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Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America.
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(Continued from p. 154.)

In my first communication respecting this route, my remarks were confined chiefly to a few general observations on the Gulf of Urabá or Darién; and the bars which impede the entrances, mouths, (or bocas,) of the several streams, (caños,) which form the delta of the Atrato; and through which that river discharges itself into the gulf.

In this, I shall proceed in the same manner, to furnish some brief notes, with regard first to the caños themselves; and afterwards to the main River Atrato.

In sounding the caños, below the junction of Caño Coco Grande with the Atrato, we did not take as many entire transverse sections of the wider ones, as I could have desired. This portion of my operations was performed in a light canoe; and, inasmuch as the proposed object of my mission would be fully accomplished, provided a low water depth of 10 feet could be secured throughout, I frequently satisfied myself with that depth near the shores, rather than encounter the intense heat of the sun, and the greater rapidity of current in midchannel. Under a pressure for time, and the necessity of traveling sometimes forty miles a day, with but two paddlers, it was on more occasions than one, necessary to sacrifice scientific considerations to strictly utilitarian ones.

In ascending the river above the divergence of the caños, opportunities for obtaining entire cross-sections of the stream, frequently presented themselves; as our patron, or captain, always sought the convex sides of the bends in the river, to diminish the labor of his polers or bogas, as the crew are called.

I had, moreover, become previously aware, that no attempt could be made to render practicable, the *entrances* to these wider caños; so that we might even have omitted to sound them at all, so far as the immediate object of my exploration was concerned.

Descending Caño Taréna, below its confluence with Caño Barbacoas, (see Plate I,) the average width varies between 250 and 300 yards. My least sounding near the shores, until within a short distance of its mouth, was 20 feet: but when we were pretty well out in the centre of the stream, the depths generally ranged between 30 and 45 feet. On the convex side of one of the bends, we found 78 feet.

The only shoal spot in Caño Taréna, is opposite the entrance of an extensive lagoon, (see Plate I,) which discharges itself into it on the west bank, at about a mile from the gulf; bringing in soft mud, which forms the shoal.

Our soundings here gave depths varying from but 18 to 22 feet, clear across the caño. Immediately below this shoal, however, we found 28 feet; but below that again, the depth gradually diminished to the mouth.

Caño Barbacoas is, like Taréna, a very beautiful stream; having an average width of from 150 to 200 yards. It is by no means so deep as Taréna. In this caño, also, I contented myself with a depth of 10 feet; but from a few observations taken entirely across, I think it highly probable that a careful series of soundings would indicate a continuous channel of from 12 to 15 feet.

Caño Pava has an average width of from 120 to 150 yards; and a channel way of full 20 feet deep throughout, with the exception of about one-third of a mile of its length next inside of the boca. Descending along this third of a mile, the depth gradually decreased as we approached the mouth; which I found to be very much obstructed by sand from the gulf. None of these three caños, Taréna, Barbacoas, or Pava, has bends so abrupt as to oppose any difficulty whatever to steamboats of the greatest length afloat.

Caño Candelaria is a short, secondary outlet to Caño Pava; (see Plate I.) Its length does not exceed a mile; and its greatest depth (except at its confluence with Pava,) is but 12 feet. It is somewhat obstructed by sunken trees, and appears to be filling up. Caño Urabá was examined only for a short distance at each end. So far as I saw it, it had a width of from 60 to 80 yards, and a safe center depth of at least 25 feet at low water; except near its mouth, where it is wider, but shallower; (see preceding Table of bars.) Even close to its banks, my soundings gave 15 to 20 feet; and nearer the middle of the stream from 25 to 35 feet.

From my acquaintance with similar caños in other parts of New Granada, I have no doubt that a perfectly clear passage for large steamboats exists throughout its entire length, after having once cleared the entrance. Should it present any very sudden bends, they could easily be straightened by dredging.

Caño Coco Grandé is of about the same character as Urabá, as regards width and depth.

Caños Pigüindé and Pántano, are but short secondary outlets to Urabá and Coco Grandé respectively, and require no especial notice.

The only one, therefore, that remains to be mentioned, is Caño Coquíto. This is, as before remarked, the most insignificant of all the mouths of the Atrato, (except Pigüindé and Pántano, which scarcely deserve to be regarded as separate mouths.) The grounds have also been stated, upon which, notwithstanding its present condition, I should select it in preference to any of the others, for adaptation to a system of improvement on a small and inexpensive scale.

