but it higher, somewhat, but still not over 8 to 10ft.

2,03 opp. lower end of small island Bento Peris opp Carua

I. 203.

We run up bet. The small Id. I Grande
which is now a good channel.

- 2.20 Opp. head of small island "Bento Pires"
The larger island "do Meio" on the map - has disappeared. This is only a small bar opp. head of little island Bento Pires - which helps to make a good channel when in rain along by Ilha Grande.
- 2.29 opp. mouth of a bayou of water Or the lower end of an island - Pilot says it is only a bay - I see up it a 1/4 mile - We run outside of Ilha das Cabras - which is being cut away. Some rocks 1000 ft. to right - remnant of jagged, of one of these islands that has disappeared. They are not at all in the way of any channel.
- 2.38 We leave the Ilha das Cabras - and steer off toward the Channel this side of the Ilhas Perceiros in front of Riacho do Torricão

[There is very little water running behind the Ilha das Cabras now. There was no visible current at the lower end.] The upper end of the Ilha das Cabras Channel appears to be closed with sand. In ~~best~~ freshets considerable water must go that way ~~out~~.

- 2.45 Opp. the (average) head of Ilha das Cabras 800 ft. out from it and 600 ft. from bar on R.B.
- 2.52 about opp. I. 202 - Lower end.

- 3.00 We are now running on toward the L.B. side a bar on our left contracts Channel to 800 ft.
- 3.07 Opp. Rocks on R.B. Show, in front of the BOQUEIRÃO Mountains (800 ft) and along lower end of Boqueirão Grande Fazenda. Faz. do Militão. property of the family who called to see us last evening.
- 3.15 Opp. the Fazenda Buildings
- 3.15 and also opp. upper end of Bar on left. This Fazenda is finely situated.

- 3.18 a large bar 60 miles to our right.
- The slopes of the Boqueirão Mountains opp. here - present a beautiful fresh green aspect at this time. ^{Pearl} Itocolumite ^{rich} at top, and granite below. -
- 3.24 We are now running obliquely toward R.B. on a clear run, about 3000 feet wide. [except the mention of the rocks - as below, though they ^{are} not in the way.]
- 3.26 Opp. - The black rocks at the shore on R.B. side 200 miles to our left. Even if the Channel were on near that side there would be no danger from those rocks, as they belong to the shore, more than to the river. The run is too wide which reduces the depth, but is very beautiful, like a charming lake.
- 3.35 A large bar on the map along the R.B. side along here, has disappeared; also one in mid river; at all events we ran over the mid one without touching. There ^{now} ~~is~~ ^{is} a new island, the lower pt. of which is about 200 miles from R.B. It is little more than a sand bar.
- 3.42 Opp. the low pt. of said sand bar island. We run obliquely past, dist. 180 miles, heading toward L.B. Bet. said sand bar island and L.B. - 1800 ft. -
- 3.50 nearly at - I. 201
- 3.57 Opp. Praia on L.B. - several houses. now on I. 201. Dinner.
- 4.23 a charming navigation 1600 ft. wide - clear 3 to 5 meters deep in Channel. "Passagem"
- 4.27 Opp. an open low place in L.B. a small inlet just below Remanso.
- 4.29 Opp. Remanso - about 10 houses - 1 tile roof
- Ilha do Traficante - lower end on R.B.
- 4.32 1000 ft. wide here. ^{roof} 40° 40' opp. up. end Bay _{150 m. dist.}

64 Monday, Nov 3 on L. 201

4.42 heading over toward R.B. Opp. Lower outlet of narrow Channel, (in L.B.) around Ilha do Estreito.

[We run near mid river and not on the halfed line of soundings on L. 201.]

4.49 about on I. 200 - Lower end

4.50 opp. - sand bar island, lower pt. 100 meters to our Pt. We run on river within 100 meters of I. do Traficante. This side of island is cutting. Channel 800 ft. to S. 50

5.04 7000 ft. wide - (100 meters from Id. heading to L.B.) No, over toward the long Ilha do Estreito.

