THE MIGHTY AMAZON

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The Amazon is the master stream of the world.* Its sheer bigness is a handicap to the development of its basin. Most naturally the early Spanish explorers called it "mar dulce", fresh water sea. Its drainage basin is nearly twice that of the Mississippi and is comparable to the total area of the United States.

Extending along and more or less parallel to a region of heavy tropical rainfall the river discharges a volume of water four times that of the Mississippi and more than all the rivers of Europe combined. The mean discharge is given as 2,692,000 second feet; and these grayish waters, drifting northwest with the equatorial current toward the Carribean Sea, ride upon the heavier blue saline waters of the Atlantic some three hundred miles before they lose their identity.

In travelling on an ocean liner from port to port on the Amazon one scarcely can grasp its immensity, it seems so little like a river of one's acquaintance. Iquitos, Peru, nearly two thousand miles from the Atlantic, is an ocean port. It is as though the Potomac River extended almost across the North American continent, and a town on its banks in the vicinity of Denver were an actual ocean port. Any of the ocean liners touching South America would have no difficulty at any season of the year in reaching Manaos, about one thousand miles from the Atlantic. Although the depth varies from place to place, the deepest section for the entire stream width is at the Obidos narrows, where no bottom can be found less than eighty-three meters, roughly two hundred and fifty feet. Soundings show other places still deeper locally up to over three hundred feet. It is this great depth that gives the river its quiet rippleless majestic flow of from one to seven miles per hour. The flow is sufficiently strong so that even the big ocean liners hug the banks in their up stream journey and take mid stream on their return, which under similar conditions takes only about one-half the time.

* For details see: Conpendio de Chorographia do Brasil, pp. 66-69.

THE GEOLOGICAL HISTORY*

The geological history of the Amazon is based on similar large conceptions. Both the Brazilian and the Guyana plateaus are made up chiefly of very old rocks similar to the Canadian Shield, generally known as Pre-Cambrian gneisses and schists. These two are now separated by the Amazon inner basin, relatively very narrow in the east at the outlet and increasing in width to the west. Along the south margin of this basin is a fairly abrupt drop from the plateau causing numerous falls and limiting navigation. Roosevelt in his book, "Through the Brazilian Wilderness," vividly describes the difficulty of passing this series of falls.

This inner basin of the Amazon is not erosional but structural. The river flows along a great synclinal basin dipping to the west. The limbs of the syncline, therefore, spread out V-shaped with the opening to the west. This plunging syncline begins in the eastern part of the state of Para, and its dip to the west is sufficient to lose its surface identity in the longitude of Manaos, a thousand miles from the Atlantic. If the syncline extends farther to the west, the limbs are now obscured by later deposits.

Within this structural basin were deposited sediments of Paleozoic age, the youngest appearing farther west, lapping up against older deposits to the east. As the formations are marine, the deposits were made by an arm of the sea coming in from the west. In time the region was elevated and rivers flowed over the surface to the sea in the west. The drainage of the region for an extremely long period of time was to the west. The drainage is believed to have been reversed with the elevation of the Cordillera in Miocene time. At first many lakes must have been formed, and finally an enormous lake covered what is now the upper part of the inner basin. With the rising waters an outlet was

* Based chiefly on
Branner; Bull. Geol. Soc. of Am., Vol. 30 (1919), pp. 189-339. Outlines of the Geology of Brazil.
Schuchert: Jour. of Geol. Vol. 14 (1906), pp. 723-740. Geology of the Lower Amazon Region.
Katzer, Frederich: Grundzuge der Geologie des Unteren Amazonas Gabietes, (1903).
Le Cointe, Paul: L'Amazonie Brésillienne. (This two volume work in French is by far the best treatment on the whole region.)

found to the east and thus started the Amazonian waters along their present course.

Later in the time that the master stream flowed to the west, erosion had gone on to such an extent that the river had cut in places a very wide flood plain, especially in its lower or western part. The flat topped hills to the north, seen so clearly from the river between Almeirim and Obidos, are believed to represent the northern boundary of the old flood plain. Across the river at Santarem are the now rounded hills representing the southern bluffs. These altitudes and distances between these hills are a measure of the cutting by this ancient stream and its tributaries. Some of the tributaries had cut even deeper than the present drainage is able to care for and have not yet been filled.* The Tapajos, Xingu, Tocantins, Negro, Uatumá, and Trombetas are examples of this type, Hudson Rivers on a grander scale.

The picture of the inner basin, therefore, is one of a vast lowland lying between two ancient crystalline rock masses partly filled with sedimentaries. Into these sediments streams had cut fairly deep valleys, wide in their lower courses, narrower above. With the reversal of flow the lower areas were filled with Tertiary and Quaternary alluvial deposits, but some of these areas still lie below even the low stages of the water table, others suffer from the seasonal inundations. Although, in general, these lowlands border the streams, in many places the older and higher inter-floodplain areas now border the Amazon and give good sites for the location of the towns along the way. Even the Island of Marajo, at the mouth of the Amazon, in its eastern and southern parts is such a higher land mass with a thriving cattle industry, and only on the west and north are there the low alluvial areas, undeveloped of course.

The Amazon is not a rapidly aggrading stream as is frequently concluded from the many islands and lakes, although there are many more of these than the best maps show. The river is not even muddy in the sense that the term might be applied to the Missouri or even the Mississippi. Its waters have an ashen grey tinge in

* Smith, H. K.: Brazil, the Amazons and the Coast. p. 628. See also Hartt, Bull. Cornell Univ. (Science) vol. 1, p. 19.

the lower course, but when dipped up it scarcely appears turbid, at least during the period of low water, and carries relatively little sediment even during high water. The waters of most of the tributaries appear either blackish or dark brown in mass, but practically colorless when in a glass. This is especially true of the Negro, of Japura, Putumayo, Javery, Jutihy, Jurma, Teffe, Purus, Madeira, Tapajos, Xingu, and others. The great basin is filling so slowly that very large areas are not yet high enough for trees to have gained a foothold, and as far as the eye can reach is one vast sea of grass.

The problems underlying any attempt in making this vast region with its enormous resources of a kind serve man more fully than it has been are likewise comparatively equally great. Space forbids even a partial outline. The acidity of the soil, the problem of the water, the clearing of the land, the keeping down of obnoxious grasses after a few years of crops, the getting of products to markets, the finding of a market for the agricultural products that will grow, the insect pests, the inability to keep food or clothing for any period, the enervating climate—all, especially when taken conjointly offer problems which, viewed in the light of present knowledge, seem insuperable. That, however, does not mean that this region will not be used ultimately much more intensively than it is now. It undoubtedly will, but probably along lines of present conditions. The time must come and will be soon at hand when these vast spaces will be studied and exploited along lines which recognize the natural conditions.