These were, that its entrance is more sheltered from the effects of the Northers, by the Isla de los Muertos; and therefore less liable to periodical changes, or obstructions, from that source. Indeed, from all I could learn, (and the representations made to me were sustained by appearances,) it is almost entirely free from them. The depositions which obstruct its entrance, extend, it is true, to a considerable distance out from the shore; (see Table of Depths, page 149.) But they consist of soft mud brought down by the river, and easily removed by the processes already alluded to; and when once removed, I conceive that the slight current produced in the artificial channel, would prevent their reproduction by forcing them out into deep water.

It may be objected to this plan, that even in deep water, the process of deposition will still continue, and eventually require further appliances; but admitting the force of the argument to the fullest extent, I still conceive that ages might elapse before serious difficulty would arise from that source.

A minute survey might show that it would be a preferable plan, to cut an entirely new channel for uniting Caño Urabá with the gulf, at a point about 3 miles south-west from its present mouth. For larger vessels than those contemplated in my survey, I am confident that this would be far better than to use Caño Coquíto; and possibly it is so in any event.

When we prepared to leave the gulf, in order to ascend the Atrato in the large river boat, in which we had made our voyage by sea from Carthagena, we had to wait for the hour of high water, before we could enter Caño Coquíto. High water gave us a depth of but 3 feet 4 inches for some distance from the entrance, and as the loaded boat drew $3\frac{1}{2}$ feet, and the rudder $4\frac{1}{2}$ feet, we stuck fast.

By unshipping the rudder, however, and putting a portion of the crew into the water to buoy up the vessel, while the remainder plied their palancas or pushing-poles, we passed through the mouth, when we instantly found ourselves in nearly two fathoms of water.

Caño Coquíto is two miles long, and has a width varying generally from 25 to 35 feet, between the bushes at its sides. In some few spots it is narrower, not exceeding 15 feet, and in others, as wide as 50 feet.

It affords a low-water depth of 10 feet, except over some few very short bars, caused probably by sunken trees. The shoalest of these bars occurs about 200 yards before reaching the junction with Caño Barba-coas. Here we found but 5 feet low-water depth; extending, however, a distance of less than 100 feet. The soft mud and vegetation at the

sides of this caño, could be removed without difficulty, by a dredging machine, and some little chopping; and a channel-way formed of 40 feet in width and 10 feet of low-water depth, at an expense of labor and money, much less than would be required to improve the entrance to any of the other caños.

Subsistence for laborers could be procured from either Carthagena, or Navy Bay. They should sleep in vessels prepared for the purpose.

It will be remembered, that the only class of improvement to which I have reference in my remarks, is that adapted to small steamboats, or other river craft, such as could at almost all times ascend the Atrato to Quibdó, some 220 miles, with a draft not exceeding 6 feet.

The boat in which we traveled from Carthagena to Quibdó, was 68 feet long from stem to stern, and 13 feet beam over all. Draft of hull, $3\frac{1}{2}$ feet; of the rudder, $4\frac{1}{2}$ feet.

The convex sides of bends in the caños, (and, as I afterwards found, in the river also,) being shoaler than the opposite, or concave sides, give luxuriant growth to a species of coarse aquatic grass, here called gram-malôte, which, in appearance, somewhat resembles young corn; and also to varieties of the arun, or spatter-dash. The greater depth of water on the concave sides, prevents the growth of these plants; and the trees approach to the very edge of the stream, which their branches overhang. The trees are frequently concealed by dense masses of vines which entirely envelope them, and in certain lights present plays of color comparable only to those of the richest velvet; and which, contrasted with the magnificent plumes of the pángana and murápo palms, afford a display of nature's handiwork, at once unique, gorgeous, and chaste. But like the plumes and velvet of the funeral pageant, they serve but to conceal and adorn corruption. Behind them stretches, far away, the pestiferous swamp, through the dreary wilds of which even the birds refuse to sport; and whose silence is broken only by the sighing of the breeze, or the sullen growl of the roving tiger. The pinnated leaves of the palma pángana are frequently from thirty-five to forty feet long; and springing out from the trunk of the tree at only a few feet from the ground, they precisely resemble in shape and gracefulness, gigantic plumes of ostrich feathers.

On our way along Caño Taréna, we came across a shelter of branches erected on the shore, and temporarily occupied by a family of blacks. Their occupation was fishing; and hunting a kind of wild hog, (the Peccary,) which is occasionally met with in the swamps, during the dry season.