P.M. 5.15 Came to anchor against Island do Estreito about one mile

We are say at L. 199 1/3 - 208.5
Having run from L. 208 1/2 199.33 9.17
9.17 leagues = about 31 miles

Good navigation on these of I.

A. dense fog before daylight this morning, Nov 4

#1 FOG Tuesday - NOV. 4th

AM 5.38 Start. Water rose 2 inches in night. I. 199 1/3

On the East or R.B. side of Redonda. Strong current sandy alluvial bank cutting badly - deep Chan. 1000 ft between islands and R.B.

Before reaching opp. pt. up end I. Redonda a small island - a remnant of a once larger island intervenes. The head of which is 200 meters above head of

5.55 opp. head of Remnant of island above head of Redonda

6.00 Steaming for the R.B. at R.B. 6.00 a.m. - going up. River 3/4 mile wide - sand bar 1500 ft. to right. R.B. shore - sand + loam. Cutting.

6.05 About opp. head of I. do Estreito. R.B.

6.07 opp. up. end bar above I. Redonda - we 150 meters from

6.19 opp. head of island (about 1/3 mile below I. dos Bois) There is 800 ft. width of water bet. said I. and the L.B. There seems to be another island the top of which is opp. the head of the one in passage. I. 199 lower end

on Tuesday NOV. 4 I dos Bois. 1165

6.26 opp. lower pt. of I. dos Bois. It is cutting badly. Bar - 1000 ft. on left toward R.B. Cool morning.

I. 199

6.33 We steer away from I. dos Bois toward R.B. Oblique
6.36 opp. up. pt. of bar above mouth of River 2000 ft. R.B. to I. dos Bois.

The bar on map along the island is gone - channel is along island at lower end.

* our soundings for the last 9 minutes give a crop sec. of River between islands R.B. within 60 meters of R.B. (4) running up, new.

6.45 Channel is now as on map - along R.B. Steep clayey shore, cutting slowly. Trees numerous, and most of them green.

6.52 Opp. lower pt. of bar close to I. dos Bois - which continues to and above upper end of island.

6.55 Now steering oblique to Rt. away from R.B. Alagadico (3 hours) Sea 3.

7.04 Lower pt. of I. do Alagadico is just above. The channel is entirely closed with sand - as on map.

7.05 Upper pt. of I. dos Bois. opp. (nearly opp. tail of bar seem to run from I. dos Bois over to L.B. map.

7.06 We are running oblique to the Rt. toward Pt. of Ilha Grande - much as on Map (at 7.15 look up ARMA

I. 198 Lower end

7.17 opp. Lower pt. I. GRANDE - 60 meters off - lower end of Id. is clayey + cutting - it runs to

7.20 We run parallel with island - 60 meters off. Channel is 1000 ft. to I. da Carnauba Torta, about as in map. [Behind that is I. da Correntes.]

9.40 opp. 4 large barcas, bound up - off 200 miles to be left - give them to get away from the main channel -

7.45 We oblique away from I. Grande - directly toward upper pt. of I. da Carnauba Torta. Fine river - beautiful

The soundings now give an oblique X - See (4) Say from 7.44 to 7.52 = 8. minutes near Pt. of Island

- 7.53 Opp. + within 10 meters of Upper Pt. of I. 198 which is rapidly cutting away - sand stream. Opp - present out. up. pt. of Island. Very large bar ab. Id. toward L.B. Some water runs down bet. bar & Id. as in map.
- 8.00 After leaving head of Id. in new straight up for 200 meters - then incline ^{beginning} toward Grande I. d.
- 8.05 We turn a little more up - but still oblique on ^{200 m. from} shore
- 8.06 We turn still more [This will no give a X Dec.] 150m

I. 197. Majorie Run!

8.15 Villa of Pilao Arcado - Shows handsomely $\frac{1}{2}$ L. of a pretty, sloping green hill makes off to R. of it - a high, lone palm, overtop Church & Town - We steer across this wide - almost direct for the Villa

8.26 Opp. head of I. GRANDE. 1200 ft. dist. ^{L.R.B.} 800ft. a bar extends 200 meters above island in line with it.

8.34 Off Point ^{180 m. off} on R.B. side [Home] Ponta das Pedras steering direct for the VILLA. [Rocks on L.B. point]

- 8.39 The best house in Ponta das Pedras, is above the Rocks.
- 8.42 Opp. Cemetery at ext. lower end of Villa.
- 8.42 [A rock in river 1/3 way across to L.B.]
- 8.42 [Two buildings of Villa. Fine Nav.]

8.45 Arrive at VILLA do PILAO ARCADE

Quite a good Church - built in 120 days through the energy of a priest, and voluntary work of the people - Otherwise, this is the most dilapidated, forlorn, and miserable spot on the river - It appears devoid of business. Many women and children - The men are farmers on the islands.

Red bead seeds - Tree - Mulungu - used the inside bark, medicinally, as a mild opiate to quiet the nervous system.

10.56 Start from PILAO ARCADE. ^{50 m. from Shore} ^{Rocks upper end}

There are several bars looking on from here and a great number of buildings about the church - But probably we did not miss much.



While without glass. view from the river.

We did not walk thro' the better portion of the town - which is about the Church.

We run out to mid river - where it is about 2000 feet wide between R.B. and a high water island just above the Villa. ^{Very} Pretty foliage on R.B. Fine River.

11.14 Bar, nearest R.B. side, begins - 800ft. to our left.

11.26 Opp. ^{Ext.} lower pt. of Angical Island - 100 meters on our Rt. We steer toward uppermost of two Mounts on R.B. side - then widening up the Channel.



View at 11:30 AM.

11.30 I. 196. about.

11.33 We now run within 30 m. of R.B. fine, large trees. This channel about 800ft. wide now - to bar of Angical Id.

11.37 Opp. the nearest + lowest of the two Mounts. The higher one is behind it. Ext. their heights at 70m. - 100m. The nearest is a 1/4 mile from R.B.

More ~~the~~ real woods than any thing yet seen - Some are in clearing a little farm in the woods here.

11.40 About here we turn from R.B. toward L.B. side - We see the Mouth of the RIO VERDE - the first river with feathering leaves in it this side of Paulo Afonso Falls - at this time.

The RIO VERDE is about 300 ft. wide at the mouth; but it appears to become narrower - the land is flat. We cannot see 1/2 a mile up the Rio.

11.48 Opp. Mouth of RIO VERDE - but we are 1500 ft. off due to Angical Island - Beautiful river.

11.55 Angical island is flat, but with irregular benches, and it is pretty generally cultivated. A large bar on R.B. side runs down to opp Rio V. from nearly a mile above

I. 193.

- 1.50 Clay point. Fine deep nar^m along here -
The island do Jatoba on our left -
2.10 House on shore - L. B. 1/2 mile below Sand Hills.
2.15 opp. Crown pt. of the high river range of Sand Hills
I call the highest part of the 140 ft. above River - 150 ft.
This range of Sand Hills is a very marked feature.
Morro d'Areia, of Halfeld.
Some small patches of vegetable growth - but most clear sand

- 2.23 Opp. upper end of I. do Jatoba. but a bar continues along
apparently becoming an island head. Yes it is so. Cultivated.
But this apparent head tapers off into a bar
2.32 Opp. little hum near head of said island - Clay shore
to our right - L. B. and 100 meters ahead is the hm -
more over 100 ft high (has) sand hill. It seems to be
tapering down toward river. Clay br. cuts, shaly.
2.37 Instead of tapering down to river this sand hill here
runs into and connects with a different formation,
having some clay with the sand, and a strong growth
of Sertao on it - then it tapers down. But