Being the first amphibious human beings we had yet encountered, we made them a friendly call for a few minutes; and purchased from them half a large peccary for half a dollar. These were the only persons we met with in any of the caños. Their canoes were constantly kept ready for a start, inasmuch as a very slight flood would suffice to drown them out.

While descending this same caño in our canoe, we saw the planet Venus with perfect distinctness, and in an unclouded sky, while the sun was shining with full brilliancy, but a few degrees below it.

The manati is abundant in these caños, and for a long distance up the

river. It appears to feed chiefly upon the grammalôte; we frequently saw considerable patches of that grass gnawed off close to the water; and were told that it was the work of this animal.

Although for some years employed in caños in New Granada, abounding with manati, I never saw but one, and even that very indistinctly. It was walking on the bottom of the caño, some feet under water, and passed beneath the boat in which I happened to be at the time. It was of the size and color of a small dun cow. We did not see a single alligator until we had ascended the river some leagues above Caño Urabá. They appear to be somewhat rare in the Atrato.

The only birds we met with in the caños were one or two cranes.

Venomous snakes abound; and are a source of dread to the river boatmen. They repose coiled up among the branches of the trees, overhanging the streams, and not unfrequently are precipitated into the boats by accidental blows of the palancas, or pushing poles.

The bogas, or crew, are constantly on the look-out for them, and by long practice become wonderfully quick in detecting them. We kept our guns ready loaded for the purpose; and killed several almost every day, to the great gratification of the bogas, who always evinced their pleasure by loud "vivas." Those we shot were generally from four to six feet long.

Wasps are another occasional source of annoyance; and, like the snakes, are regarded with great aversion by the bogas. Our patron appeared to know every wasp's nest between the Bocas and Quibdó; and always gave us timely warning to enter the cabin, and hang up blankets at the doors to prevent their entrance.

The bogas, who at other times are constantly singing, preserve perfect silence on approaching a wasp's nest; and take especial care not to touch with their palancas, the trees in which they are built. By this means they generally escape being stung.

The wasps are of two species; the larger ones do not sting, unless provoked; but the smaller ones are less considerate, and appear to fight for the fun of the thing.

Instead of entering into a detailed description of the Atrato, I will confine myself to such an outline of its chief peculiarities as will suffice to convey a tolerably correct idea of its general character. In doing this, I shall adopt such subdivisions as suggest themselves to me at the moment of writing; filling them in by remarks hastily taken from my several books of memoranda.

THE NATURAL LEVEES of the Atrato, extend from the Gulf of Urabá or Darién, almost to the very sources of the river; or up to those points on its several tributaries, at which it begins to assume the character of a torrent.

Although the banks or levees of the caños, (as well as those of the river for a great distance above them,) consist of soft mud; still they do not slope very gently towards, and beneath the surface of the water, as might be supposed. On the contrary, they descend quite abruptly to a considerable depth; so that it is common, in straight reaches, to have nearly the same soundings close to the edges of the stream, and in its

center. For miles at a stretch, we found depths of from 18 to 30 feet, within from 20 to 50 feet of the shores of the Atrato, as well as those of some of the caños.

Near the Gulf, where the tide rises generally about 18 inches, the height of these levees varies from but a few inches, to a foot above the ordinary level of high water.

Their height above the ordinary stages of the river increases as we ascend, but still is subject to variations of several feet throughout. The depth of their highest points below the highest flood-stages, appeared to be more uniform; being ordinarily comprised between one and three feet, throughout the course of the river.

Thus at the mouth of the River Súcio, which I estimate at 61 miles above the mouth of Caño Coquíto, I found, by leveling, that the height of the greatest freshet known for 20 years, and which occurred in November and December, 1851, was $8\frac{1}{2}$ feet above the very low stage of water at the time we arrived at that point. Its marks were shown to us, and it had overtopped the highest portions of the levees 3 feet. Consequently, the levees were $5\frac{1}{2}$ feet above the same low stage of the river, which was as low as had been known for some 4 years.

At Vigía Curbaradó, about 96 miles above the mouth of Coquíto, the same freshet had risen about 10 feet above the same low stage; overtopping the highest levees about 2 feet.

Opposite the mouth of the Napipi, the highest points of the levees are 11 feet above very low stages of the river; and here I was shown the marks of the great flood of 1851, which proved to be 12 feet above a very low stage of water; and overtopped the highest parts of this levee some two feet. This point is 135 miles, (by my estimate,) above the mouth of Caño Coquíto. In Tevada, 149 miles above the mouth of Coquíto, the great flood of December, 1851, rose about 18 feet above the lowest stages of the river.