I. 192.

- Another amphitheater of hills appears - shown on
2.45 Halfeld's map - we still hang L. B. shore
2.50 opp. From upper end of the above said bar island
head and bar, which extends clear onto the R. B.
side forming a channel on R. B. side which I judge
to be navigable.
2.51 We are now heading away from L. B. over toward R. B.
If he keeps on this course it will cross see River.
2.54 Heads meet up river. ^{still appears as} River is narrowing ^{of L. B. side} from bar.
2.57 Bar 100 meters on our Rt. ^{River 1500 ft. clear} has 100 meters of water begins bar
3.05 River about 1600 ft. bet. R. B. and sand bars ^{near mill river} Swift current
3.13 Opp. water opening ^(about middle of it) on L. B. side bet. bar + I. do above.
This opening, along river, is 200 meters wide - or less.
3.15 The upper side, or lower pt. of island is about opp.
(Point on R. B. side - a rounded, clay cutting point).
3.19 Swift current - 3 m. or more River at this side 800 ft. only.
deep water within 10 meters of shore - then fallen in, dead.

- 3.21 very swift - over 3 m. an hour. Snag to Rt.
Many trees have been cut under, and have fallen ^{river} into
I would let all of these trees alone - those in the water -
partly in, or on the edge. They do more than man
can do to delay the cutting away of new bank. From
its shape I think it would now cut slowly.
2.28 River narrow - in lower R. B. and oblique bar + island
I presume that this is the I. Paos Brancas
3.31 Pass close to sharp snag - 2 ft up 200 meters from bar L. B.
3.35 Opp. where said bar begins away over near the R. B.
We are within 60 meters of sand bar ^{on island} 10 ft. high steep - cutting.
3.42 The bars on the R. B. side merge into a large sand island
River narrowing - Swift water - 800 ft. water-way - 3 m
an hour, or more.
3.46 opp. head of island proper - on our right. 150 m. off
a little water 30 ft wide - then a sand bar above head
3.47 of island. Swift water continues (3 1/2 m. in hour & thick) of
We are heading now for nice looking buildings at
the Point Pedras do Ernesto - (3 m) Itabirite.
There is a narrow place in the river.
3.50 Aracimada's only
L. B. (3.47) I. 191. Just above head of island
3.55 Opp. upper point of bar on R. B. side - Considerable water
goes down between the bar and R. B.
4.00 We head toward mid river (4.4).
4.04 Swift water again - apparently shallow in middle
in an off toward L. B. side. Pretty place and rocks
4.05 Opp. now. Iron rocks - 2 ledges come in - and
above that on shore more iron rocks.
4.06 200 meters from L. B. This is narrow place in River
(The ledges cross my obliquely).
4.07 We turn and head for the R. B. side coming just
4.09 above the upper black rocks - within 150 m. of R. B.
4.10 Turn up stream. Strong current 3 m. or more.
4.14 River in dem out. We are passing in front of an apparent
iron mountain - on R. B.
4.25 Opp. lower end of (present end) Ilha da Venda

Wednesday NOV 5. L. 190

- 4.45 after going along the Ilha da Venda (clay, cut
bally) in incline away toward L. B. side.
- 4.45 We are about opp. a Form 1 mile off on R.B. side.
- 4.50 in incline from near L.B. to mid river River
1600 ft. wide. to about Ilha da Venda.
- 5.05 opp. remarkable ledge, 30 ft. high of iron rocks
Sinking river at an angle ^{nearly} N 15° ~~degrees~~ ^{top}
It is steep on the side, and only a few feet wide in
It looks like a diorite big wall.
- 5.08 Passing near R.B. - nice cultivation - low.
- 5.10 Stop - and partly about a place for Wood, to,
- 5:20 Finally, after moving farther up - Anchor.

We cannot make out the corresponding
ledge on this side of the River - We passed
the place without seeing it.

We are at about 189 $\frac{1}{2}$

Good Navigation all day - a few
snags - not dangerous

Nothing to be done - unless it may
be pull out a few snags - provided
they will stay here a year or two.

Tapera Cima
near the Itabirite Rocks

on League 190. The other place
on n 191 - is much more prom-
inent and important.

The iron ore is very good; but there is no fuel here. I make
the quantity at this spot visible, above low water level 300meters
long 40 meters wide & 108,000 c. meters = 3,921,040
Cubic feet = a 7 c. It is ^{about} 1.5 45.863 tons of Ore. There is
much more on the other side of the river and my much more
in the mountains 1 league below here

Thursday. Nov. 6" Tapera Cima

Good iron ore region. We spend the day
here getting wood for the steamer.
Write long letter to S. W. Roberts.
Finished long letter to Addi.
Also added some to Col. O. C. James letter.



Friday. NOV. 7 - Finish wooding
League 190.

- 7.38 Start. 7.38 $\frac{1}{2}$ in line of iron rock dyke. 7.40 Opposite
Upper bluff of iron rock dyke - 25 ft. ab. water
We run in toward R.B. where chan. seems to be.
I. da Manga ou da Porta - is on L.B. begins just
above the iron rock dyke nearly $\frac{1}{2}$ mile below dyke on R.B.
Fine looking river. over $\frac{1}{2}$ mile to island - clear to the
On map, the I. do Cajueiro is behind the front I. and
the I. do Barro, farther up is behind that. We can
not distinguish them, from the steamer.
- 7.38 I. 189 - Lower end.

River widens.

- 8.06 About opp. Upper end I. da Manga - large bar in, at
8.17 Opp. Lower end I. do Povo - which stands in front of
I. do Barro. and also in front of I. da Salina.
8.20 Snag, 2-3 ft up - 15 miles from R.B. Channel is along here.
These islands appear about as on Maps, excepting that
the river opp. up. part of I. do Povo is wider if the large
bar now in front of island be included. As in turn the
8.28 Point on R.B. - grand looking river ahead - Wooded sand
and loam bank cuts along here - Channel clear in
(R.B. side not cultivated for more than a league above
the iron rock dyke)
- 8.45 In 5 M. 150 M. ^{5 M.} from Conceição ^{5 M.} then $\frac{1}{4}$ mile below Point on R.B.
we head out away from the land -
See now, a large bar puts out about Point on R.B. side
- 8.51 We head off - oblique - toward L.B. - 4.4 $\frac{1}{2}$ 4 $\frac{1}{2}$ 5.
[We do not have chance of seeing the "diagona" on R.B. side]
- 9.00 Opp. 2 or 3 small islands ^{200 meters in length} on L.B. (200 meters from shore) heading
9.03 Opp. Lower end Sanebar island (new large net in it)