At Quibdó, (220 miles above the mouth of Coquíto,) from 12 to 15 feet above extreme low water, is quite a common occurrence; and the former may indeed be regarded as about the ordinary stage of the river at that place.

Approaching Quibdó, the levees are frequently full 20 to 22 feet above the lowest stages of the river, and are overtopped at times as much as 2 feet, which gives for the height of the greatest freshets about 24 feet above the lowest stages.

Above Quibdó, the levees gradually *decrease* in height, until near the head of canoe navigation they are but from 3 to 6 feet above the very beds of the streams.

The sides of the levees which front on the river are generally quite steep; but those on the land side, (or, more properly speaking, on the swamp side,) slope away gradually from the top.

The trees which grow on the levees are both larger and much more numerous than those in the swamps. In the latter they are frequently very sparse and stunted, amounting to mere shrubs.

It is manifest that but little space is available for the purposes of cultivation in the immediate vicinity of the river. Being confined almost

exclusively to the tops and land slopes of the levees, clearings rarely have a greater width than from thirty to fifty yards.

Until we ascend the Atrato as far as the mouth of the River Súcio, sixty-one miles above Boca Coquíto, not the slightest attempt at cultivation is seen, in consequence of the wet, spongy character of even the levees themselves. Indeed, the first huts to be met with are at the mouth of the Súcio.

Even above the Súcio, we saw but one or two of the meanest description, until we reached Vigía Curbaradór, which is ninety-six miles above Boca Coquíto. (See Plate IV.)

Above the Vigía they become much more numerous, several being frequently in sight at a time, each with its little patch of cultivated ground.

Plantains, yams, sugar-cane, and corn are the principal articles raised. To these may be added a few beans, tomatoes, red peppers, yuca, lemons, oranges, cacao, and rice. Scarcely a mouthful more is produced than will suffice for the bare subsistence of the occupants of the huts; so that considerable difficulty is frequently experienced by the boatmen in obtaining supplies during their trips along the river.

After ascending some 140 miles above Boca Coquíto, or five miles above the mouth of the Napipi, the monotony of the levees begins to be occasionally broken by low bluffs of stiff clay; and still higher up by bluffs of clay and pebbles.

Below that distance, I remember only the Cerro, or Hill of Tumaradór, twenty-three miles above Boca Coquíto; and the Loma, or Hill of Caca-rica, thirty-four miles above the same point.

The former is a small isolated cone, perhaps 100 feet high, on the east side of the river; and the latter a low range of about the same height, and some five miles long, on the west side. It, together with other ranges much higher, and to the west of it, we saw stretching away Northwardly towards the Carribean coast. Views of spurs of the Cordilleras frequently present themselves to the East. Many of them are striking, but none grand.

The elevated bluffs just mentioned are sometimes selected as sites for the erection of huts; but more generally these are built on the narrow summits of the levees, which are better adapted to the primitive processes of agriculture which prevail here, the soil being richer and more easily worked. The only farming implement employed is the machéte, or long knife, which answers in turn for axe, carving-knife, plough, fighting, grave-digging, and various purposes to which more complex machinery is adapted by other people.

The houses are necessarily placed on stilts, so as to be beyond the reach of floods; and their floors, which are thus raised from three to six feet above the summits of the levees, afford an excellent gauge for determining high-water-level.

During such floods as overtop the levees, and inundate all the back country for a great distance, not only the inhabitants, but also the dogs, hogs, and poultry take refuge in the huts, where they sometimes remain imprisoned for several days at a time.

Once, in the *dry* month of August, when Dr. Halsted and myself de-

scended the river, *from almost its very source*, to Quibdó, *all the levees throughout that distance were submerged by a flood*, and the huts resembled so many miniature arks, except that the unclean beasts greatly outnumbered the clean. (See Plate V.)

The material of which the levees are composed undergoes a gradual change as we ascend. Along the lower parts of the river it consists of soft mud mixed with leaves and logs; but further up, it by degrees, assumes a more firm consistency, until, on approaching the Napipi, it presents a soft, rich, loamy soil, filled with beds of dead leaves and logs. Still further up, it gradually acquires a clayey character, mixed with sand and gravel. The water of the swamps is continually seen percolating through the porous soil of the levees into the river, when the latter is low.