BREAKFAST

L 188

During breakfast Sandings 4 to 8 miles
 9.25 Boa Vista I. on our left. We run the Channel between island and L.B. much as shown on map (without sandings) The channel bounded by Hal-feld is on R.B. side of the island. (island ^{is} cutting)
 Opp. opening in island
 9.42 Opp. low plain - further passage oblique down coast. It is near head of island than appears on map. Our channel is directly over Hal-feld's bar, 3.3.3 1/2 m.
 [1/2 deg bar] BOA VISTA das ESTEIRAS is
 9.50 on R.B. - justly below opp. head of island. p. (nothing)
 We now oblique to Rt. from 200 meters below ^{of I.}
 9.58 Opp. head of Boa Vista I. away to our left - we are now within 200 meters of L.B. Sandy bank - (island)
 10.01 Opp. head of newly sand bar island on L.B.
 2 mile current - this bar is now cutting. Riv. ^{very} wide
 I.P.S. a large bar extends about I. Boa Vista over ^{R.B.} to near
 There must be a channel still down that side.
 The long narrow high bar abn. mentioned gradually merges into an immense bar filling the river in front of us - and we now oblique toward R.B. ^{point of}
 10.12 Morro da Boa Vista - opp. on R.B. (Itacolumite)
 Hat top, rocky ^{point} 3/4 mile from River.
 River 2500 ft. wide here - 3.2.2 - 3 1/2 m go. ^{channel}
 10.35 on R.B. side, opp. lower end of high water (water visible) 1 1/2 to 1 3/4 M. Current! (Some take it ^{low})
 [The upper end of this H.W. channel, is nearly 1/2 league up.]
 10.37 L. 187. Channel near I. do RIO
 I. do RIO now becomes practically the R.B., at present.
 10.45 Opp. Angical, on L.B. a minor sand ridge be-hind it - and back of that, the big high, gently ^{rising} sand hills large shown on map. [2 mile current]
 Bars contract the river here to 200 meters - 10.45 m. ^{depth}
 Some water runs the other side, but the main body ^{is} here.
 # EXTENSIVE Sand Ridges mark the boundary of the scenery on L.B. - for 2 leagues ahead - beginning a 1/2 league back. The ridge is broken in several places, but the best long stretch is one continuous ridge. See map

10.58 Oblique to Rt. Opp. sand house - on L.B. N.B. We add 40 per cent to our distance ^{to do} run by our oblique running - River 2500 ft. wide ^{here}
 11.10 Still running oblique toward L.B.
 11.15 100 meters from L.B. - running up now - [I notice tree limbs occasionally in the shallows]
 11.20 CLAY - It caves off in chunks. Sandy above
 11.22 Clay on shore ends - Sand again.
 11.24 Start, oblique to left - then stop for something back. Pilot says no channel when we were steering. We back to opp. CLAY - banks. ^{channel} Pilot has gone out with yawl, to look out a channel. (I would have looked it out with the steamer, but it is in the line of safety, I say nothing, and in some time + steam, wood - which is precious. River is 2500 ft. wide.
 12.17 Start. [Lost 53 minutes!] We return to within 50 meters left bank - and then proceed slowly up, 3 1/2 3.3.3 1/2
 12.22 2. 1 1/2. 2. 2. 2. [12.24] 1 1/2 1 1/2 1 1/2 2. 3. 2. 2 1/2 2 1/2 2 1/2 2 1/2
 12.26 2 1/2 2 1/2 2 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 1/2
 12.29 1 1/2 1 1/2 1 1/2 [12.30] 1 1/2 1 1/2 1 1/2 [2.30] 1 1/2 1 1/2 1 1/2 [2.32] 1 1/2 2. 2. 2
 12.30 2. 2 2. 2 now 1200 to 1300 ft. from each shore. [12.34] 2 1/2 2 1/2
 heading for H.B. - we have crossed the Submoya bar [I think that we should have been sooner (some time back on to the R.B. or else we should have kept up on the L.B. shore behind island.) We crossed over the tail of a mid river bar, that's certain. ^{bar to our right.}
 12.37 Opp. lower end of I. do Silva - which is on L.B. side. The sand hills on the L.B. are becoming more marked.
 12.45 Running up 50 meters from R.B. good channel.
 12.52 1200 ft. only bet. R.B. and bar - 5.5.5m. Shore cut. It is sandy, loam - woods - thin.
 12.55 [I have not seen the upper inlet for I. do RIO.] on map it is opp. lower end of I. do Silva.
L. 186
 1.20 Snag - 100 m. fr. R.B. 2 1/2 ft out - (1.25' Riv. 1000 ft. ^{2 M. 2} _{current})
 1.32 Opp. much in long narrow channel on L.B. Swift 2 1/2 M.
 1.45 Our near L.B. side - 1.46' opp. lower end I. das Wier. ^{channel} _a
reas - now only a sand bar. (1.56' River 800 ft. _{L.B.})
L. 185.
 River widens just above.