Neither a rock, nor a stone larger than common paving pebbles, is seen up to the very head of canoe navigation; nor, indeed, up to the low hill range which forms the line of partition between the waters of the Atrato and San Juan; and which itself consists of gold-bearing gravel and clay, without rock.

I should except a heap of small boulders, at the water's edge, on the East bank of the river, some thirty miles above Boca Coquíto. On the published maps these are marked "Pulgas," or "the Fleas." How they got there I cannot imagine. We passed on the opposite side of the river, and, consequently, did not examine them.

WIDTHS AND DEPTHS OF THE ATRATO, *between the Gulf of Darién and Quibdó.*—When once inside of the bocas, and above the shoal spots already spoken of in Caño Coquíto, there is a sufficient channel for steamboats drawing six feet water, as far as Quibdó, (or 220 miles,) for about 300 days in the year. The intervals at which the river is lower are very irregular, and continue from a day to a week or more at a time, depending on its constant fluctuations.

Up to the Vigía Curbaradór, ninety-six miles above Boca Coquíto, measured by the windings of the river, the width generally varies between 250 and 350 yards. In some few spots it is wider, and in others narrower.

Throughout this latter distance there is a channel of sufficient width and depth for the largest ocean steamers.

At the River Súcio, sixty-one miles above Boca Coquíto, I found the width to be 1050 feet, with a low-water channel-depth of fifty feet.

At seventy-five miles, the width was 950 feet—the low-water channel-depth, forty-five feet.

At Vigía Curbaradór, which I made latitude $7^{\circ} 5'$ North, the width is 700 feet—the low-water channel-depth, thirty-six feet.

In many intermediate spots, I found depths of from sixty to seventy-five feet; and by following a more serpentine course, so as to hug the concave sides of bends, a steamer could carry forty feet, at low water, up to the Vigía.

For a few leagues above the confluence of Caño Coquíto and the Atrato, we had occasionally but forty feet soundings, in spots where the river was widest. I do not hesitate, therefore, to assert, that at the very

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VIGIA CURBARADOR.

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OVERFLOW OF THE LEVEES.

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lowest stages of the Atrato, a perfectly safe channel-depth of at least thirty-five feet may be carried up to the Vigía.

In the foregoing channel-depths I have not always given the deepest soundings at each spot, but those which afford, at the same time, a width sufficient for the manœuvres of large river steamboats. They have been selected from a great number, merely to show the rate of gradual diminution of depth as we ascend.

It was generally impossible to measure base-lines on shore, for determining the widths of the river, on account of the soft deep mud and the dense vegetation at the water's edge, as well as from my unwillingness to cause any undue detention of the boat, which was loaded with merchandize for Quibdó.

To obviate this difficulty, I was frequently obliged to assume the length of our boat (sixty-eight feet) as a base-line. At every stop, whether for meals or other purposes, Dr. Halsted would perch himself at one extremity and I at the other, each with a pocket sextant in his hand, and at the same instant (in order to counteract any trifling motion in the boat) take angles to some well defined object (generally a sapling) on the opposite side.

Our instruments were capable of reading minutes; therefore I suspect that our widths are never in error more than ten or twenty feet. Whenever we could, we measured a base-line on shore. I mention this, (as I shall other expedients,) merely to enable the reader to attach what degree of confidence he may see fit to the results.

We also took soundings, by means of our canoe, (with a line, carefully adjusted every day,) whenever the boat stopped; as also whenever she crossed the river, in order to hug the convex sides of the bends, for the sake of the less rapid current. From Mr. McCann's expertness in this operation, it was generally performed by him, while I noted down the results.

The small canoe, which we constantly towed astern, was brought into requisition very frequently. Dr. Halsted availed himself of it for gathering plants; and all three of us would occasionally use it together for examining a few miles of some tributary of the main river. When quietly towing in our wake, it answered for bath and wash tub; and after we had ascended above Vigía Curbaradó, it was used for running out lines for pulling our large boat off from sunken trees, upon which she sometimes stuck fast, as we hugged the shore.

Below Quibdó these trees rarely extend out more than fifty feet from the banks; but, after ascending some leagues above that point, they appeared completely to cover the bottom of the stream.

After passing above the Vigía Curbaradó, a rapidly increasing shallowness is perceptible in the depth of the river, which at this point divides into two channels. These unite again about a league above the mouth of the Napipi, a distance of forty-two miles. The Western one is called the Atrato, and the Eastern one the Caño Tadia.

At both the upper and lower junctions, Tadia has but about half the width of the main stream. I saw no other portions of it, but was told that its depth was fully equal to that of the principal branch. The space which they enclose is called the Island of Tadia.

Commercially considered, the depth of the Atrato possesses interest, chiefly when regarded in connexion with the proposed inter-oceanic canal routes, by way of either the Napipi or the San Juan.

Therefore, in my further remarks respecting it, I shall be guided by that consideration only; and instead of presenting a long series of soundings, varying alternately from shallow to deep, and from deep to shallow, shall merely state the depths that may be carried from the Vigía to the mouth of the Napipi—to Quibdó—and from Quibdó to the point of partition between the waters of the Atrato and San Juan.

Although I myself consider the project of a ship canal through either of these routes to be a perfectly Quixotic conception, there are some who do not coincide with me in opinion; and with the sincere hope that their views may be the correct ones, I cheerfully contribute what little I can, to the data upon which the preliminary calculations must be based.

We carried a *very low stage* of water with us all the way from the bocas to near the mouth of the Napipi, as low as the patron of our boat had ever seen in twenty years, and his statement was confirmed by all the persons living along the river, whom I interrogated on the subject.

Ordinary stages of the river are distinctly indicated by a line along the levees, below which no grass grows. This line was from three to four feet above the water, as we approached the Napipi. While at this very low stage, the most serious impediment, or rather the least limiting depth that occurs between the Vigía and the mouth of the Napipi, is eighteen miles above the former. The width of the Atrato here expands to 1100 feet, and the greatest low-water depth is fifteen feet for a channel-width of 250 feet.

Only a mile above this spot, the river contracts to 500 feet in width, affording a low-water channel-depth of 25 feet; and in many places between the Vigía and the Napipi we had soundings of thirty-five feet. Still some two or three more places equally shallow with that just mentioned occur before reaching the Napipi; so that we may regard fifteen feet as the minimum channel-depth, at the lowest stages of the Atrato, that vessels would encounter between the ocean and the mouth of the Napipi, a distance of 135 miles.

It will be borne in mind, however, that these lowest stages are of rare occurrence and of short duration; and that, for the greater part of the year, eighteen feet might safely be assumed as the ordinary one.

I think it probable that the most effective proceeding for obtaining an increased depth would be to stop up the upper end of Caño Tadíá, about three miles above the mouth of the Napipi, assisting this process by dredging.

The most sudden bend in the Atrato, below the mouth of the Napipi, is but a mile from the latter point. Even it, would allow the passage of river steamboats of the largest class. It is shown on the map, (Plate VI.)

At half a mile below the Napipi, the Atrato is 925 feet wide; immediately opposite that tributary it is 740 feet.

Near the bocas the current appeared to vary from about half a mile to nearly a mile per hour; but increasing gradually as we ascend, it be-

came nearly two miles per hour, (at the low stage,) near the Napipi, except in narrow spots, where it was sometimes three miles.

THE NAPIPI.—Having now reached the mouth of the Napipi, and pointed out the capabilities of the Atrato for navigation to that point, we will, for a short time, take leave of the latter, while we examine a few miles of the lower portion of the former.

The stipulations of my engagement did not embrace or even contemplate an exploration of the Napipi route to the Pacific; nor did I, when I left the United States, intend to devote my attention to it, fearing that I might thereby prolong my proper survey into the rainy season.

But on arriving at the spot, and learning that above Quibdó the rainy season occupies the entire year, I found it impossible to restrain my desire to take, at least, a hasty glance at the lower portions of the Napipi. I had seen no reliable description of that river, and wished to form some general idea of its capacities for the important purpose to which it is so generally supposed applicable.

I, therefore, made arrangements for detaining our large boat at the mouth, while I should ascend the river in our small canoe. From this course, however, I was dissuaded by Señor Cayatáno, a colored man, who resides about half a mile below its mouth. He owns extensive tracts of levee along this portion of the Atrato; and in his buildings, cultivation, and improvements generally, evinces a degree of intelligence and energy in striking contrast with the almost brutal apathy of his neighbors.

He assured me that it would be very difficult, if not impossible, to ascend the Napipi with a canoe and paddles; and kindly lent me a boat of his own, with three men to pole her. This boat was 39 feet long, three feet beam, and fifteen inches deep; made, like all the boats here, from a single log.