Piranhas to the Ocean ^{Lean miles} 143 = 146

Halpa Palmas	Ft.	Leagu Dis.
Estrema	2331	0
V. de S. Ramao	2263	5
Angicos	2225	15.5
Maria da Cruz	2167	30.7
Jacarã	2131	41.5
Arr. dos Morrinhos	2105	56.50
Rio Corrente	1940	86.80
Sítio do Mato	1935	113.
Bom Jardim	1885	126.4
Xique-xique	1669	167.5
Sobradinho	1420	196.4
V. do B. Terço de Capim Grosso	1302	211.3
Miss. de S. Baptista de Rodellas	1061	228.
Vargem Redonda	984	233.8
		238.
		246.4
		268.7
		283
		299.5
		310.3
		316
		324
		325.2
		339
		345
		347
		373
		382

miles up, 225.06

miles up, 197.73

miles up, 146.63

miles up, 30.69

Elevations above the sea.

Leagues	Dis.	Height Palmas Ft	Height Ft
0		2416	1711
5		2365	1675
24.60		2290	1622
56.50		2160	1530
86.80		2054	1455
113.		1945	1378
126.4		1909	1352
167.5		1729	1225
196.4		1587	1124
211.3		1527	1082
228.		1463	1036
233.8		1442	1021
238.		1423	1008
246.4		1383	980
268.7		1289	913
283		1205	853
299.5		1039	730
310.3		1000	708
316		972	688
324		827	586
325.2		426	302
339		82	58
345		60	42
347		45	32
373		5	4
382		0	0

Barrett	Kruger	Krauss
Jatoba 688 ft	ft. 923.38	1056 ft.
Piranhas 58"	ft. 102.27	

Diff. 630 - ft 821.11

- 821.11

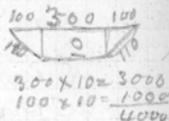
630 -

191 ft Difference in Fall from Jatoba to Piranhas

Ordinary formula for Rivers and Canals

$$V = 95 \sqrt{\frac{A \times F}{P \times L}} = \text{Vel. in ft. per Secd}$$

- Where A = Sect. Area of water way
 F = Fall in a given length L
 L = Length.
 P = Wetted perimetre
 Q = Quantity discharged per second
 V = Velocity per second.



$$\sqrt{95} \sqrt{\frac{4000 \times 1}{520 \times 1800}} = \frac{4000}{950400} = \frac{63.24}{970} = 9.075 \text{ ft per sec}$$

Difference of Fall in the River-

(According to Krauss and Halfeld) between different points on the river from Jatoba up to Sobradinho.

Between Jatoba and Pajai

Krauss	Pajai Atalho	ft
Halfeld	1086 - 1056 =	30
	730 - 688 =	42
	Jatoba	
	Difference only	12 ft.

Part of this difference is made by Krauss's elevation referring to Atalho, and Halfeld's to Jatoba

Between Jatoba and Sobradinho

Krauss.	Sobrad. Atalho	
Halfeld.	1368 - 1056 = 312	
	1008 - 688 = 320	
	Jatoba	
	Diff. in ft.	8

Part of this difference is made by Krauss's elevation referring to Atalho and Halfeld's to Jatoba.

Between Jatoba and Joazeiro.

Krauss.	Joazeiro Atalho	ft
Halfeld.	1342 - 1056 =	286
	980 - 688 =	292
	Jatoba	
	Difference only	6 ft

At Pajai, Joazeiro, and Sobradinho they coincide, within a few feet the whole difference is below Jatoba.