Dr. Halsted, Mr. McCann, myself, and the three bogas, together with a box of provisions, and a change of clothes, constituted our load. We sat off without any definite idea of when we should return. That would depend upon the character of the stream. Should it prove to be a really fine one, we should cross over to the Pacific; otherwise, we should return without doing so. We did return on the evening of the same day.

The mouth of the Napipi is, by my observations, in latitude $6^{\circ} 35'$ North; and 135 miles from Boca Coquito by the windings of the river.

Its width is just 100 feet, as measured by our tape line. The low-water depth at the same place, taken at three equi-distant points twenty-five feet apart, is eight feet, five feet, and two feet; but at a short distance inside it is greater. The Atrato had risen, on the day of our arrival, four feet above the extreme low water stage with which we had ascended the river, therefore, the depths, as we actually found them, were twelve, nine, and six feet.

Whenever we stopped, even for an hour, a gauge-pole was instantly planted, so as to inform us, several times a day, of the rate at which the river was rising or falling.

This was the first rise we had had since leaving the gulf, and it subsided almost as rapidly as it had approached.

We ascended the Napipi but eight miles. Along this portion I took the bearings and distances, as accurately as I could, from the boat; and Plate VI. (map) exhibits a protraction of them, together with one of the Atrato from the Napipi to Tevada, also from my notes.

Throughout the eight miles which we examined, the width of the stream was pretty uniformly about seventy-five feet; and its depth, as we found it, twelve feet in the centre, six to nine feet on the convex sides of bends, and from fifteen to eighteen feet on the concave sides; being equal to a uniform depth of twelve feet. The depths were about equal throughout the eight miles; and are near the ordinary ones.

There was a current of a trifle more than two miles per hour at the upper end of the eight miles.

The levees are generally from four to five feet above the level of the water; and, like those of the lower parts of the Atrato, consist of soft mud, leaves and logs; though near the end of our observations they were becoming more firm.

The freshet-marks were throughout about two feet higher than the tops of the highest levees.

Bottom, mud, with an admixture of fine sand near the upper end. From the very mouth, we found the bed of the stream to be literally paved with sunken trees. In many places they nearly closed it, so that we had difficulty in getting our boat along. In some parts they formed rapids, along which we should scarcely have been able to force a short canoe by paddles only. We had four hours of pretty hard work in passing up the eight miles, even with poles.

About three miles up we noticed a short bluff on each side of the stream. They consisted of red and white clay, and were some twenty or twenty-five feet high.

The branches of trees growing on opposite sides frequently interlock overhead. Among them we saw a few monkeys and toucans. We also smelt alligators two or three times, but did not see them.

Some of Señor Cayatano's men had several times crossed by this route to the Pacific. According to their statement, they generally occupied three days in poling up to near the head of the Napipi, and half a day more in walking from that point to the ocean. The whole distance, I was told, however, had been traversed within two and half days by persons in a hurry.

They likewise informed me that gravel showed itself within a day's boating above where we had reached; and that there also the first habitations and cultivation were met with.

When I turned back from ascending the Napipi, (although disappointed,) it was with a determination to revisit it on my return, and make a careful exploration of the entire route. But before completing my survey by way of the Atrato and San Juan, I had crossed to the waters of the Pacific, by three different paths, all of which had been represented as far preferable to that of the Napipi. On one of them especially, it was insisted that no shadow of difficulty presented itself. An eminent ecclesiastic even went so far as to state positively that I should find the point of partition to be but eighteen feet above the waters of the Atrato. Yet, on ascending the tributary so highly recom-

mended, for miles after it had become a roaring brook, I levelled up the aforesaid point of partition for some 500 feet, before putting away my level in despair; and climbed over the remainder in unspeakable disgust.

I had also found that the *canal* of Raspadúra, mentioned by Humboldt as having been made by a curate of Névita, and through which loaded canoes were said to have passed from the waters of the San Juan to those of the Atrato, was in reality a *hill*, across which canoes were dragged, as they now are, not only at that point, but at many others in this region. A canoe was so transported at one of the partition points at which I crossed, and at the same time.

There being no roads here, all traveling is done by canoes, which supply the place of the horse with us; with, however, the important difference, that in bad places the traveler carries the canoe, instead of the canoe carrying the traveler.

It may be readily imagined, that after proximity to the scene had so rudely dispelled the charm with which distance and false representation had invested it, my anxiety to explore additional routes was sadly diminished; and I may possibly be excused when having, for the second time, reached the shores of the Pacific by different paths, I preferred to turn my face homeward by way of Panama rather than toil for days up the San Juan, and again embark on the Atrato, to explore, at my own expense, other lines which I had every reason to believe were equally impracticable.

In the absence of positive information respecting the upper portions of the Napipi, and the point of partition near the Pacific, it would be sheer presumption in me to pronounce that route impracticable for a ship-canal. I may, however, be permitted to offer a few humble suggestions respecting the portion which came under my notice :

1st. The soil of which the levees and swamps along the lower portions of the Napipi consist, is open and porous, being composed in great part of beds of dead leaves, logs, and entire trees, the accumulations of ages. No material could be more entirely unfit for forming canal banks, especially for a ship-canal; or offer greater difficulty in the foundations of the locks, and other contingent constructions. All along the Atrato, we noticed the water from the swamps percolating through it, very often in full gushing streams.

2d. The entire region for *at least* twelve (very probably for more than twenty) miles along the stream, is liable to overflow, from one to three or four times a year. At these times it is submerged several feet, and the back-water does not drain off for some weeks, during which periods all work would have to be suspended. How are embankments to be made under these circumstances; or, admitting that they could be commenced, what precautions could be adopted for preventing their destruction by every overflow, while in an unfinished condition?

3d. Throughout the same extent back from the Atrato, more or less rain may be safely calculated on for nearly 300 days in the year, and in every week.

How would embankments of soft marsh-mud, and leaves, stand under the destructive influence of these rains?

Note: My observations made the Latitude of the mouth of the Napipi $6^{\circ}35'$ North, and distant from the entrance of Caño Coguila into the Gulf of Darien, 135 miles, measured along the windings of the Atrato. J.C.T.

Lagoons

MAP

OF

PORTIONS OF THE RIVERS

ATRATO AND NAPIPI

Laid down from observations made by

JOHN C. TRAUTWINE, CIVIL ENG^R

in 1852.

Country

Swamp

Extensive

Brought forward, - - -	\$24,000,000
Eight miles in better soil, and less unhealthy locality, at, say, \$200,000, - - -	1,600,000
Deepening the Atrato thirty-nine miles, to the Vigía Curbaradó, so as to secure a depth of twenty-five feet of channel-way, removing, say, 200,000 cubic yards per mile, on an average, at \$1 per yard, including raising it over the levees and depositing it on their inland slopes, - - -	7,800,000
Stopping up the upper end of Caño Tadia, so as to force its waters through the channel of the main river, - - -	1,000,000
Improvements at Boca Urabá, - - -	1,000,000
	<hr/>
	\$35,400,000
Add, roughly, for interest on gradual expenditures during fifteen years of construction, - - -	15,000,000
	<hr/>
	\$50,400,000

By this supposititious process, therefore, we arrive at the sum of fifty millions of dollars for the construction of the canal, a sum which I regard, however, as *totally inadequate for the purpose*.

Whether water could be obtained for filling it, even if it should be constructed, I cannot pretend to say, but regard it as extremely doubtful.

Were it as easy a matter to *raise* a few hundred millions of dollars as it is to *talk* about them, there would be no difficulty about water, inasmuch as that of the Atrato itself might be used for locking down into the Pacific.

I have coasted and boated along both sides of the region comprised between the Pacific Ocean, from Panama to Buena Ventura, on one side, and the Caribbean Sea, the Atrato, and the San Juan, on the other side; and have crossed it both at the site of the Panama Railroad, and at three other points more to the South. From all I could see, combined with all I have read on the subject, *I cannot entertain the slightest hope that a ship-canal will ever be found practicable across any part of it*. When I employ the word *practicable* it is meant in a practical sense.

From careful levellings (with a spirit level) at several points, I am confident that the fall of the Atrato, from the mouth of Napipi to Boca Coquito, does not exceed 28 feet, or an average of about $2\frac{1}{2}$ inches to a mile.

The River Opogadó enters the Atrato from the West, thirteen miles below the Napipi. I ascended it for four miles. Its width at the mouth is 120 feet; at four miles above, it is 100 feet. Depth near the mouth, two fathoms, which it retains for more than two miles, gradually shoaling afterwards to eight feet at the end of the four miles. It is very crooked, and encumbered by sunken trees. The bottom is of mud, so sticky that we could scarcely detach the heavy lead of our sounding line. Current near the mouth, $1\frac{1}{2}$ mile per hour; at four miles up, two miles.

To be Continued.