According to Krauss Heights - above the sea - in metres -

	League	ft	metres	M.	Slopes	According to Halfeld, Heights.
Sobradinho			1368	417		1008 ft
Joazeiro	26	1342	409	8	1 in 4100	980 "
Cabim Gross		1232	391	18	1 in 5500	
Boa Vista		1277	389	2	1 in 1800	913 "
Caraihos	274	1253	382	7	1 in 4300	
Missao	290	1271	387	25	1 in 3600	
(Rodellin)					1 in 1800	
Pajai	300	1086	331	26	1 in 2600	
Atalho		1056	322		1 in 8700	

The steepest of the above 1:1800 is less than 3 ft. per mile; so that with the great friction (proportional) caused by the rough rocky bottom and sides of the channels the velocity is reduced, so that it rarely exceeds, in low water, 3 miles an hour, and in the deepest parts of the navigable channels, for short distances (say 200 to 300 metres, at most 6 miles an hour) about 5 miles an hour is the general maximum of the "swifts" between Atalho and the rapids and the Sobradinho rapids. W.M.R. Oct 21st

Elevations

	metres	feet		metres	feet
Krauss - Italho	322 =	1056	Krauss - Joazeiro	409	1342
Halfeld	217 =	712	Halfeld.		980
	metres 105	344 ft.			362

Rodeller - Pajai

	metres	feet
Krauss	331	1086
Halfeld		730
		356

Sobradinho.

Krauss.	417	1368
Halfeld.		1008
		360

mens. in Piranhas, Aug. 18

	metres	feet
Jatoba	286	
Piranhas.	46.5 diff.	239
Greatest rise of water at Piranhas		13 1/2
R. way above greatest rise		2
Stake h ^t 286 m. above low water at Jatoba.		

Joazeiro - W. Sa Co. Bonendes Moreira do Prado
Picas from Ant. Jose Germano de Moraes
of Cobrolo.

Ant. Luiz Vianna -
from Angelo Vieira Sampaio -
of Boa Vista

Joazeiro Oct 18 - 1879
Sr. Tenente Cor Bonendes Moreira do Prado
sends me two letters of introduction -
one to Sr. Capitão José Honório
the other to Sr. Juvinho Ant. Perana
at Cachoeira
at Santa Anna.

Tatu-Bolla.  armadillo kind
in Santa Anna

1 marine League = 3.41 Statute miles
1 " " = 5.49 Kilometers. Fall of River.
in 78 leagues. Palmos
Leagues 238 1420 P.
Leagues " 316 972.4
" " 78 447.4
From Sobradinho 238
to Jatoba 316 = 317 English Feet,
= 96.6 meters
= Leagues 78
Averaging among
78 Leagues = 428 Kilometers 0.226 meters
78 " = 266 Statute miles per Kilometer
= 1.19 Ft per mile.

Fall of River in 13.64 miles below Pirantias,
is 15.25 ft, or 1.12 ft. per mile; or only 0.07
ft less than the average fall per mile from
Sobradinho to Jatoba (including the rapids).
So that the average fall of the pools above Jatoba
is about the same as the river below Pirantias on 13.64 miles

212
57
153 2, 4 1/2 6, 8, 12, 9 1/2 4-7-8, 10, 6 1/2 3 1/2 4, 4 1/2 6.
6, 6, 5, 5.

"Capivara" - the piggin animal that comes from the
water and feeds on the crops along the margin
Hence the hut on my little patch, when some in
crops are washed - they wash them the day too.

252.66
248.50
4.16
528
132
396
1.10
2500.
20
5000
10.50
176
176
105,600
60x10=600
176
600
105,600
20x250.
1650
412
1238

St. Cor. Jose Soares de Mello

Avellani - 17. 4.25

League 270 = 45,000
271-72 60,000
273 60,000
274-75 10,000
17/10000 6
602.5
1700 90x20x1=1800
5000
625
112,500
56.3m
ambas
3515

Remansa on 211
Villa do Pilao Arcade 197
Xique xique 180-179
Have to get to. 32/112,500
165 100 3m
50
1000 rinda 32 3/4 of the
20 180
50
100
50 1/2
of the que



20 200 per month for
1 steamer -
5 steamer only make a
trip per week
50 x 7000 ambas = 350,000
328
1076
2296
328
398096
34
1264
248
172
5 up
10 down
100